FLORA AGARICINA NEERLANDICA

Critical monographs on families of agarics and boleti occurring in the Netherlands

Edited by
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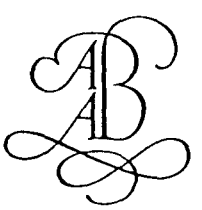
A. General part
B. Special part: Entolomataceae by M.E.Noordeloos



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Foreword

Systematics is a scientific discipline in its own right and with its own aims, but it also has a service function in and outside biology. This 'useful' side of plant systematics is especially visible in Floras, the part of its output that catches most of the limelight. A Flora makes it possible to identify and name a specimen and the name so found gives the user access to all the information that has ever been published about the species in hand and about the higher taxa to which it belongs. The more elaborate Floras, like the present one, give much more than only the name and also compile a larger or smaller part of the non-systematic data about the species.

The Rijksherbarium is and has been involved in several Flora projects and the present book is the first volume of one of the more ambitious projects. It is true that the Netherlands are only a dot on the map of the world but the group involved, the Agaricales, is large. More important is that the present state of knowledge requires that a large amount of original scientific research must be done in writing this Flora.

World-embracing or even continent-embracing monographs of agaric genera, often large and widely distributed, are rare. Systematic agaricology is in an intermediate phase, where the production of regional taxonomic revisions of genera and families must have attention and priority. This Flora has 'neerlandica' in its title but the authors know and study specimens and literature from a much wider region. This will make the semi-monographic and fully illustrated Flora agaricina neerlandica a series of regional importance useful in a larger part of Europe than suggested by its name.

The number of professional students of systematic mycology is small in the Netherlands, as in most countries. The decision that the Rijksherbarium would involve itself in this Flora project was, consequently, not easily taken. We trust that future financial and personal conditions will be such that the work at this project which we consider part of our scientific duty can be continued.

I hope that the Flora agaricina neerlandica will play the directive role in European mycology that editors and authors have in mind.

C. Kalkman
Director of the Rijksherbarium, Leiden

A

General Part

CHAPTER 1

Introduction

C. BAS

What preceded

In the Netherlands the study of agarics and boleti does not glory in a rich historical tradition (Lütjeharms 1933). It is true that already in 1564 the Dutch medical doctor Hadrianus Junius published what was probably the first independent work completely dedicated to a fungus, but that was a gastromycete, viz. the present *Phallus hadriani*. It is also true that what was probably the first monograph on fungi was published in 1601 at Leiden by C.Clusius, but it was based on material observed and collected in Hungary.

In the 16th and 17th centuries, several famous botanists such as R.Dodoens (Dodonaeus), Clusius and M.de Lobel (Lobelius) included in their publications a few records of fungi found in the Netherlands (then still including the southern Netherlands = present Belgium), but the only agaric mentioned is '*Agaricus campestris*'. The very remarkable 'Theatrum Fungorum' by F.van Sterbeeck (1675) is the first mycological book in the Dutch language. In this work several agarics are described and depicted (often with illustrations drawn after those published earlier by Clusius), but nearly all localities mentioned are situated in present-day Belgium.

J.Commelin in his Catalogus Plantarum indigenarum Hollandiae (1683) recorded 18 species, including seven agarics, from the present province Noord-Holland. More or less recognizable are: again *Agaricus campestris* along with *Lactarius piperatus*, *Macrolepiota procera*, *Coprinus micaceus*, *Hypholoma fasciculare*, and *Kuehneromyces mutabilis*. In 1687 P.Hermannus in a catalogue of the Leiden Botanical Gardens added what is probably *Calocybe gambosa* to this list, so that by about 1700 altogether less than ten of the agarics now known to occur in the Netherlands had been recognizably recorded in literature.

In the 18th century, several fungi were reported to be indigenous, again in catalogues of the Leiden Botanical Garden, e.g. by H.Boerhaave (1720) who enumerated 61 species of which about 25 were agarics and by A.von Royen (1740) who added others to the list.

Linnaeus who worked in the Netherlands from 1735 to 1738 mentioned a few Dutch fungi in his 'Hortus Cliffortianus' (1737) including the first record of *Clathrus ruber* from the Netherlands, but no agarics. In this period agarics were generally in the minority among the fungi reported. Moreover they are often difficult to recognize because of very short diagnoses.

In the middle of the 18th century, local floras started to appear such as D.de Gorter's 'Flora Gelro-Zutphanica' (1745) and Meese's 'Flora frisica' (1760). In these works, a few agarics and boleti are often mentioned, sometimes with detailed data on the localities where they were found. Species concepts were mostly wide and vague, as often demonstrated by the references to earlier authors. Such local floras continued to appear until late in the following century. The gradually increasing knowledge of the larger fungi was exemplified among others by N.Mulder (1818) in his 'Elenchus Plantarum quae prope Urbam Leiden nascuntur', which included about 30 species of agarics and boleti with rather exact indications of localities where some of them still can be found. Mulder was probably the first Dutch mycologist to relate his findings to Persoon's 'Synopsis' (1801).

Until the middle of the 19th century, reports on fungi found in the Netherlands were mainly by-products of floristic activities of phanerogamists. This changed with the publication of F.Dozy & J.H.Molkenboer of the three parts of their 'Bijdrage tot de Flora Cryptogamica van Nederland' (1844-1846) in which, together with other cryptogams, circa 650 species of fungi are recorded including about 100 agarics and boleti. Dozy & Molkenboer actively promoted the study of cryptogams in the Netherlands and succeeded in getting support from a group of very industrious collectors such as R.B.van den Bosch, L.H.Buse, F.W.van Eeden, J.Hartsen, and T.Sprée. Their mycological records were based on herbarium material that at least in part is still preserved at the Rijksherbarium, Leiden. When Dozy & Molkenboer published their 'Prodromus Florae Batavae' in which they treated the agarics and boleti in volume 2, part 3 (1858), the number of species listed for the Netherlands had increased to nearly 300. After the death of Dozy the work of the two partners was taken over by C.A.J.A.Oudemans & G.D.Westendorp who published the second half of the fungi in volume 2 part 4 (1866) of the 'Prodromus'.

In 1800 the publication of a large botanical iconography with the title 'Flora Batava' was started. The first two plates of agarics appeared in volumes 7 and 8 (1836, 1844). From volume 10 onwards, plates of agarics and boleti were regularly included. The 28th and last volume appeared in 1934 and by that time nearly 350 species of agarics and boleti had been illustrated.

Apparently the 'Flora Batava' was not widely distributed and therefore failed to become a means of communication among mycologists and the mycological plates are only rarely cited. This failure occurred despite the fact that the rather extensive descriptions and notes accompanying the plates are bilingual, viz. in Dutch and French.

C.A.J.A.Oudemans (1825-1906) was the man who dominated Dutch mycology in the second half of the 19th century. Soon after the completion of the 'Prodromus' he started to publish addi-

tional lists and comments on earlier observations in his 'Matériaux pour la flore mycologique de la Néerlande' (Part 1 in 1867, part 2 in 1873) and a series of publications initially (parts 1-10, 1872-1885) entitled 'Aanwinsten voor de flora mycologica van Nederland' and later (part 11-20, 1886-1904) 'Contributions à la flore mycologique des Pays-Bas'. These contributions covered macro- as well as micromycetes and myxomycetes.

Oudemans' mycofloristic activities finally culminated in his 'Revision des champignons tant supérieurs qu'inférieurs trouvés jusqu'à ce jour dans les Pays-Bas', volume 1 (1892) and volume 2 (1897), the one and only original mycological flora of the Netherlands ever published. This work comprises descriptive keys and for each species references to descriptions and illustrations in the literature, data on habitat, time of fructification, and geographical distribution in the Netherlands, occasionally followed by a shorter or longer discussion. As for the recognition of agarics and boleti, with few exceptions, only macroscopical characters were utilized, Oudemans' species concepts were in many cases vague and not very reliable. He included circa 625 species of agarics and boleti, but the value of this work is now mainly historical. Much of the material studied by Oudemans is still available in his herbarium at present housed in the Rijksherbarium, Leiden.

In his 'Catalogue raisonné . . .', printed in 1904, Oudemans enumerated all fungi up to that time found in the Netherlands with a restricted synonymy and references to earlier records and descriptions in literature. Nearly 700 agarics and boleti are admitted to this list. Oudemans' work was made accessible to the amateur mycologist in a pocket-flora by Miss C.E.Destrée (1901). A flora compiled from different sources by J. Ruys followed in 1909. It is now difficult to estimate how great the influence of these two floras was in comparison to foreign floras such as those of Costantin & Dufour (1891 and later editions) and somewhat later A.Ricken's 'Blätterpilze' (1910-1915).

In the surge of the great revival of general interest in natural history at the beginning of the 20th century, the 'Nederlandse Mycologische Vereniging' (N.M.V.) was founded in 1908. This provided a great stimulus for the study of macrofungi, among which the agarics and boleti attracted and still attract most attention. In 1910 the N.M.V. decided to initiate a mycological herbarium and found the Rijksherbarium, Leiden, willing to accommodate this collection, for which the N.M.V. appointed a conservator in 1912, thus introducing mycological research at the Rijksherbarium. In 1922 that institute was able to offer the then conservator Miss C.Cool a permanent position on its staff.

Although the N.M.V. usually had no more than between 300 and 500 members, its activities have been of paramount importance for the development of the knowledge of the Dutch agarics and boleti. In this society amateur and professional mycologists have always worked closely together and with mutual benefit explored the macromycete flora of the Netherlands. Some of its non-professional members have gained a solid international reputation in the field of agaricology, e.g. H.S.C.Huijsman, A.F.M.Reijnders, and more recently, E.Kits van Waveren.

Much mycological information is available in the several journals of the N.M.V., initially from 1914 to 1952 in the 'Mededeelingen van de Nederlandsche Mycologische Vereeniging', from 1929 onwards also in 'Fungus', later in 1959 taken over by the Rijksherbarium and continued under the name 'Persoonia', and from 1954 onwards in 'Coolia'.

From the early days of the N.M.V., there was an urge to publish a new fungus flora but it never came to fruition. Preliminary results towards this undertaking were K.Boedijn's relatively unknown publication on *Inocybe* (1925) and A.J.P.Oort's better known study on *Mycena* in the Netherlands (1928).

At the beginning of the fifties, there was still only a single mycological conservator at the Rijksherbarium, a position then held by R.A.Maas Geesteranus, who divided his interest between fungi and lichens. He succeeded in convincing the then director H.J.Lam that the time had come to establish at the Rijksherbarium a centre of taxonomic research on macrofungi. Successively then were appointed C.Bas for the Agaricales, M.A.Donk for the Aphyllophorales and J.van Brummelen for the Ascomycetes.

At the end of the forties, Maas Geesteranus had started to build up a modern herbarium of dried fungi with accompanying descriptive notes for the taxa with fleshy fruit-bodies. In later years, collecting increased considerably through the activities of the new staff-members, the students they coached, and a growing number of increasingly skillful amateurs who were willing and able to buy mycological books and a good microscope.

Simultaneously a number of important private mycological herbaria came into being, together containing tens of thousands of annotated collections, e.g. the herbaria of Huijsman, Kits van Waveren, Reijnders, F. & G.Tjallingii, and others, of which the first two have been presented to the Rijksherbarium and others probably will follow.

In the sixties, J.J.Barkman at the Biological Station at Wijster (prov. Drenthe) started the systematic analysis of the macromycete flora of well-defined plant communities, and under his influence, that institute became a noted centre of mycocoenological research. Its staff members made important contributions to mycotaxonomic and -floristic knowledge in the Netherlands, meanwhile building up an interesting mycological herbarium.

At the end of the seventies, the feeling developed that all the knowledge of and information on agarics and boleti in the Netherlands and adjacent countries accumulated particularly during the preceding thirty years should be brought together in a modern, critical standard flora. This flora should offer extensive completely mutually comparable descriptions and line drawings of the habit and the most important microscopical characters of all the species of agarics and boleti found or to be expected in the Netherlands and should be based on original observations. Additional arguments for publishing such a flora were the lack of a recent similar one for surrounding countries (although the concept of the British Fungus Flora comes close except for lack of illustrations) and the availability of a number of potential cooperators specialized in the taxonomy of agarics.

Once the so-called Flora agaricina neerlandica project had been formulated, considerable support was obtained through the Foundation for Fundamental Biological Research (BION) from the Netherlands' Organization for the Advancement of Pure Research (ZWO) and through the Rijksherbarium from the University of Leiden.

Producing the Flora agaricina neerlandica turned out to be much more difficult and time-consuming than expected and the original schedule of publication had to be abandoned completely

So much the greater, however, is the pleasure of introducing here its first volume.

What is expected to follow

Publication of the Flora agaricina neerlandica is planned now in circa 10 volumes, each treating 150 to 200 species. Volume 2 (in preparation) will contain Pleurotaceae, Pluteaceae, and Tricholomataceae tribus Hygrophoreae. Volumes 3 and 4 will present the rest of the Tricholomataceae, but a few genera of this family have still to be worked up. Thanks to continuing support from the Rijksherbarium and from voluntary collaborators, work on the families to be treated in further volumes is in progress and the studies of several smaller and larger genera have been completed.

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CHAPTER 2

The Netherlands as an environment for agarics and boleti

EEF ARNOLDS

1. INTRODUCTION

The flora of a region can only be understood against the background of the dominant environmental factors. The main factors determining the composition of the mycoflora are climate, soil and human influence. These terms in fact relate to complexes of chemical and physical, interacting processes that find expression in a pattern of biogeocoenoses. The most important and most prominent part of these biogeocoenoses is formed by the primary producers, i.e. the plant communities. Decomposing and symbiotic organisms like agarics are either directly or indirectly dependent on the plant communities. Historical factors are very important for the explanation of the flora of flowering plants, but probably much less important for fungi since their dispersal capacity is much greater.

In this chapter the climate, soil and human influence in the Netherlands will be briefly reviewed. The resulting distribution patterns of agarics will be described and discussed. The more important plant communities will be treated in relation to the composition of their mycocoenoses.

2. TOPOGRAPHY

The Netherlands, except for the extreme southeast (S.Limburg), form part of the Lower Rhine lowland. The country is situated between 50° 45' and 53° 30' N.L. and 3° 20' and 7° 1 E.L. The surface amounts to ± 34,000 km^2. The more important regions, rivers, islands and towns are indicated in Figure 1.

The coastline is in most places marked by sand dunes up to 56 metres high. Behind the dune ridges, areas are found situated below sea level, called 'polders'. Generally speaking an altitudinal gradient exists from the northwest to the southeast where the highest point (321 m) is reached. This gradient is interrupted by ridges of sand, especially in the centre of the country (Veluwe) (Fig. 2). The differences in altitude, although relatively small, have a distinct influence on the local climate, especially the amount of precipitation (cf. Fig. 5).

3. CLIMATE AND ITS INFLUENCE ON PERIODICITY AND FLUCTUATIONS OF AGARICS

The climate in the Netherlands is submaritime and cool-temperate. The average daily minimum temperature in De Bilt (Central Netherlands, near Utrecht) in the coldest month (January) is –0.8 °C; the average daily maximum in the warmest month (July) is 22.1 °C. The average annual rainfall at De Bilt amounts to 800 mm (Koninklijk Nederlands Meteorologisch Instituut, 1972).

The influence of the North Sea is the main factor determining the climatological pattern in the Netherlands. Travelling from the coast inland the numbers of both frost days (with a minimum below 0 °C) and summer days (with a maximum of 25 °C) increase. This is indicative of the more continental character of the climate in the eastern parts of the country (Figs. 3, 4).

The pattern of the annual precipitation (Fig. 5) is more complex and together with other factors is influenced by local differences in altitude (cf. Fig. 2). The highest rainfall is measured in the eastern provinces in July and August, in the western provinces in September and October, in the extreme south-west even in November. An important measure of moisture conditions is the difference between precipitation and evaporation. The precipitation surpasses the evaporation in the period August (along the coast September) until March. The pattern of the mean precipitation surplus in October, the most important month for the fruiting of agarics, is given in Figure 6.

The local differences in climate may explain the distribution patterns of some fungi in the Netherlands, although soil factors seem to be much more important in this respect (see Section 4). However, the annual weather conditions directly influence the periodicity and fluctuations of fungi, at least the formation of basidiocarps.

In the Netherlands the vernal aspect (April-May) is poorly developed. For some unknown reason, most species fruiting in spring are found in grasslands, e.g. *Agrocybe praecox*, *A. paludosa* and *Panaeolus ater*, and in forests and scrub on rich soils, e.g. *Entoloma vernum*, *E. clypeatum*, *E. saepium* and related species, *Calocybe gambosa*. Some vernal species are found growing on cones of pines in coniferous forests, viz. *Strobilurus stephanocystis* and *S. tenacellus*.

Only a few species seem to be characteristic of the climatological summer (June-August), in general an unfavourable period for fruiting. Examples are the grassland species *Agrocybe pediades* sensu lato, *A. dura*, *Conocybe lactea*, thermophilic fungi from compost piles and rubbish dumps, such as *Volvariella volvacea* and *Stropharia rugosoannulata*, and a few mycorrhizal species from forests on rich soils, e.g. *Amanita strobiliformis* and *Inocybe erubescens (=patouillardii)*.

Early autumn (late August-September) is in forests the optimal period for some mycorrhizal genera, such as *Boletus*, *Russula* and *Lactarius*. In poor grasslands, a *Leptonia* aspect may b

Fig. 1. Topographical map of the Netherlands (1-12: provinces; 1. Groningen, 2. Friesland, 3. Drenthe, 4. Overijssel, 5. Flevoland, 6. Gelderla 7. Utrecht, 8. Noord-Holland, 9. Zuid-Holland, 10. Zeeland, 11. Noord-Brabant, 12. Limburg).

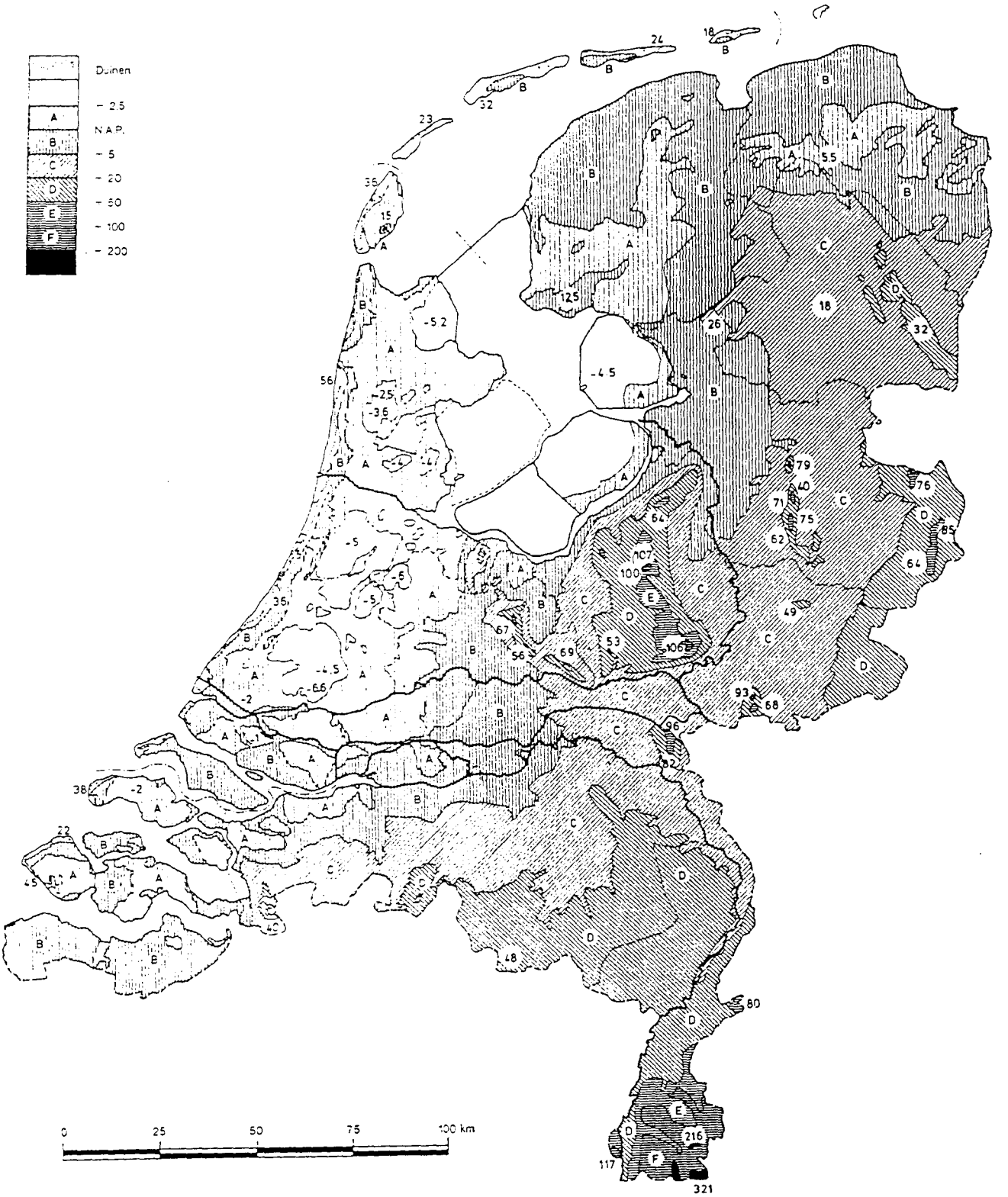

Fig. 2. Contour lines (metres above sea level) in the Netherlands; Duinen = dunes, N.A.P. = c. sea level (after K.N.M.I., Klimaatatlas van Nederland).

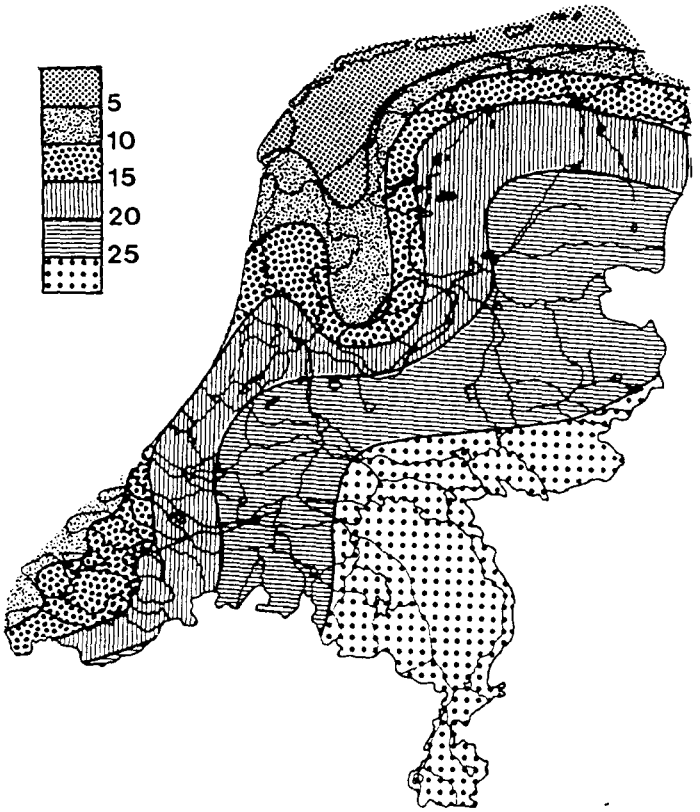

Fig. 3. Mean annual number of days with maximum temperature above 25 °C, 1931-1960 (after K.N.M.I., Klimaatatlas van Nederland).

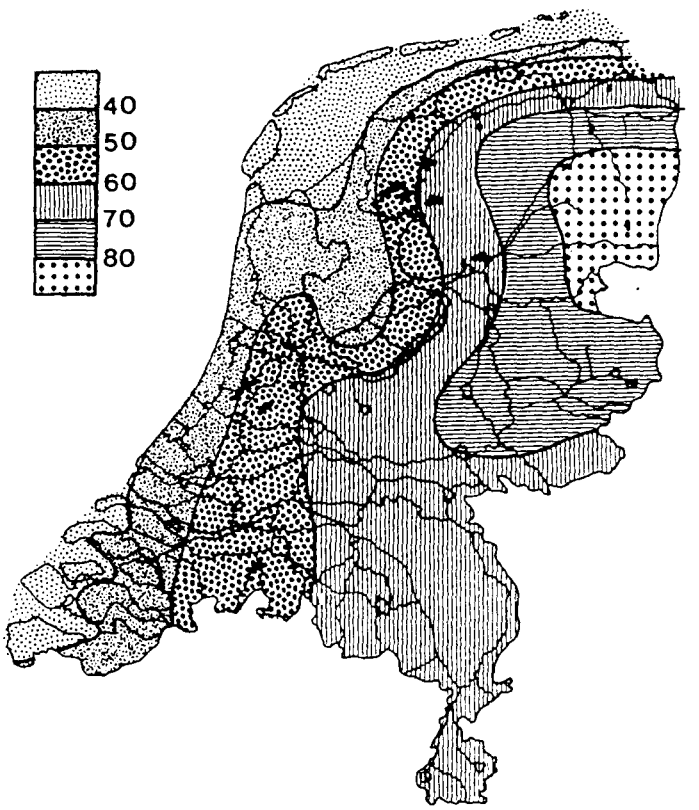

Fig. 4. Mean annual number of frost days with minimum temperature below 0 °C, 1931-1960 (after K.N.M.I., Klimaatatlas van Nederland).

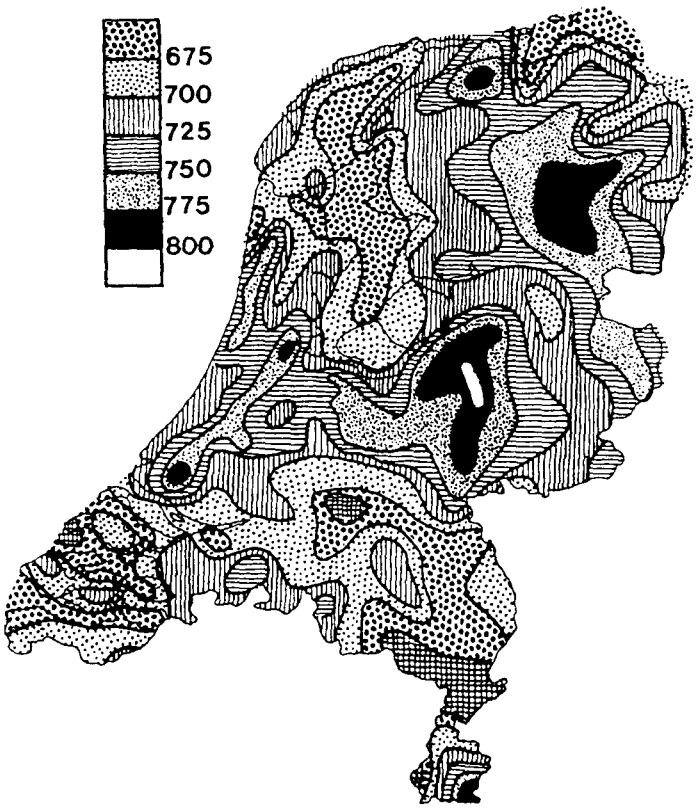

Fig. 5. Mean annual precipitation in mm in the Netherlands, 1931-1960 (after K.N.M.I., Klimaatatlas van Nederland).

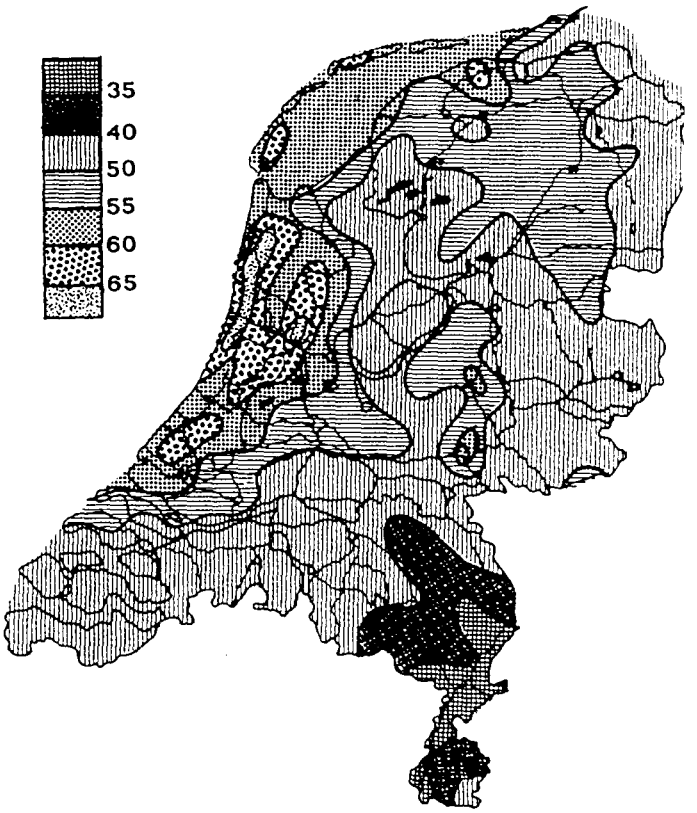

Fig. 6. Mean precipitation surplus (precipitation minus evaporation) mm in October, 1931-1960 (after K.N.M.I., Klimaatatlas van Nede land).

developed under favourable conditions, in manured grasslands an *Agaricus* aspect.

In the Netherlands the majority of agarics fruit mainly in mid-autumn (October-early November). This optimal aspect ends with the first heavy night frosts with a minimum temperature below –5 °C at the soil surface. These frosts usually occur between late October and late November. Late autumn (November-early December) is characterized by some species usually appearing after the first frosts, e.g. *Hygrophorus hypothejus*, *Mycena cinerella*, *Clitocybe barbularum*, *Pseudoclitocybe obbata*, and *Lepista nuda*. In winter (December-March) only a few species with frost-resistant basidiocarps are found, e.g. *Flammulina velutipes* and *Pleurotus ostreatus*.

The vernal aspect is poorly developed in most years, due to frequent drought in April and May. The summer aspect is also very irregular and usually short-lasting. The early autumn aspect is only well-developed in years with amounts of precipitation considerably in excess of the usual, that is to say once in about five years. In forests on riverclay, many rare boleti and Russulales can be found at such a time, but only after a warm period with heavy rains, occurring once in about ten years. The autumn aspect and especially the late autumn aspect is less variable and often well represented, caused by the favourable moisture conditions in October and November.

Differences in weather conditions between successive years cause considerable fluctuations in fruiting activity of agarics. In a certain locality a species may be frequent in one year and scarce in another (quantitative fluctuations), or present in one year and absent in another (qualitative fluctuations). The main factor determining a 'good' or 'bad' year for agarics is the amount of precipitation in summer and autumn, but the stimulating effect of much rain can largely be offset by low temperatures. Field experience indicates that periods with severe frosts without snowcover in winter are unfavourable for fruiting in the following autumn. The same applies to very dry spring seasons. Apparently the development of mycelia is strongly reduced under such circumstances.

4. THE DEVELOPMENT OF THE LANDSCAPE AND PLANT COVER IN THE NETHERLANDS, INCLUDING HUMAN INFLUENCE

During part of the Ice Age before last, the Saalien (or Riss glacial, ± 200,000-70,000 BC), the northern part of the Netherlands was covered with glaciers, whereas the southern part was an arctic desert. The glaciers pushed up fluvio-glacial sands to high ridges, at present recognized as high sand soils (Fig. 7).

During the most recent Ice Age (Weichselien or Würm glacial, ± 70,000-8,000 BC), the land-ice did not reach the Netherlands, but the climate was arctic and large parts were covered with tundra, witness numerous subfossil remains of such plants as *Salix herbacea*, *Betula nana* and *Dryas octopetala*, all of them long since extinct in the Netherlands. In a late period of the Weichselien (Pleniglacial, 23,000-13,000 BC), the climate must have been so cold and dry that plant growth was practically absent. The country is supposed to have been an arctic desert with permafrost soils, where strong hurricanes transported and deposited enormous volumes of sand (cover sands) and, in the extreme south-east, loess. The North Sea was almost completely dry.

Since about 8,000 BC, the climate became consistently warmer and the geological period of the Holocene began. At first the vegetation was dominated by forests of *Betula*, soon replaced by *Pinus sylvestris* (Preboreal, 8,000-7,000 BC). In the Boreal period (7,000-6,000 BC), *Corylus* played an important role in the forest and tree species such as *Quercus, Ulmus, Tilia,* and *Fraxinus excelsior* invaded and became more abundant. During the warm and moist Atlanticum (6,000-3,000 BC), the centre, east and south of the Netherlands were covered by virgin forests, on the higher soils dominated by *Quercus* and/or *Tilia*, on the lower soils by the increasing *Alnus glutinosa*. In depressions peat formation increased and large peat bogs developed, overgrowing the former forests. In the western and northern parts of the Netherlands, a shallow sea existed with many mud flats, separated from the North Sea by foreshores and low dunes. The human population in that period was small and made up of hunters without fixed abodes.

In the Subboreal period (3,000-900 BC), *Fagus sylvatica* reached the Netherlands and became an important forest tree, mainly on the richer soils. On the soils not flooded by the sea, man settled down and began to cultivate the soil and to breed cattle. Many forests on the higher soils were cut down and replaced by meadows, arable fields and heathlands. In the forests the important role of *Ulmus* was reduced, among others, by the use of young twigs as cattle forage. Behind the dune ridges, peat was formed under the influence of fresh river water.

In the Subatlanticum (900 BC until today), *Carpinus betulus* was a new-comer in forests on the richer and drier soils. In the eastern and southern parts of the Netherlands, the decimation of forests increased, especially since 1100 AD. The last virgin forest was decimated in the year 1869. In most of the remaining forests, *Quercus robur* (in places also *Q. petraea*) was the dominant tree, due to its exploitation as coppice-wood and grazing by domestic animals, especially pigs, while in particular *Fagus* and *Tilia* decreased. Since about 1500, large, bare sand dune areas developed because of overgrazing by sheep. The introduction of artificial fertilizers about 1880 made it possible to convert almost all heathlands into arable fields and pastures.

In the western provinces, the coastline was fixed by the construction of dykes since circa 1100 AD. Since about 1500, many lakes have been reclaimed and converted into fertile polders. Recent polders from this century are the Flevopolders in the IJsselmeer in the centre and the Lauwersmeerpolder in the north-east of the country.

Around 1850, forests had become very scarce in the Netherlands and were mainly restricted to estates, game-reserves and coppice-woods of *Quercus*, e.g. for tanning of leather. In the Netherlands, only 26 native species of trees are found. As in other N.W.European countries, the flora has been greatly impoverished during the Ice Ages. Recently, many exotic trees have been introduced. Already in the Roman period (circa 100 AD), *Castanea sativa* had been cultivated, succeeded, in the 19th century, by *Quercus rubra*. Since 1850, forests of *Pinus sylvestris* have been planted, initially mainly in order to fix the windblown sands in the coastal dunes and on high pleistocene soils, later also in former heathlands. *Pinus sylvestris* has probably maintained

itself as a solitary growing tree since the latest Ice Age in extreme habitats, e.g. along the margin of peat bogs and on very dry and poor sand. However, forests dominated by *Pinus* are not natural to the Netherlands. Other important trees, used in plantations on sandy soils, mainly since circa 1900 are *Picea abies* (from C.Europe), *Larix leptolepis* (from Japan), *Pseudotsuga menziesii* (from N.America), *Picea sitchensis* (from N.America) and, especially in the dunes, *Pinus nigra* (from S. and C.Europe). On clayey soils, plantations of *Populus* x *canadensis* are important.

In recent years (since about 1950), the landscape in the Netherlands has undergone changes, especially as a result of increasing urbanization, industrialization and road construction. The rural landscape is also drastically changing as a result of extensive land reallocation accompanied by canalization of streams and deep drainage of nearly all soils. These activities have negative impact on the remains of natural plant communities (see Section 7).

The successive establishment of various trees since the latest Ice Age must have been accompanied by the simultaneous appearance of specialized mycorrhizal and/or saprophytic fungi. However, direct proof of this process is lacking since spores of agarics are only rarely discovered in palynological analyses.

The introduction of exotic trees has led to the occurrence of associated fungi, including agarics. These fungi are usually, as in this flora, treated as indigenous, although this proposition is certainly contestable. The same is true to a lesser degree for fungi from anthropogenic habitats such as compost heaps, rubbish dumps and unheated glasshouses, which do not or seldom occur in the Netherland under natural conditions.

5. Soils

In Figure 7, a very simplified map is given of soil types occurring in the Netherlands, based on a combination of the morphology (structure, texture, colour) and origin of the soils. A much more detailed soil classification, based on morphological characters only, was published by de Bakker & Schelling (1966). For each of the types presented here, the more important subtypes according to the classification of de Bakker & Schelling are mentioned between brackets.

Marine clay soils cover large parts of the western provinces and are often situated below sea level. Usually no distinct horizons are found in the profile. They mostly have a clayey top soil of at least 80 cm and hydromorphic characteristics within 50 cm ('polder vague soils'). Marine clays are fertile, moist, rich in minerals, but with a variable lime content and pH, mainly dependent on the age of the deposits.

Riverclay soils are rather similar, for the greater part also 'polder vague soils' but deposited by the big rivers Meuse, Rhine and their tributaries. Part of the riverclay soils are drier, however, without hydromorphic characteristics ('ooi vague soils'). Forests in the river valleys are usually found on the latter soils.

Löss soils are only found in the extreme south-east and also comprise limestone-weathering soils. They are in general dry, fertile and rich in lime. According to de Bakker & Schelling (1966), they consist of various types of 'brick soils'.

Peat soils have, within 80 cm of the surface, peat or peaty material that is more than 40 cm thick. On the map, two types of peat soils are distinguished: 'dal soils' and 'low peat soils'. The 'dal soils' are artificial soils, originating from the reclamation of extensive, ombrotrophic raised bogs, developed on pleistocene sands above soil water level. Nowadays these bogs have almost completely been dug away. The remnants and thrown back upper layers were intermixed with sand, which make up the usually well-drained 'dal soils' ('mond' and 'meer peat soils' after de Bakker & Schelling 1966). Only very locally in the east and south are initial raw peat soils ('vliet peat soils') found, in the remaining *Sphagnum* bogs saturated with water.

The low peat soils have originated in or under the strong influence of mesotrophic to eutrophic ground water in the western holocene part of the Netherlands. Most of these soils have been sufficiently drained to cause the moulding of the peat ('earthy peat soils'). Another important subtype is soil where the peat is covered by a clay layer thinner than 40 cm ('waard peat soils'). In places where this peat has been dredged away or dug off, lakes have been formed where, at present, new peat formation occurs.

Coastal and inland dunes consist of dry, sandy soils without or with only weak formation of a humus layer and other horizons ('duin vague soils'). The wind-blown sands on the pleistocene are from secondary origins, blown away after overgrazing by sheep. They are acid and very poor in lime and other minerals. The sea dune sands are much richer in minerals and lime, especially in the central and southern dunes.

The marine sand soils are sandy, more or less calcareous soils without distinct horizons, differing from dune soils by the favourable moisture conditions including a higher groundwater table (at most 80 cm below the surface). They can be found in sandy parts of sea polders and where dunes have been dug away to 50 cm above groundwater level. In many areas, the marine sand soils are alternating with earthy soils with a thick humus layer.

The high sand soils are mainly situated in the centre of the Netherlands. They comprise brown xeropodzol soils with a deep groundwater table throughout the year ('moder' and 'haar podzol soils'), having a distinct acid humus layer (A1 horizon) overlaying a thick, grey A2 horizon where iron has been washed away and a reddish to black B horizon due to illuvated iron and humus. Gradual transitions to wind-blown sands are frequent.

The low sand soils are widespread in the eastern and southern provinces. They mainly consist of hydropodzol soils ('veld podzol') influenced by groundwater within 80 cm below the surface. Included in this group are the nonpodzolic, moist earth soils widespread in the valleys of brooks and rivulets, having a thick humose top soil between 15 and 50 cm ('peaty earth soils', 'beek earth soils').

6. Phytogeographical districts and distribution patterns of agarics

The present division of the Netherlands into phytogeographical districts has been proposed by van Soest (1929). A recent critical review of these districts has been published by Mennema (1978). The floristic, geological and climatological characters of the respective districts were discussed by Westhoff et al. (1970) and

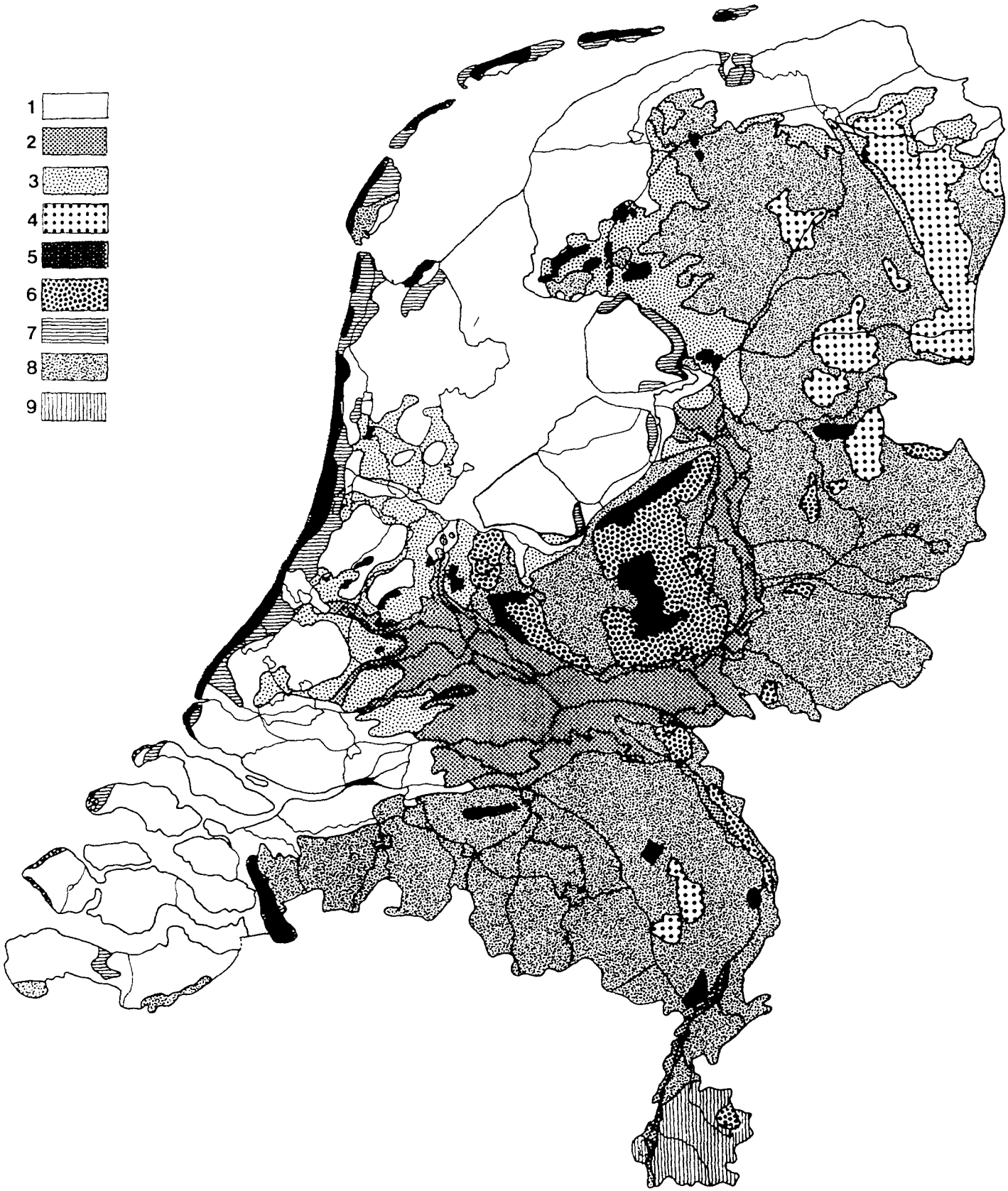

Fig. 7. Soil map of the Netherlands. – 1. marine clay soils; 2. river clay soils; 3. low peat soils; 4. 'dal soils'; 5. coastal and inland dunes; 6. high sar soils; 7. marine sand soils; 8. low sand soils; 9. loess soils (after K.N.M.I., Klimaatatlas van Nederland; slightly altered).

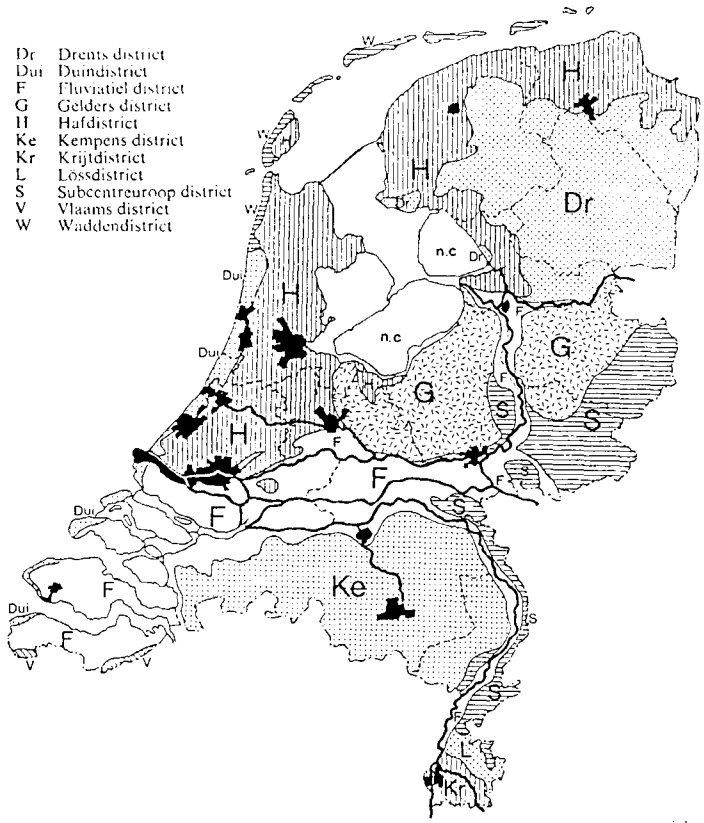

Fig. 8. Phytogeographical districts in the Netherlands; n.c. = not classified (after Weeda in Heukels/Van der Meijden, Flora van Nederland, 1983).

Fig. 9. *Micromphale foetidum* in the Netherlands, mainly in the 'Krijtdistrict'.

Weeda (1983). The boundaries of the phytogeographical districts according to Weeda are indicated in Figure 8.

Although this division is based on distribution patterns of phanerogams, it can be used as a starting point for the treatment of geographical patterns in agarics as well. In fact the flora of a particular area is nothing but an expression of the local soil, climate and long-lasting human influence. Fungi are dependent on similar factors and in addition on the spatial patterns of plant communities and plant species.

In this section, the vegetation, soils and climate of the various districts will be briefly described in relation to the distribution patterns of agarics. Representative distribution maps of different patterns are given. Although phytogeographical districts seem to be a sound basis for the description of distribution patterns of agarics, we have refrained from using them in the species descriptions in this Flora. Knowledge of geographical distribution is very unbalanced for various taxonomic groups and insufficient for the great majority of species to justify the indication of districts. The examples presented in this section are the most typical and well-known cases.

The data and maps presented here are based on both herbarium collections and literature accounts. Since 1980 a special Working Group of the Netherlands Mycological Society has tried to stimulate and co-ordinate the mapping of macrofungi in the Netherlands (Arnolds 1984). The data collected in this way until the year 1983 are also included in the maps.

The maps are based on the grid of the topographical maps, dividing the Netherlands into 1672 squares of 5 × 5 km each.

Fig. 10. *Hygrocybe reai* in the Netherlands, restricted to the 'Krijtdistrict'.

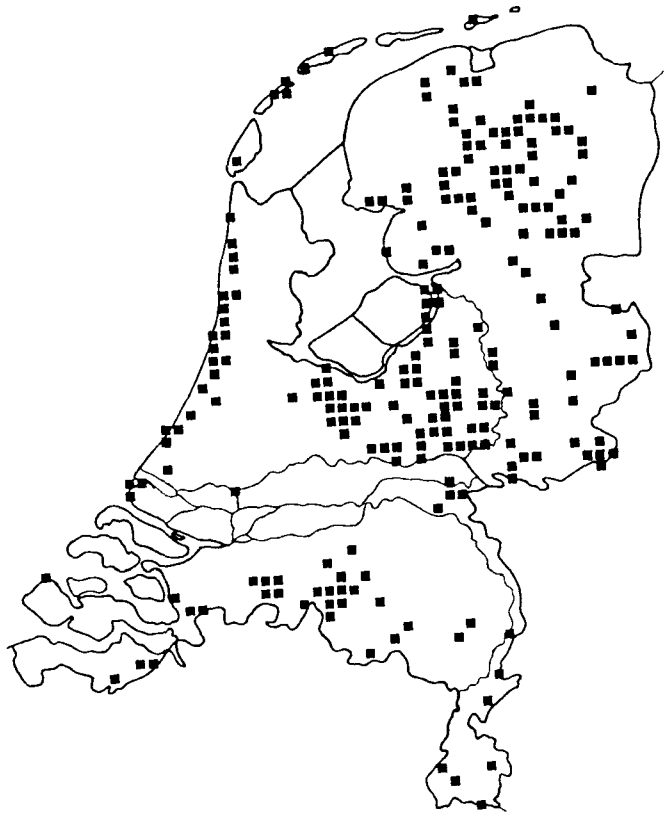

Fig. 11. *Amanita citrina* (incl. var. *alba*) in the Netherlands, mainly in the pleistocene districts and the coastal dunes.

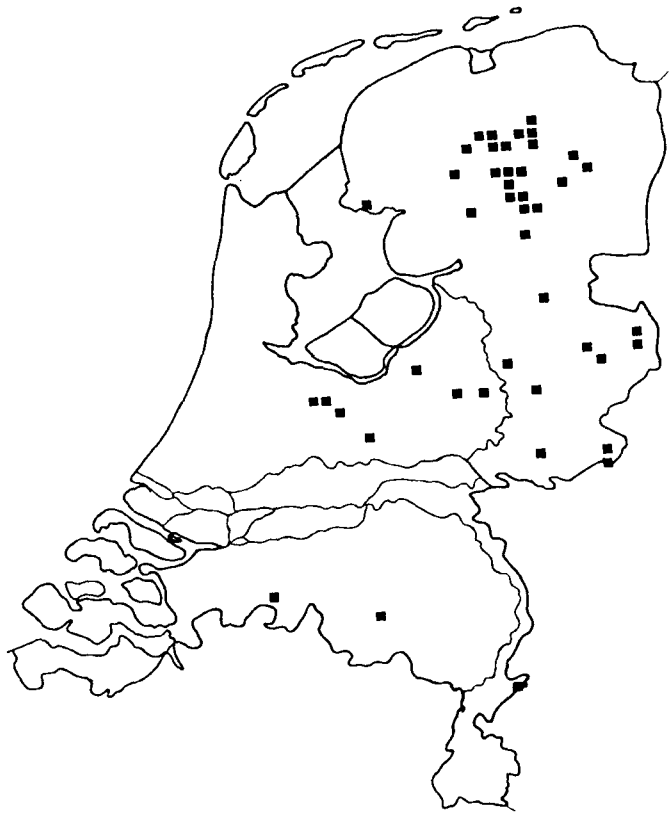

Fig. 12. *Boletinus cavipes* in the Netherlands, restricted to the pleistocene districts but centred in the 'Drents district'.

Fig. 13. *Boletus calopus* in the Netherlands, restricted to the pleistocene districts but centred in the 'Gelders district'.

Fig. 14. *Entoloma sphagneti* in the Netherlands, restricted to the pleistocene districts.

The 'Krijtdistrict' (Kr) is situated in the extreme south-east of the Netherlands, a region called South Limburg. It is the only district that belongs to the Central European flora region. All other districts form part of the Atlantic region. The Krijtdistrict is characterized by a hilly landscape, including the only areas in the Netherlands situated above 150 metres s.m. (see Fig. 2). It is also the only area where rocky outcrops are found and where shallow soils ('brick soils') cover the slopes of the valleys. These rocks are made up of rather soft, porous limestone from the Cretaceous period. The plateaux are covered with thick deposits of löss and weathered, rather acid loams.

In the Netherlands many phanerogams are (almost) restricted to the Krijtdistrict, e.g. the forest plants *Actaea spicata* and *Mercurialis perennis*, and the grassland plants *Cirsium acaule* and *Galium pumilum*. The mycoflora is still insufficiently explored. Rare species only known from this area are, e.g. *Cystolepiota bucknallii*, *Lepiota xanthophylla*, *Limacella ochraceolutea*, and *Marasmiellus candidus*. Other agarics with an optimum in the Krijtdistrict are the lignicolous saprophyte *Micromphale foetidum* (Fig. 9) and the grassland species *Hygrocybe lacma*, *H. reai* (Fig. 10), *H. calciphila*, *H. colemanniana*, *Entoloma bloxamii*, and *E. incanum*.

Many species of phanerogams in the Netherlands are restricted to more or less dry, calcareous, subneutral to basic soils and are therefore mainly distributed in the Krijt-, Fluviatiel and/or Duindistrict. Many agarics also have that pattern, e.g. the forest species *Agaricus meleagris* (Kr, Dui), *Lactarius circellatus* (Kr, F), *Lepiota fulvella* (Kr, Dui, F), *L. subincarnata* (Kr, Dui, F), *Tricholoma album* (Kr, Dui, F), the scrub species *Calocybe gambosa* (Kr, Dui, F), and the grassland species *Dermoloma atrocinereum* (Kr, Dui, F).

The 'Lössdistrict' covers only a small area in the south of the Netherlands north of the Krijtdistrict (Fig. 8). It is an undulating landscape, covered with thick loess deposits and almost entirely intensively cultivated. It is weakly characterized by phanerogamic plants, mainly by weeds of corn-fields. The mycoflora is practically unknown and probably without characteristic species.

The 'Subcentreuroop' (S), 'Vlaams' (V), 'Kempens' (Ke), 'Gelders' (Ge) and 'Drents district' (Dr) are closely related in phytogeographical respect. They cover large parts of the south, east and centre of the Netherlands. The soils consist mainly of pleistocene, acid sands, poor in lime and other minerals. Most of them belong to the xero- and hydropodzols. Dune vague soils are more local. In places richer, loamy soils occur. During the Holocene, large peat bogs had developed in depressions, mainly in the Drents and Kempens district, but they have almost completely been reclaimed to arable land on 'dal soils' (see Section 5).

The mutual differences between the pleistocene districts are less pronounced than between most other districts and based on differences in distribution patterns of relatively few phanerogams. The Drents district is characterized by a relatively cold, wet, atlantic climate and the high frequency of some boreal plant species such as *Empetrum nigrum*, *Trientalis europaea* and *Carex aquatilis*. Until circa 1900, the largest part was covered by moist heathlands. Most forests are young and planted since 1850. This district was extensively treated by Barkman & Westhoff (1969).

The Subcentreuroop district has a warmer, drier and more continental climate. Rich, loamy soils are more common than in other districts. The forests are in part old and have many plants in common with the Krijtdistrict, e.g. *Veronica montana* and *Melica uniflora*.

The Gelders district is mainly situated on high, poor sands, pushed up by land ice in the Saalien Ice Age (see Section 5). Its climate and flora are more or less intermediate between the Drents and Kempens district. A few continental species are characteristic.

The Kempens district in the south has a slightly warmer and drier climate than the Drents district. Most boreal plants are lacking. Some southern atlantic species are characteristic. Most forests are young, except those in the valleys of rivulets.

The Vlaams district covers only a very small area in the extreme south-west. The flora is very different from the adjacent fluviatile and maritime deposits of the Fluviatiel district but within the Netherlands hardly different from the Kempens district.

The great majority of agarics have their main distribution in the pleistocene districts. This may be only caused by the distribution of forests: over 90 % of the forests in the Netherlands are situated there (Fig. 22). It appears that many species can grow in other areas as well if forests are planted there, as practised in the Flevopolders. Mycorrhizal species such as *Xerocomus chrysenteron*, *Lactarius quietus*, *Amanita rubescens* and *Laccaria laccata* and litter saprophytes like *Collybia dryophila* and *C. peronata* are not restricted to poor soils, although their distribution patterns seem to suggest so. This applies even more to species restricted to coniferous trees, since in the Netherlands these trees are only rarely planted on rich soils.

However, large numbers of agarics are really more or less restricted to poor sandy soils as found in the pleistocene districts and in old coastal dunes, e.g. the mycorrhizal species *Amanita citrina* (Fig. 11), *A. porphyria*, *Xerocomus badius*, *Tricholoma columbetta*, *T. saponaceum*, *Russula emetica*, *Lactarius chrysorrheus* and *L. necator*, and the saprophytes *Marasmius androsaceus* and *Clitocybe clavipes*.

Other species seem to be restricted to the pleistocene and to be (almost completely) absent from the dunes, e.g. the mycorrhizal species *Amanita virosa*, *Boletus calopus* (Fig. 13), *Boletinus cavipes* (Fig. 12), *Hygrophorus eburneus*, *H. nemoreus*, *Lactarius trivialis*, *Rozites caperata*; several species from peat bogs, e.g. *Hygrocybe coccineocrenata* and *Entoloma sphagneti* (Fig. 14) and, remarkably, the wood saprophyte *Marasmiellus ramealis* (mapped by Noordeloos, 1983).

The mycofloristic differences between the four pleistocene districts are still insufficiently known, but they seem to be relatively small. It seems that the *Larix* symbiont *Boletinus cavipes* (Fig. 12) and the litter saprophyte *Rhodocybe caelata* have an optimum in the Drents district. Some very rare species, only known from one or two places, are also restricted to that area and may be characteristic, e.g. the *Pinus* symbionts *Suillus flavidus* and *Russula decolorans* and the litter saprophyte *Hygrocybe turunda*. *Boletus calopus* has its main distribution in the Gelders district (Fig. 13), apparently because its optimum habitat – old

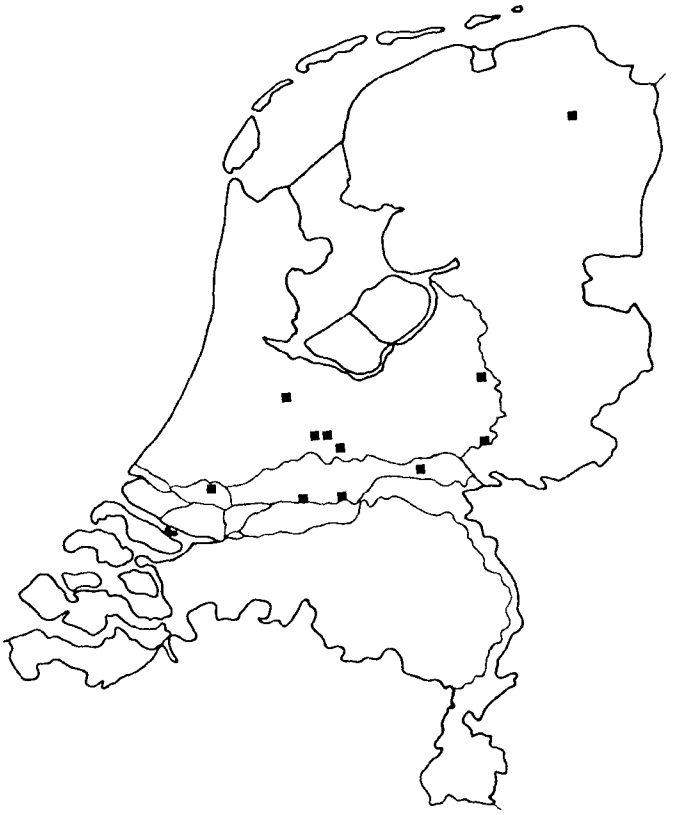

Fig. 15. *Boletus radicans* in the Netherlands, mainly in the 'Fluviatiel district'.

Fig. 16. *Inocybe fraudans* (= *I. pyriodora* s.auct.) in the Netherlands, restricted to the 'Fluviatiel district'.

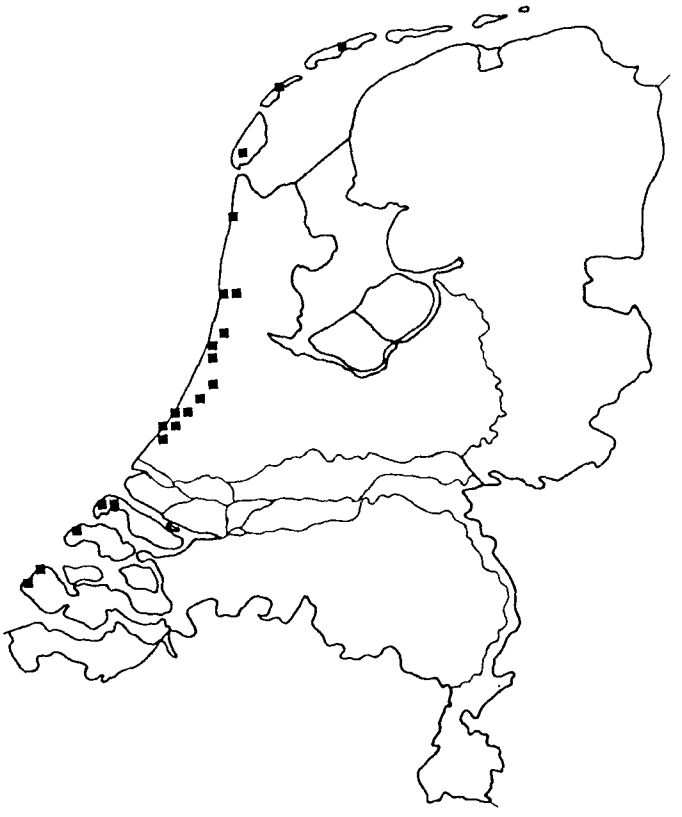

Fig. 17. *Agaricus porphyrhizon* in the Netherlands, restricted to the 'Duindistrict' and 'Waddendistrict'.

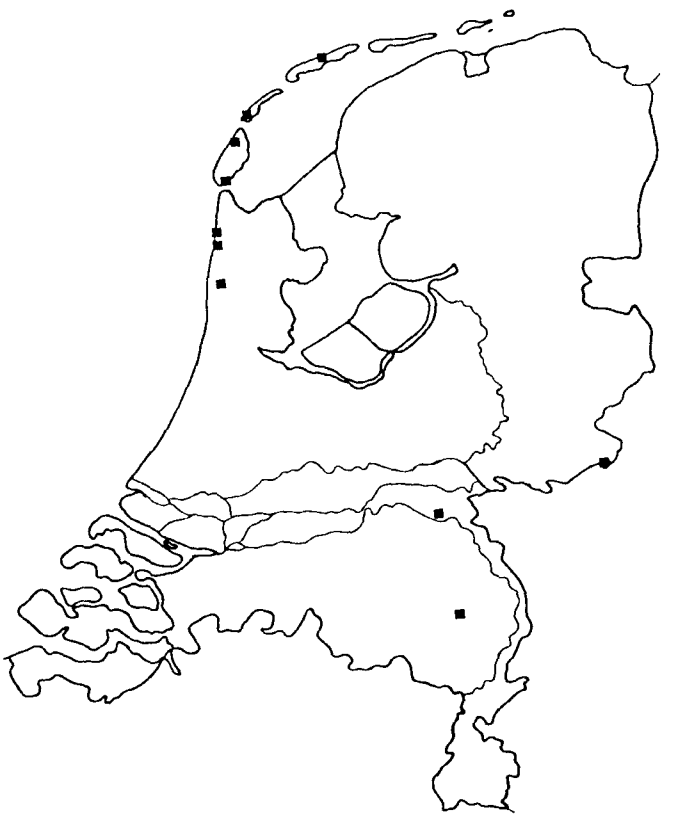

Fig. 18. *Hygrocybe phaeococcinea* in the Netherlands, mainly in the 'Waddendistrict'.

Fagus avenues on very poor, dry sand – is mainly found there. A few species seem to have their optimum in the Subcentreuroop district, e.g. *Hygrophorus russula*, *H. eburneus*, and *H. lucorum*. No agarics are known at the moment with a main distribution in the Kempens and/or Vlaams district.

The 'Fluviatiel district' comprises the river clays and river sands along the Rhine and its branches and the Meuse, as well as the maritime deposits in the south-west. It is well-characterized in mycofloristical respect by the occurrence of a considerable number of calciphytic mycorrhizal species with deciduous trees, e.g. *Amanita ceciliae* (= *A. inaurata*) (see Bas 1967), *A. franchetii*, *A. echinocephala*, *A. lividopallescens*, *Boletus appendiculatus*, *B. radicans* (Fig. 15), *B. queletii*, *B. impolitus*, *Lactarius pallidus*, *L. ichoratus*, *Inocybe corydalina*, *I. fraudans* (= *I. pyriodora* s.auct.) (Fig. 16), *Russula luteotacta*, and *R. pseudointegra*. These species occur in old forests of estates and along old avenues. It is remarkable that they are lacking in the Krijtdistrict where suitable habitats also seem to be available. The characteristic fungi are restricted to the river beds and are not found in the maritime part. On the other hand, they follow the valleys of the river Vecht N. of Utrecht and the river Oude Rijn W. of Utrecht. The boundaries of the Fluviatiel district may be modified in this way on mycofloristical grounds. Moreover, such a modified district coincides better with the distribution of river clay soils (Fig. 7). Many species are common to the Krijt- and/or Duindistrict (see also Krijtdistrict). Examples of species with a main distribution in the Duin- and Fluviatiel district are *Hygrophorus persoonii* (map, see Arnolds 1980b), *Amanita strobiliformis*, *Boletus rhodoxanthus*, *B. satanas*, *Lactarius evosmus*, and *L. decipiens*.

The 'Duindistrict' and the 'Waddendistrict' cover the young and old dunes along the coast of the North Sea. The young dunes and primary dune slacks of the two districts have many characteristic plant species in common, e.g. *Ammophila arenaria*, *Leymus arenarius*, *Eryngium maritimum* and *Schoenus nigricans*. In the Duindistrict the sand is primarily rich in lime. The flora contains numerous calciphytic plants, in part in common with the Krijt- and Fluviatiel district (see there), e.g. *Anthyllis vulneraria*, *Thymus pulegioides* and *Potentilla verna*. Such species are lacking or rare in the Waddendistrict. In the old dunes of the Duindistrict, the chalk has been leached out down to the deep soil layers and in places acidophytic plants occur. On the transition between Duin- and Hafdistrict many old estates are found with rich forests.

In the Waddendistrict the sand is primarily poor in lime. In the older dunes extensive dune heaths have developed. The forests are young and usually planted.

The coastal dunes are also well-characterized by their agaric flora. Characteristic of the outermost yellow dunes of the two districts are, e.g. *Psathyrella ammophila*, *Melanoleuca cinereifolia*, and *Agaricus devoniensis*; of dune grasslands, *Lepiota alba* and *Mycena chlorantha*; of grassland and scrubs, e.g. *Agaricus porphyrizon* (Fig. 17) and *Clitocybe phaeophthalma*; of *Salix repens* thickets, e.g. *Inocybe serotina* and *I. dunensis*. Some species are (almost) restricted to pine plantations in the dunes, e.g. the mycorrhizal symbionts *Tricholoma myomyces* and *Suillus collinitus*, the litter saprophyte *Mycena clavicularis* and *Mycena seynii* on cones of *Pinus pinaster*.

Characteristic of the Duindistrict are a number of calciphytic agarics which are lacking in the Waddendistrict, e.g. in grasslands *Pseudoclitocybe obbata* and *Dermoloma atrocinereum* (also in Kr and F), in pine forests *Russula cessans* and in deciduous forests *Hygrophorus persoonii* (also in F), *Lactarius evosmus* (also in F), *Lepiota ignicolor*, *L. subalba* (also in Kr), *L. pseudohelveola*, *Leucoagaricus wychanskyi*, and *Leucoagaricus croceovelutinus*.

The 'Waddendistrict' differs mainly from the Duindistrict in a negative way, viz. by the absence of the calciphytic species mentioned above. However, some acidophytic fungi are much more frequent than in the Duindistrict, e.g. *Mycena adonis*, *Hygrocybe miniata* and *H. laeta*. These species are also found in the pleistocene districts. A species with an optimum in acid, moist dune slacks of the Waddendistrict is *Hygrocybe phaeococcinea* (Fig. 18).

The 'Hafdistrict' comprises the low peat moors and sea clay areas in the western part of the Netherlands. It is a densely populated, intensively cultivated landscape, poor in forests and therefore mainly negatively characterized by the lack of numerous species of phanerogams and fungi. However, some recently planted recreational forests have proven to be rich in saprophytic fungi, especially of *Psathyrella*, *Conocybe* subgen. *Pholiotina* and *Lepiota*, e.g. *Psathyrella olympiana*, *Conocybe aporos*, *C. appendiculata*, and *Lepiota brunneoincarnata*. Most of these species are also known from the Fluviatiel and/or Duindistrict. The peat moors accommodate a rich phanerogamic flora including some characteristic species such as *Hierochloë odorata* and *Lathyrus palustris*. Some characteristic fungi of these moors are *Hygrocybe helobia* (Fig. 19), *Pholiota henningsii*, *Marasmius menieri*, and *Psathyrella typhae*.

Fig. 19. *Hygrocybe helobia* in the Netherlands, mainly in the 'Hafdistrict'.

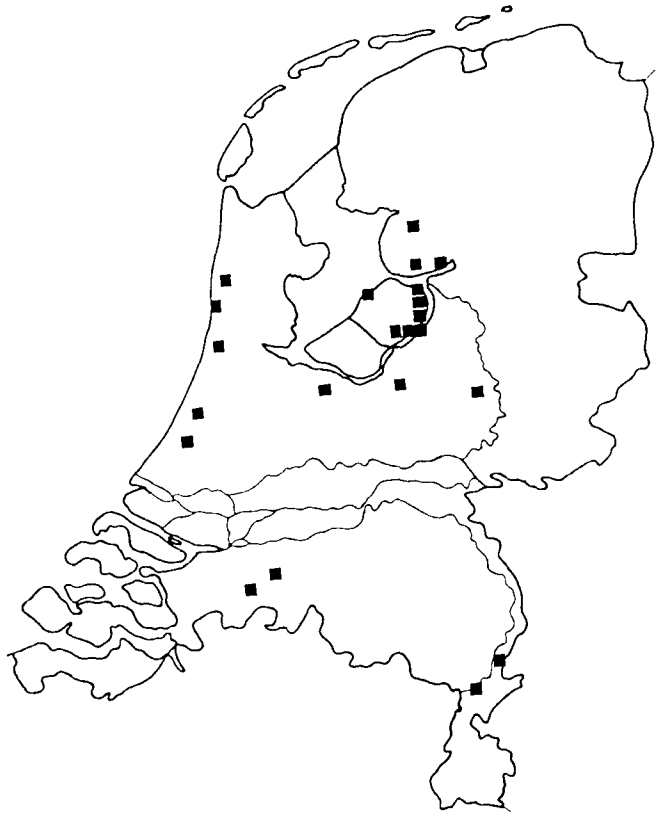

Fig. 20. *Clitocybe costata* in the Netherlands, mainly in the Flevopolders.

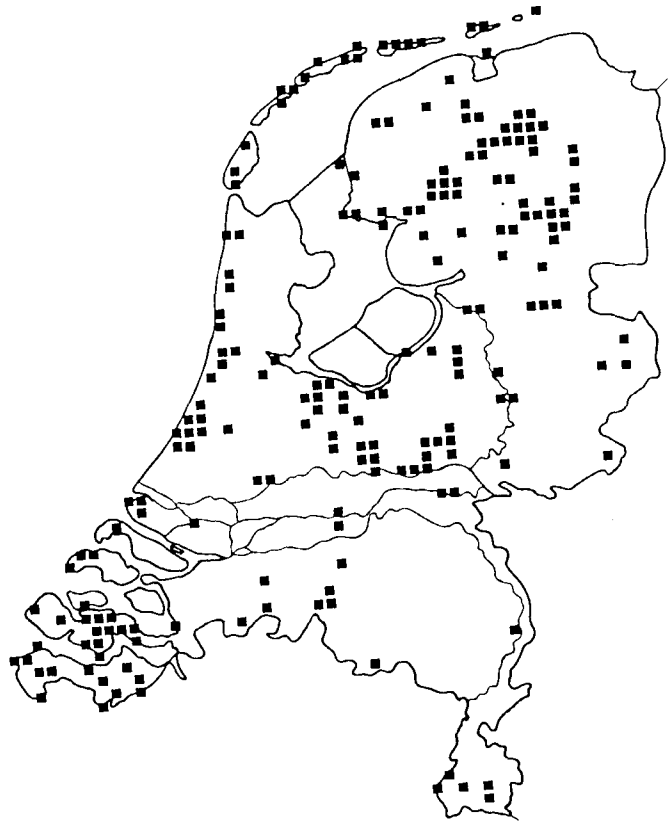

Fig. 21. *Marasmius oreades* in the Netherlands, without distinct pattern.

As yet not classified in the phytogeographical districts are the Flevopolders, reclaimed during this century from the IJsselmeer (Fig. 1). The young soils are generally rich in lime and vary from heavy clay to sands, in places also peat. The phanerogamic flora is not yet balanced so that it is difficult to assign it to one of the existing districts. In these polders many forests have been planted which are still very young (40 years at the most). The mycoflora has been relatively well investigated (Tjallingii & Tjallingii-Beukers 1983) and proved to be very interesting. It mainly contains elements from the Duin-, Fluviatiel and Hafdistrict, but some agarics have a distinct optimum in the Flevopolders, e.g. *Clitocybe costata* (Fig. 20), *Lepiota cortinarius*, *L. ventriosospora*, *Calocybe obscurissima*, *Inocybe ochroalba*, and *I. squamata*. On the basis of the agaric flora, the Flevopolders may be recognized as a district of its own or they may be attached to the Hafdistrict.

In Figure 21 the distribution pattern of *Marasmius oreades* is shown. This species, like many other species of man-made habitats, does not show a distinct preference for certain phytogeographical districts. It is expected to occur in almost any square of 5 × 5 km. Therefore the pattern of this species is more representative of the distribution of active mycologists than of its actual occurrence in the Netherlands.

7. AGARICS AND PLANT COMMUNITIES

Agarics and boleti play an important role in the carbon and nutrient cycle of many ecosystems. They can schematically be divided into three major ecological groups. In the Netherlands a majority of species belong to the saprophytes, contributing to the decomposition of dead organic matter, mainly of cellulose, hemicelluloses and lignin. Their ability to break down lignin make agarics important decomposers of woody substrates (e.g. Frankland, Hedger & Swift 1982). Another very large group is made up by ectomycorrhizal species, living in mutualistic symbiosis with woody phanerogams. The fungus component in this symbiosis provides the tree or shrub with water, minerals (the transport of phosphate being very important), sometimes also with vitamins and hormones. In addition, it may have antibiotic action against parasitic fungi and bacteria. The fungus in turn receives assimilates from the tree (e.g. Marks & Kozlowski 1973; Harley & Smith 1983). Ectomycorrhizal association is obligatory for many important genera of woody plants, including *Quercus*, *Fagus*, *Betula*, *Carpinus*, *Corylus*, *Alnus*, *Salix*, *Populus*, *Tilia*, *Pinus*, *Picea*, *Abies*, *Larix*, and *Pseudotsuga*. A small minority of agarics are necrotrophic parasites, their carbon source being living plants, which are often gradually killed. Most parasitic agarics mainly occur on weakened or wounded trees, but some species may attack healthy trees and cause economic damage, e.g. *Armillaria* spp. and *Oudemansiella mucida*.

The importance of agarics in ecosystems varies according to the environmental conditions. Generally speaking, wet and saline habitats are unfavourable, as are substrates with a low carbon/nitrogen (C/N) ratio. The most favourable conditions are found in moist to mesic ecosystems with a low nutrient level and on many substrates with a high C/N ratio (mainly wood).

In this section, some general information on the agaric flora, e.g. on species diversity and productivity, and some characteristic and/or dominant species will be mentioned for the more important plant communities in the Netherlands. The communities are approximately treated according to the sociological progression from pioneer to climax communities and named after Westhoff & den Held (1969). The data on the agaric flora are partly based on mycofloristic observations, partly on extensive mycocoenological studies. According to the latter approach, permanent plots are selected in homogeneous phytocoenoses (surface ± 500-1000 m^2) and visited several times a year during several successive years in order to count or estimate the numbers of carpophores for each species of macrofungi (Arnolds 1981, Barkman 1976). This method yields accurate results on the composition of fungus communities or mycocoenoses. Some authors prefer to describe and classify entire fungus communities or partial communities on homogeneous substrates (synusiae) in an independent, hierarchic mycocoenological system, analogous to the syntaxonomic system of plant communities (e.g. Darimont 1973, Runge 1980), mainly in view of the different function and taxonomic status of fungi. In our opinion it is better not to overload science with a new, vast set of formal names, but to incorporate mycocoenoses into a system of biocoenoses, at the moment best expressed in the syntaxonomy of plant communities.

a. Arable fields, gardens, and other man-made habitats

The habitats of this category are characterized by frequent churning up of the soil or other substrates by ploughing, digging and hoeing. Spontaneous vegetation is absent or mainly composed of annual weeds. In general, such conditions are not favourable for agarics, but some specialized species are characteristic. The mycocoenoses of these habitats have not been studied systematically and are very insufficiently known.

The mycoflora of corn-fields (belonging to the *Secalietea*) and fields of other crops (belonging to the *Chenopodietea*) has hardly been studied in the Netherlands, but is apparently very poor in number of species and basidiocarps. The most widespread are species of dark-spored genera, such as *Agrocybe* (e.g. *A. arvalis*, *A. praecox*), *Stropharia* (*S. coronilla*), *Panaeolus* (*P. fimicola*), *Coprinus* (*C. comatus*), and *Psathyrella* (*P. gracilis*, *P. prona*), furthermore *Volvariella gloiocephala*.

Within the rural landscape, the dung heaps and compost heaps have a special agaric flora, resulting from the heating of the substrate by fermentation. This mycoflora is in part different from the mycoflora on excrements (see *d.*), due to the larger mass and the higher temperature. Characteristic species of these substrates are, for instance, *Coprinus cinereus*, *C. macrocephalus*, *C. narcoticus*, *C. hexagonosporus*, *Agaricus bisporus*, *A. subperonatus*, *A. vaporarius*, and *Stropharia rugosoannulata*. It is doubtful whether these species really belong to the original mycoflora since their substrate does not occur naturally in the Netherlands. This applies even more to a species such as *Volvariella volvacea* that grows on a few rubbish dumps and fruits only in very warm summer periods when the air temperature reaches 30 °C. A very abundant agaric on rubbish dumps is *Coprinus comatus*.

The habitat of unheated glass houses, especially those used for the cultivation of cucumber on straw bales, is related to compost heaps. They can be very rich in agarics, e.g. *Panaeolus subbalteatus*, *Coprinus stercorarius*, *Conocybe fragilis* and *C. aurea*. *Bolbitius coprophilus*, *B. variicolor*, and *Conocybe intrusa* are only known from these glasshouses or comparable indoor habitats. In flowerpots in houses species of *Leucocoprinus* are often found, especially *L. birnbaumii* and *L. denudatus*, less frequently *L. lilacinogranulosus* and *L. magnusianus*. As these species are never found outside buildings, it is very doubtful if they should be assigned to the indigenous fungus flora. This certainly applies to agarics in heated glasshouses, which are therefore not treated in this flora.

A characteristic appearance in towns is *Agaricus bitorquis*, often fruiting in between the pavement and therefore named 'Straatchampignon' (= Street mushroom) in vernacular language. A relatively new habitat in towns is formed by public gardens where the pruned branches are cut into wood chips (mulch). Such soils intermixed with wood fragments can be rich in fungi, including more or less characteristic agarics like *Stropharia aurantiaca*, *S. percevalii*, *Psilocybe cyanescens*, and *Psathyrella bipellis*.

b. Coastal pioneer communities

Agarics are entirely lacking in areas regularly flooded by sea water, viz. in the plant communities belong to the *Zosteretea*, *Ruppietea*, *Spartinetea* and *Puccinellion maritimae*. Only a few grassland species seem to persist on the higher parts of the salt marshes and saline meadows, incidentally flooded at springtide only (*Armerion maritimae*), e.g. *Agaricus campestris*, *Lepista saeva*, *Panaeolina foenisecii*, and *Conocybe rickenii*. *Agaricus bernardii* has its optimum in this community. A characteristic species of brackish (mesohaline) marshes is *Marasmiellus trabutii*, apparently restricted to stems and leaves of *Juncus maritimus*.

The yellow dunes along the coastline (*Ammophiletea*) are only incidentally influenced by salt spray and are much richer in agarics, living on the dead roots of *Ammophila* or on buried organic remains washed ashore. The most abundant agarics are *Psathyrella ammophila* and *Melanoleuca cinereifolia*, whereas *Laccaria maritima* is also characteristic but rare. *Hohenbuehelia culmicola* is characteristic of dead stems of *Ammophila*. *Crinipellis stipitarius* is also frequently found on that substrate, but has a wider range.

Dry, sandy places behind the sea dunes and secondary windblown coastal dunes are often overgrown with a very open grassland with a high moss coverage. This community (*Tortulo-Phleetum*) is fairly rich in agarics in late autumn, including remarkable species such as *Clitocybe barbularum*, *Agaricus devoniensis*, *Hygrocybe conicoides*, *Galerina uncialis* and, on living *Tortula ruralis*, *Arrhenia muscigena* (= *Leptoglossum m.*).

c. Marshes and bogs

The hydrophyte communities belonging to the *Lemnetea*, *Charetea* and *Potametea* are without macrofungi, which are also very scanty in frequently inundated pioneer communities, but *Hypholoma subericaeum* may be abundant on rich, muddy soils (*Bidentetea*) and *H. elongatipes* and *H. udum* can be found in comparable, but poorer conditions (*Littorelletea*). The communities of tall herbs in eutrophic marshes and along banks (*Phragmitetea*,

Fig. 22. The distribution of woods in the Netherlands (after Atlas van Nederland).

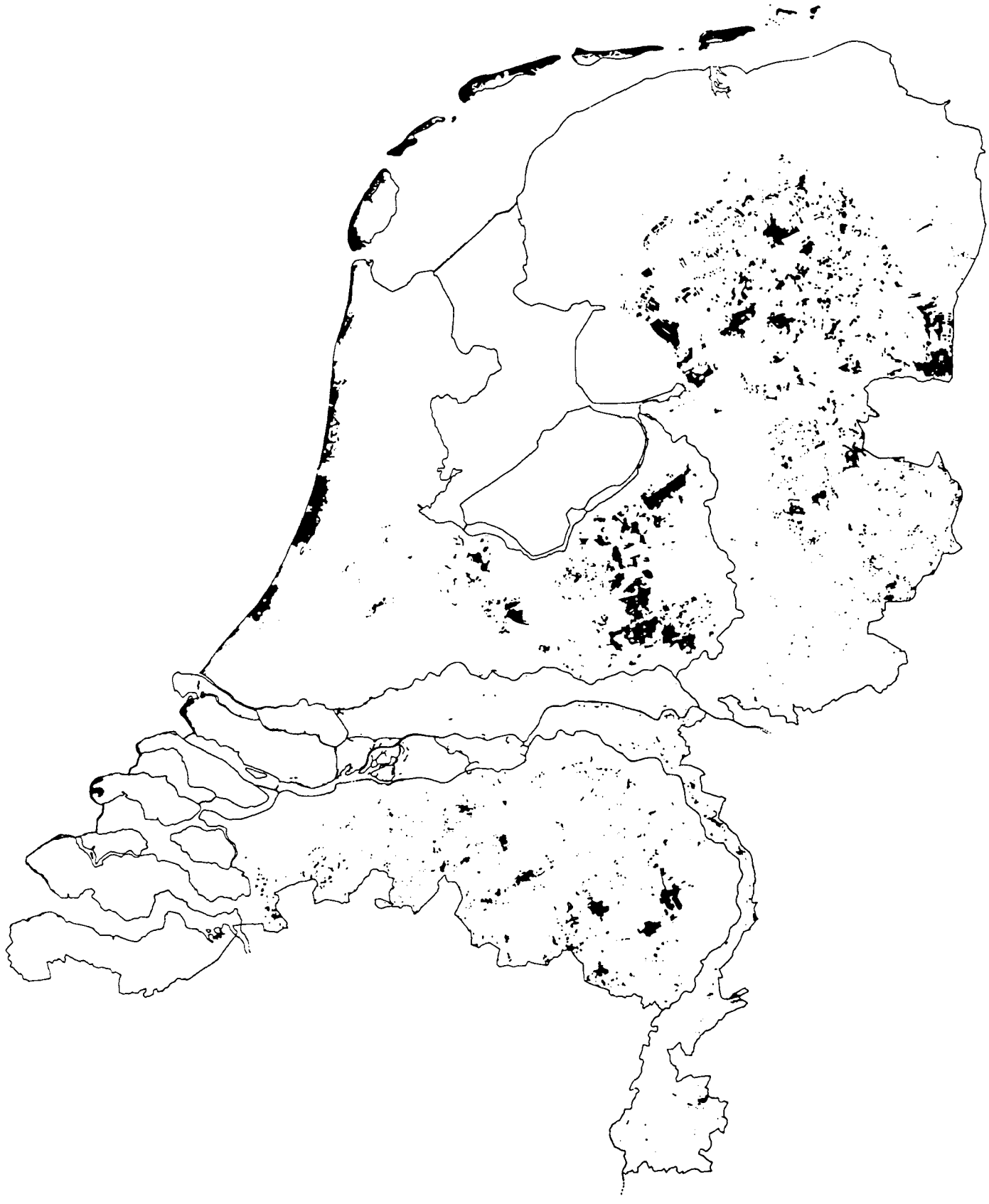

Fig. 23. The distribution of non-forested natural areas (marshes, moors, heaths, dunes, etc.) in the Netherlands (after Atlas van Nederland).

Filipendulion) have hardly been investigated mycologically, but seem to be somewhat richer in species. *Psathyrella typhae* is a species characteristic of culms of various tall herbs just above the waterline. *Marasmius menieri* and *Mycena typhae* are restricted to stems of *Typha*, *Mycena belliae* to culms of *Phragmites*. *Psathyrella almerensis* and *P. basii* are very rare species from similar substrates. On remains of grasses *Mycena quisquiliaris* can be abundant. Other more or less characteristic species are *Entoloma minutum* and *Marasmius limosus* (mainly on leaves of *Phragmites*). These eutraphent marsh communities develop, when not disturbed, into willow shrubs and alder forests (see p. 24). By mowing, they develop into mesotrophic, passable reed lands, often rich in *Sphagnum* spp. (*Pallavicinio-Sphagnetum*, *Sphagnetum palustri-papillosi*). The most characteristic agarics are here *Hygrocybe helobia*, *Armillaria ectypa* and *Pholiota henningsii*. Other frequent species are *Sphagnum*-associates such as *Tephrocybe palustris*, *Galerina paludosa*, *G. tibiicystis*, *Hypholoma elongatipes*, and *H. udum*. The last five species also grow in oligotrophic peat bogs, locally developed on the pleistocene sands of the eastern and southern provinces.

The mycocoenoses of oligotrophic bogs were recently studied by Barkman (in prep.). They are relatively poor in species and basidiocarps, much poorer than described by Favre (1948) from the Jura, Lange (1948) from Denmark, and Einhellinger (1976) from Bavaria. The lowest, wettest parts of the peat bogs (*Scheuchzerietea*) have hardly any differentiating species with regard to the higher tussocks. Only a few sphagnophilic species occur, including the five agarics mentioned above and *Entoloma sphagneti*. These species are also found, however, on the tussocks belonging to the *Sphagnetalia magellanici*. Characteristic of this community are, for example, *Psilocybe atrobrunnea*, *Mycena concolor* and the rare species *Omphalina sphagnicola*, *O. philonotis*, and *Hygrocybe coccineocrenata*. A characteristic agaric of freshly cut peat walls is *Galerina stordahlii*.

d. Grassland communities

The mycocoenoses of grasslands are relatively well-known from extensive mycocoenological studies by Arnolds (1981, 1983) in the north-east of the Netherlands. However, several important types of grassland in the coastal dunes (*Galio-Koelerion*), on clay (*Arrhenatheretum elatioris*) and chalk (*Mesobromion*) have only been investigated in a qualitative floristic way.

Grasslands on wet, periodically water-saturated or inundated soils ('peaty earth soils', 'beek earth soils'), are mainly situated in brook valleys and depressions with peat. They belong to the order *Molinietalia* and are relatively poor in species as well as carpophores of macrofungi. Frequent saprophytic agarics are, for example, *Mycena leptocephala*, *M. filopes*, *Panaeolus acuminatus*, *Conocybe rickeniana* and bryophytic species on large pleurocarpous mosses such as *Rickenella fibula*, *R. swartzii*, *Galerina pumila*, *G. vittaeformis*, and *G. heterocystis*. These species are not characteristic, but widespread in various grassland types and some also in heathlands and forests. More characteristic of wet grasslands are, for example, *Omphalina acerosa*, *Galerina jaapii* and *G. hygrophila*. Within the *Molinietalia*, the alliance *Junco-Molinion* comprises old, permanent hayfields on unfertilized, poor, wet peat and sand. This community has become very rare in the Netherlands. It lodges various rare agarics, especially of the genus *Entoloma*, e.g. *E. pseudocoelestinum*, *E. porphyrophaeum*, *E. velenovskyi* and, in addition, *Hygrocybe glutinipes* and *H. helobia*. In the *Calthion palustris*, several associations are united, growing on slightly richer, weakly fertilized soils. *Agrocybe paludosa*, *Entoloma pygmaeopapillatum*, *Mycena bulbosa* (on leaf sheaths of graminoid plants), and *Galerina inundata* are remarkable species there.

The opposite extreme is pioneer communities on wind-blown sand dunes in the heath landscape on pleistocene soils (*Spergulo-Corynephorion*); very open grasslands (*Festuca ovina*, *Corynephorus*, *Agrostis coarctata*) dominated in fact by mosses and lichens. The mycoflora on these acid sands, very poor in humus, has hardly anything in common with the mycoflora of the yellow coastal dunes. It is very poor in agarics, dominated by widespread species, such as *Mycena sepia*, *M. galopus*, and *Psilocybe muscorum*. More characteristic fungi are *Entoloma psilopus* and *Psilocybe montana*. *Hygrophoropsis aurantiaca*, usually occurring in forests, is often found on these sand dunes as well.

Permanent grasslands on not or weakly fertilized, poor, mesic or rather dry soils are usually rich in fungi. Their species diversity increases with the duration of undisturbed use as grassland. Old, moss-rich pastures are characterized by the abundance of species of *Hygrocybe* and *Entoloma*. Therefore, they are known as '*Hygrophorus* grasslands' (Arnolds 1980a: Fig. 2). Part of these species occur in all kinds of these poor grasslands, irrespective of the soil type (acid sand, weakly acid loam and peat, subneutral to basic clay), e.g. *Hygrocybe virginea* var. *virginea*, *H. pratensis*, *H. psittacina*, *H. ceracea*, *Entoloma sericellum*, *E. infula*, *E. chalybaeum* var. *lazulinum*, *E. sarcitulum*; in addition, e.g. *Dermoloma atrocinereum* and *Rhodocybe popinalis*.

Hygrophorus grasslands on sandy soil, belonging to the *Festuco-Sedetalia*, are characterized by a large number of species, including *Galerina unicolor*, *Agaricus cupreobrunneus*, *A. porhyrocephalus*, *Hygrocybe persistens*, *Omphalina obscurata*, and *Entoloma papillatum*. The richest areas are some grasslands in the old, inner dunes (*Galio-Koelerion*). Some fine examples are found near Castricum (Noord-Holland) and on the isles Schouwen, Goeree, Voorne, Texel and Terschelling. *Lepiota alba*, *Pseudoclitocybe obbata*, *Hygrocybe luteolaeta* and a few other agarics are (practically) restricted to the dune grasslands; *Hygrocybe russocoriacea*, *H. coccinea*, and *Rhodocybe popinalis* have their optimum there. The poor, sandy grasslands outside the coastal dunes (*Thero-Airion*) are almost restricted to roadsides and a few nature reserves. They differ by the abundance of many acidophytic fungi, also known from heathlands, e.g. *Mycena cinerella*, *M. pelliculosa*, *Galerina pumila*, *G. vittaeformis* var. *atkinsoniana*, and *Rhodocybe caelata*.

Not or weakly fertilized pastures and open hayfields on clayey soils (*Mesobromion*, *Arrhenatheretum elatioris* p.p.) are mainly found along the big rivers and on limestone slopes in S.Limburg, although these grasslands are very rare. They are usually less rich in basidiocarps of agarics than sandy grasslands, but their species number can be of the same size. Characteristic species are for example *Hygrocybe chlorophana*, *H. konradii*, *H. calciphila*, *H. fornicata*, *Entoloma incanum*, *Camarophyllopsis foetens*, and *Conocybe dumetorum*. In the few limestone grasslands of S.Limburg (*Koelerio-Gentianetum*), some species are added, e.g. *Hygrocybe lacma*, *H. colemanniana*, *H. reai*, *Camarophyllopsis*

schulzeri, *C. phaeophylla*, *Entoloma prunuloides*, and *E. exile* var. *pyrospilum*.

More intensive agricultural use, especially the application of artificial fertilizers, invariably leads to a strong impoverishment of the floras of both phanerogams and macrofungi. All characteristic species of *Hygrophorus* grasslands are very sensitive to artificial fertilizers as well as disturbance of the soil by, for example, ploughing. In moderately fertilized, permanent pastures (*Lolio-Cynosuretum*), the mycoflora is still rather well-developed. Species with an optimum in this community are, e.g. *Agaricus campestris, Lepista personata*, *Leucoagaricus naucinus*, *Macrolepiota excoriata*, *Psilocybe semilanceata*, *Agrocybe praecox*, and *Calocybe carnea*. Such grasslands are found on almost all kinds of soil, but they are becoming rare due to further intensification of agriculture. The differences between these pastures on different soils are not well-known, but probably rather small.

At present most grasslands in the Netherlands are artificial meadows of a few sown grass species (mainly *Lolium perenne*, *Poa trivialis*, *Phleum pratense*), only lasting a few years and then ploughed and renewed sown or converted into fields. They are enriched with enormous quantities of artificial fertilizers and liquid manure. In this community (*Poo-Lolietum*), mainly coprophytic fungi are found. Terrestrial fungi include several species of *Panaeolus* (e.g. *P. fimicola*, *P. subbalteatus*, *P. acuminatus*), *Conocybe* (e.g. *C. siliginea*, *C. rickeniana*, *C. rubiginosa*), further *Marasmius oreades*, *Clitocybe agrestis*, and *C. amarescens*.

In grasslands coprophytic agarics have an important function in the cycling of nutrients. Some coprophytes are mainly found in relatively poor grasslands (*Hygrophorus* grasslands), e.g. *Anellaria semiovata*, *Panaeolus campanulatus*, and *Coprinus niveus*. Some species prefer straw-rich dung of horse, rabbit and sheep, e.g. *Psilocybe coprophila*, *Coprinus curtus*, *C. niveus*, *C. radiatus*; other species prefer the straw-poor dung of cow, e.g. *Coprinus velox* and *C. bisporus*.

e. Heathlands

Heathlands once occupied the majority of the pleistocene soils, but most have been reclaimed to agricultural areas or planted with forests. Some large and many small heathlands have been saved as nature reserves. The most widespread type is the dry heath on podzolic sands, dominated by *Calluna vulgaris*, in the northern provinces replaced by *Empetrum nigrum* in places. Mycocoenological plots in dry heathlands have been studied by Kramer (1969, n.p.; see also Arnolds 1981: 221). Abundant litter saprophytes are, e.g. *Mycena galopus*, *M. sanguinolenta*, *M. epipterygia*, *M. cinerella*, *Clitocybe vibecina*, and *Marasmius androsaceus*, but these species are not characteristic and are also found on acid raw litter in other communities. More characteristic of heathlands, including the types on moist soils, are *Entoloma farinogustum*, *E. elodes*, *E. turbidum*, and *Cantharellula umbonata*.

In slightly enriched places and along tracks through heathlands, small grass heaths are found, dominated by the grasses *Festuca tenuifolia*, *Nardus stricta*, and *Sieglingia decumbens* (*Violion caninae*). Some agarics with an optimum in this habitat are *Mycena pelliculosa*, *Entoloma hispidulum*, *E. vinaceum*, *Galerina pumila*, and *G. vittaeformis* var. *atkinsoniana*.

Moist to wet heathlands, dominated by *Erica tetralix* (*Ericetum tetralicis*), have become much rarer. The dominant agarics are the same as in the dry heathlands, except for *Mycena cinerella*, which is scarce. Differentiating are some fungi with an optimum in peat bogs, such as *Gymnopilus fulgens*, *Mycena uracea*, *Hypholoma udum*, and *H. elongatipes*. Also on moist soils grass heaths are found, dominated by *Molinia caerulea*, *Nardus stricta*, and *Juncus squarrosus* (*Nardo-Gentianetum pneumonanthes*). The mycoflora is related to the *Erica* heath but additional, more or less characteristic species are, e.g. *Mycena adonis*, *Hygrocybe laeta*, *Entoloma formosum*, and *E. xanthocaulon*.

In recent years, many heathlands have changed into monotonous grass communities, dominated by *Deschampsia flexuosa* on dry soils and by *Molinia caerulea* on moist soils. This is caused by inappropriate management, input of nitrogen by air pollution and lowering of the groundwater table in surrounding areas. The agaric flora in these grass communities is a weak reflection of the flora in the original heathlands.

f. Scrub

In many habitats, scrub is the last stage in vegetation succession before the establishment of a (climax) forest. However, some plants form pioneer scrub. On slopes in the calcareous sea dunes of the Duindistrict buckthorn scrub soon develops (*Hippophao-Sambucetum*), made up of a few endomycorrhizal shrubs. This habitat is rather poor in agarics and characteristic species are not known. The buckthorn scrub is often replaced by mixed scrub of *Crataegus monogyna*, *Euonymus europaeus*, *Rosa* spp., *Berberis vulgaris (Hippophao-Ligustretum)*, richer in agarics and characterized, for example, by *Tubaria dispersa*, *Entoloma clypeatum*, and *Calocybe gambosa*. These species are also found in thorn thickets on clay and rich, sandy soils along the big rivers (Fluviatiel district) and in S.Limburg (Krijtdistrict) (*Carpino-Prunetum spinosae*; *Sambuco-Prunetum spinosae*). *Prunus spinosa* is often an important shrub in these communities, associated with *Entoloma saepium* and sometimes *E. niphoides*. It is not yet certain whether these vernal Entolomas form ectomycorrhizae or not.

In dune slacks in the Duin- and Waddendistrict, low scrub of *Salix repens* is found (*Pyrolo-Salicetum*, *Polypodio-Salicetum*, *Thalictro-Salicetum*). It is rich in agarics, in particular in ectomycorrhizal species. Some of these are (almost) exclusively associated with *Salix repens*, e.g. *Inocybe agardhii*, *I. serotina*, *I. dunensis*, *I. vulpinella*, and *Russula laccata*. Others also grow with larger *Salix* species, e.g. *Hebeloma pusillum*, *Tricholoma cingulatum* and *Cortinarius trivialis*. Interesting is a group of agarics which are widespread in coastal *Salix repens* scrub, but which elsewhere are associated with different woody plants, e.g. *Lactarius controversus* (elsewhere with *Populus*), *L. mitissimus* (usually with coniferous trees), and *Russula persicina* (with deciduous trees). A characteristic saprophyte on fallen leaves of *S. repens* is *Flammulaster carpophilus*. Other types of *Salix repens* scrub occur in moist depressions on pleistocene sand. They are much poorer in characteristic fungi.

In bogs and marshes scrub is also important. In places, *Myrica gale* constitutes dense thickets (*Myricetum gale*) without any ectomycorrhizal fungus and with slowly decomposing litter and wood. They only contain some trivial agarics. Much more inter-

esting is the scrub of *Salix aurita* on mesotrophic soils (*Frangulo-Salicetum auritae*) and of *Salix cinerea* on eutrophic soils (*Alno-Salicetum cinereae*). These communities have many fungal species in common. The differences have not yet been studied in detail. Among the numerous characteristic ectomycorrhizal fungi of *Salix* are *Naucoria salicis*, *N. amarescens*, *Inocybe salicis*, *I. squarrosa*, *Cortinarius uliginosus*, and *Russula subrubens*. Characteristic as well, but doubtfully mycorrhizal are, for example, *Entoloma bisporigerum* and *Galerina permixta*. Many saprophytic agarics are found on the wood of *Salix*, also favoured by the moist microclimate. *Hohenbuehelia myxotricha* is very characteristic. Other species with an optimum on *Salix* wood are *Resupinatus trichotis*, *Phaeomarasmius erinaceus*, *Mycena adscendens*, and *M. picta*.

A very special habitat is formed by scrub of *Juniperus communis* (*Dicrano-Juniperetum*, *Squarroso-Juniperetum*), formed by pioneer communities on formerly overgrazed, poor, sandy soils with extreme variations in microclimate (Barkman, Masselink & de Vries 1977). Such scrub occurs very locally on wind-blown sands (duin vague soil) in the Drents, Subcentreuroop, and Gelders district. During 15 years, extensive mycocoenological investigations have been carried out in juniper scrub by Barkman, Masselink and de Vries, but only part of the results have been published up to now (Barkman 1976, 1985). Juniper scrub has proved to be a very rich habitat for agarics, but in fact without exclusive species. The mycoflora is a mixture of elements from heathlands, grasslands and coniferous forests, but ectomycorrhizal species are lacking in pure juniper stands. Species with a relatively high frequency in such scrub are, e.g. *Leucopaxillus lentus*, *Hygrocybe laeta*, *Omphaliaster asterosporus*, *Tephrocybe ambusta*, and *Ripartites helomorphus*.

g. Deciduous forests

In almost all habitats of the Netherlands, deciduous forests are the natural climax communities. Yet only eight per cent of the surface is actually covered by forests, the majority made up of relatively young, planted forests of coniferous trees. The distribution pattern of forests (Fig. 22) is only determined by human interference. The largest forest areas are found on unfertile, pleistocene sands in the centre, south and east (Drents, Subcentreuroop, Gelders and Kempens district). The distribution patterns of some important forest trees in the Netherlands are presented in Figures 24-26. These patterns can explain to some extent the distribution of the associated fungi.

Among the deciduous forests, the willow forests of *Salix triandra*, *S. alba*, *S. viminalis* and some other species on clay along the main rivers *(Salicion albae)* take a special place because they are in fact pioneer communities. Their mycocoenoses are poor in species and hardly known. *Lentinus tigrinus* seems to be a characteristic wood saprophyte of these willow forests.

Forests of *Alnus glutinosa* are often the climax community on wet, peaty soils (*Carici elongatae-Alnetum*). They are very rich in exclusive mycorrhizal agarics and in wood saprophytes. The mycocoenoses of alder forests in brook valleys in the Drents district are studied in detail by Arnolds (not yet completed). Dominant mycorrhizal species are *Naucoria escharoides*, *N. scolecina*, *N. alnetorum*, *Lactarius obscuratus*, *L. omphaliformis*, and *Cortinarius alnetorum*. Other characteristic companions of *Alnus* are, e.g. *Naucoria suavis*, *Russula pumila*, *Lactarius lilacinus*, *Gyrodon lividus*, and *Paxillus rubicundulus*. Some of these species seem to be lacking in the alder forests in the eutrophic bogs of the Hafdistrict, e.g. *Russula pumila* and *L. lilacinus*. These forests have not yet been extensively studied, however.

Some lignicolous fungi with a preference for *Alnus* are *Pholiota alnicola*, *Entoloma euchroum* and *Mycena speirea*. The litter in these forests is quickly decomposed and agarics are not very important in this process. *Entoloma politum*, *E. sericatum*, and *Conocybe cryptocystis* are species with a possible optimum in alder forests.

In very oligotrophic, wet habitats such as ombrotrophic peat bogs, *Alnus* is replaced by *Betula pubescens*. Such *Betula* forests on raw peat soils, rich in *Sphagnum* (*Betulion pubescentis*), have been mycocoenologically studied in Drenthe by Jalink & Nauta (1984) and are poorer in agarics than *Alnus* forests. The flora of mycorrhizal species is quite different from the *Alnion*. Characteristic taxa are *Russula emetica* var. *longipes*, *R. claroflava* and *Leccinum holopus*. *Lactarius theiogalus*, *Russula betularum*, *Leccinum scabrum*, *Tricholoma flavobrunneum*, and *Cortinarius armillatus* are also regularly found, but are shared with the drier *Betula* forests of the *Quercion robori-petraeae* (see p. 25). Important differentiating species of the *Betulion pubescentis* are a number of sphagnophilous agarics, also found in open bogs, such as *Galerina paludosa* and *Tephrocybe palustris*. The agarics on *Betula* wood are mostly ubiquists.

The *Alno-Padion* comprises various forest associations on moist to mesic (but not wet), clayey or sandy soils rich in nutrients ('ooi vague soils', 'sea sand soils', 'earth soils'). The canopy is often rather varied and includes many predominantly endomycorrhizal tree species, e.g. *Ulmus*, *Fraxinus excelsior*, and *Acer*. In the moist types *Alnus glutinosa* is still present, but the ectomycorrhizal flora is much poorer than in the *Alnion*. *Quercus*, *Fagus*, and *Corylus* are important ectomycorrhizal trees often present. *Alno-Padion* forests are most frequent on sandy soils in the inner coastal dunes of the Duindistrict (*Ulmion carpinifoliae*) and on loam and clay along the big rivers (Fluviatiel district) and some rivulets (*Circaeo-Alnion*). The forests of these areas have many species in common, e.g. *Boletus satanas*, *Lactarius decipiens*, *L. insulsus*, *L. acerrimus*, and *Amanita strobiliformis*. Mycorrhizal species with an optimum in dune forests are, e.g. *Hygrophorus persoonii*, *Russula decipiens* and *R. fontqueri*. In some places, these forests are very rich in saprophytes (mainly *Lepiota* species and relatives) on mull humus, especially amongst *Urtica* in forests rich in *Ulmus*, e.g. *Agaricus meleagris*, *A. porphyrhizon*, *Lepiota fulvella*, *L. ignicolor*, *L. pseudohelveola*, *L. subincarnata*, *Leucoagaricus badhamii*, *L. croceovelutinus*, and *L. wychanskyi*.

The forests on river clay are much poorer in basidiocarps than the forests on sandy soil, but they can be rich in species in some years and contain a lot of striking and rare fungi, e.g. *Boletus impolitus*, *B. radicans*, *B. queletii*, *Amanita ceciliae*, *A. franchetii*, *A. echinocephala*, *A. lividopallescens*, *Russula luteotacta*, *R. viscida*, *R. pseudointegra*, *Lactarius pallidus*, *Inocybe corydalina*, *Entoloma eulividum*, etc. Most of these species are hardly found in the true forests, but mainly in old avenues of *Fagus* and *Quercus*. Some rare wood saprophytes are also found mainly in

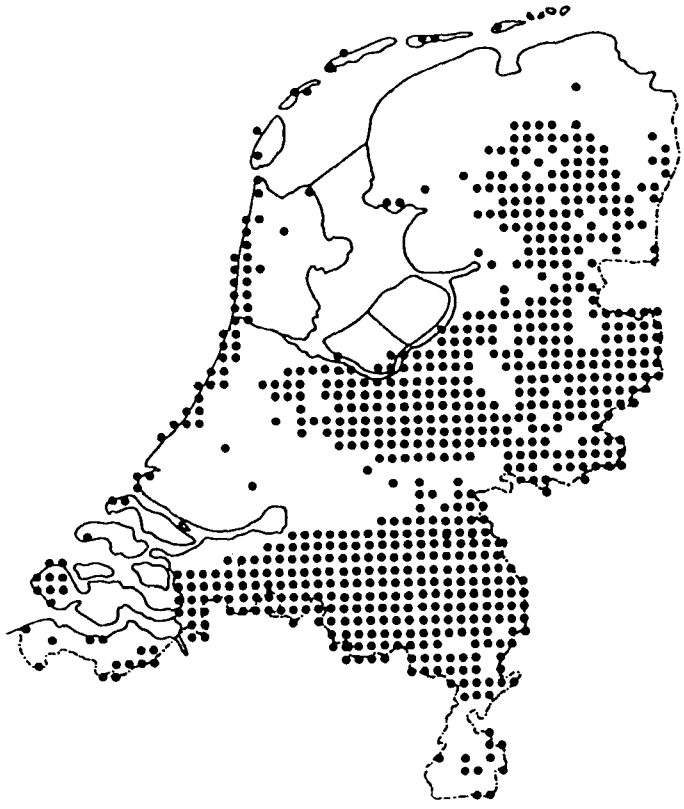

Fig. 24. *Pinus sylvestris* in the Netherlands (including planted trees in woods and parks) (after Mennema et al., Atlas Nederlandse Flora 3 (in prep.)).

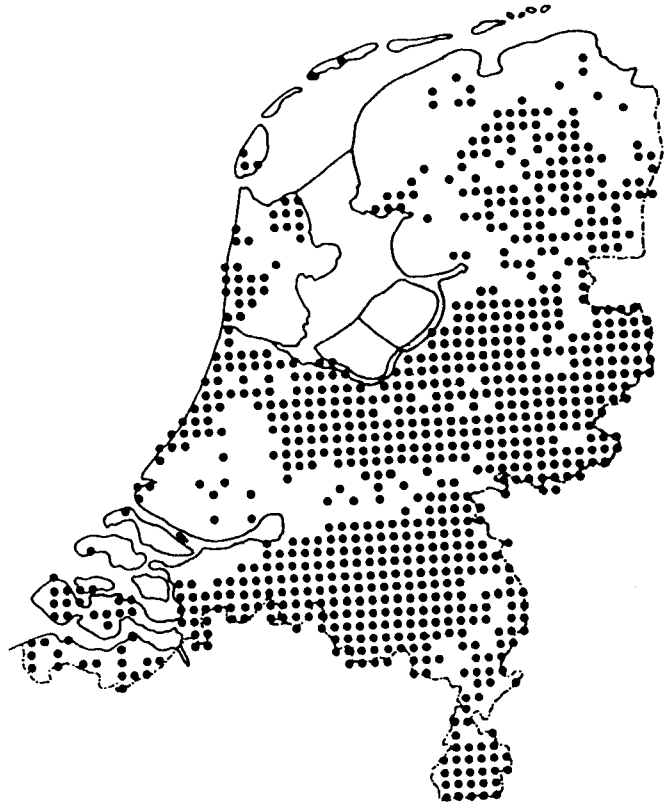

Fig. 25. *Fagus sylvatica* in the Netherlands (including planted trees in woods and parks) (after Mennema et al., Atlas Nederlandse Flora 3 (in prep.)).

these forests on river clay, e.g. *Omphalotus olearius* and *Xerula longipes*.

In the natural areas of *Alnion* and *Alno-Padion*, the forest is often replaced by plantations of *Populus* x *canadensis*, *P. nigra* and some other poplar species. They are usually rather poor in agarics but have some characteristic species: e.g. the mycorrhizal *Inocybe squamata*, *Lactarius controversus*, *Tricholoma populinum* and, mainly in the coastal dunes, *Lactarius evosmus*, the leaf saprophyte *Pholiota oedipus* and the wood saprophyte *Pholiota destruens*.

On dry calcareous loam, the *Carpinion* is the prevailing forest type, represented in the Netherlands by the *Stellario-Carpinetum*. The canopy is dominated by *Quercus robur* and *Carpinus*, but many other trees and shrubs may be present too. Well-developed examples are found almost exclusively on cretaceous slopes in South Limburg (Krijtdistrict), a region only incidentally explored by mycologists. Therefore the mycoflora of the *Carpinion* is insufficiently known. In most years these forests are poor in mycorrhizal species. Some *Carpinus* symbionts may be characteristic, such as *Lactarius circellatus* and *Leccinum griseum*. Some rare saprophytes of mull humus are known mainly from these forests, e.g. *Cystolepiota bucknallii*, *C. hetieri* and *Lepiota fuscovinacea*. *Marasmiellus candidus*, and *Micromphale foetidum* are characteristic of twigs in the *Carpinion*.

The climax communities in the *Carpinion* area are in fact *Fagus* forests (*Melico-Fagetum*, *Cephalanthero-Fagetum*), but such forests are actually lacking in the Netherlands due to prolonged exploitation as coppice wood. *Fagus* occurs only as an isolated tree in the *Carpinion*. This explains the absence from the Netherlands of characteristic *Fagus* associates such as *Hygrophorus penarius*, *Marasmius alliaceus*, and *Mycena crocata*, as well as the scarcity of, for example, *Hygrophorus eburneus* and *H. unicolor*. These fungi are not rare in adjacent regions in east Belgium and Germany (Eifel, Teutoburger Wald), where beech forests on chalk are widespread.

The deciduous forests on oligotrophic, mesic to dry, acid, sandy soils, belonging to the *Quercion robori-petraeae*, are by far the most widespread type in the Netherlands. It is usually dominated by *Quercus robur*, often intermixed with *Betula* spp., *Sorbus aucuparia* and *Populus tremula*. The herb layer is often sparse, but may be well-developed, with species such as *Deschampsia flexuosa*, *Vaccinium myrtillus*, *Pteridium aquilinum*, and *Corydalis claviculata*. In young spontaneous forests, for instance arisen from ungrazed heathlands, *Betula* spp. may be dominant. This *Betula*-rich form of the *Quercion* has been investigated in mycocoenological respect by Jalink & Nauta (1984) and is characterized by a number of mycorrhizal fungi, in part listed already for the wet *Betulion pubescentis* (see p. 24). Differentiating species of the dry *Betula* forests are, for example, *Russula nitida*, *R. aeruginea*, *Lactarius necator*, *L. vietus*, *Amanita muscaria*, and *Cortinarius pholideus*.

All forests dominated by *Quercus robur* or *Q. petraea* have many mycorrhizal species in common, e.g. *Russula ochroleuca*, *R. krombholzii*, *Lactarius quietus*, *Amanita rubescens* and *Laccaria amethystea*. The mycocoenoses of the acidophytic oak

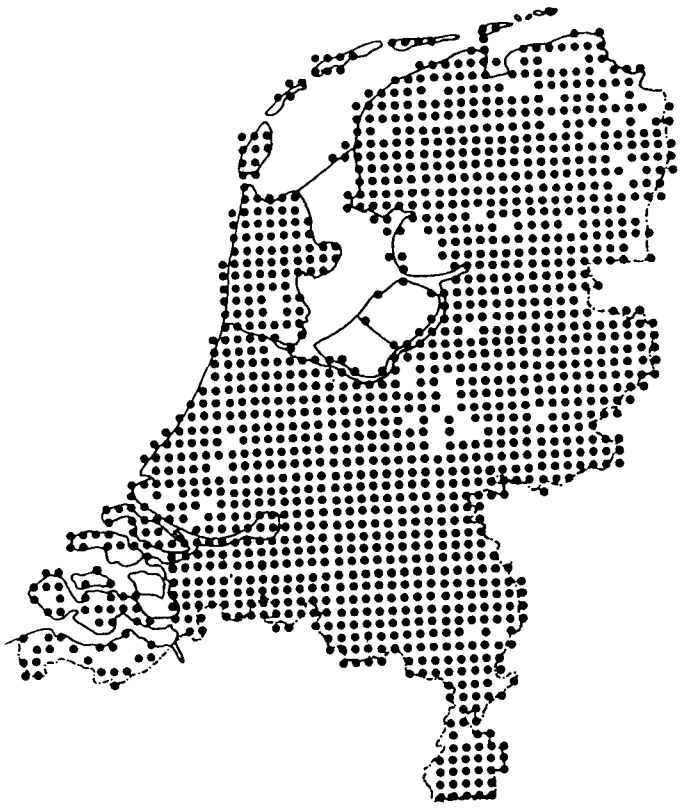

Fig. 26. *Alnus glutinosa* in the Netherlands (planted trees included) (after Mennema et al., Atlas Nederlandse Flora 3 (in prep.)).

forests of the *Quercion* have been extensively described by Jansen (1981). Characteristic of these forests are, for example, *Amanita citrina*, *A. fulva*, *Lactarius chrysorrheus*, *L. camphoratus*, *Tylopilus felleus* and *Cortinarius paleaceus*. Within the *Quercion*, the richness in mycorrhizal fungi is negatively correlated with the development of the soil profile. Many species have a distinct optimum in the *Dicrano-Quercetum*, an association of low, shrubby oaks on dry, acid sand dunes, with a very thin humus layer ('duin vague soils'), e.g. *Tricholoma portentosum*, *T. columbetta*, *Cortinarius bolaris*, *C. fusisporus*, *Inocybe lanuginosa* s.str., and *Russula adusta*.

Some agarics are associated with *Quercus* and *Fagus* on poor soils, but mainly found near old, isolated trees and along roadsides, e.g. *Russula nigricans*, *R. amoenolens*, *Lactarius vellereus* and *Boletus erythropus*. The litter in the *Quercion* is slowly decomposed and agarics make an important contribution, especially ubiquitous species like *Collybia dryophila*, *C. butyracea*, *Mycena sanguinolenta*, *M. galopus*, etc. Species with an optimum on oak leaves are, e.g. *Mycena polyadelpha*, *M. smithiana*, *Clitocybe candicans* and *Marasmius splachnoides*. Agarics mainly associated with *Quercus* wood are, for example, *Collybia fusipes*, *Mycena inclinata*, and *Panellus stypticus*.

In many places the native oak species have been replaced by *Quercus rubra*, more rarely also by *Castanea sativa*. The mycoflora of such woods is similar to the *Quercion*, although strongly impoverished and without characteristic accompanying fungi.

Another important planted deciduous tree on acid sands is *Fagus sylvatica*. It is doubtful whether this tree would dominate on these soils under natural conditions. *Fagus* has many mycorrhizal symbionts in common with *Quercus*. Species characteristic of *Fagus* on various soils are, e.g. *Russula fellea*, *Lactarius blennius*, *L. subdulcis* and *Cortinarius cinnabarinus*. *Boletus calopus* is restricted to old avenues of *Fagus* on poor, acid sand. Lignicolous fungi of beech forests are, for example, *Oudemansiella mucida* and *Xerula radicata* (on roots). Most species of *Fagus* litter are also found on other substrates. *Flammulaster carpophilus* var. *subincarnatus* (on cupules), *Collybia konradiana*, *Marasmius wynnei*, and *Mycena fagetorum* are more or less characteristic.

h. Coniferous forests

Forests dominated by conifers are not native to the Netherlands and are usually planted. The only indigenous coniferous plants are *Pinus sylvestris*, *Juniperus communis* and, probably, *Taxus baccata*. Communities dominated by *Juniperus* were discussed under scrub. *Pinus sylvestris* was originally only found as a solitary tree in very extreme habitats, e.g. peat bogs and very dry sands. At present, it is the most abundant forest tree in the Netherlands, although restricted to sandy soils. It has also formed subspontaneous forests due to the spreading of seeds from planted trees.

The most abundant exotic conifers planted in forests are *Picea abies*, *Pseudotsuga menziesii* (on slightly richer, sandy and loamy soils), *Larix leptolepis* and *Pinus nigra* ssp. *nigra* and *austriaca* (especially frequent in the dunes). More local are plantations of *Abies alba*, *Picea sitchensis*, *Pinus pinaster* (mainly in the coastal dunes) and *Pinus strobus*. Some other species of *Abies*, *Tsuga*, *Picea*, *Larix*, *Pinus*, and *Chamaecyparis* are incidentally planted.

The mycocoenoses of the various coniferous forests have many species in common, for instance, the ectomycorrhizal symbionts *Lactarius hepaticus*, *L. rufus* and *Xerocomus badius*; the litter saprophytes *Entoloma cetratum*, *Marasmius androsaceus*, *Collybia butyracea*, *Clitocybe metachroa*, *C. vibecina*, *Mycena galopus*, and *M. sanguinolenta* (all also in deciduous forests); the characteristic wood saprophytes *Hypholoma capnoides*, *Pholiota astragalina*, *Gymnopilus penetrans*, *Panellus mitis*, and *Paxillus panuoides* and the cone inhabiting species *Baeospora myosura*.

The mycocoenoses of forests of *Pinus sylvestris*, *Picea abies*, *Pseudotsuga menziesii*, and *Larix leptolepis* have been extensively studied by Jansen & de Vries in Drenthe (N.E.Netherlands) (not yet published). It appears that only *Pinus* forests have a rich and characteristic mycoflora, comparable to the mycoflora in the natural area. Several types can be distinguished. The richest mycoflora is found in forests on very dry, poor sand with a thin humus layer and an undergrowth dominated by lichens (*Cladonia* spp.). Characteristic mycorrhizal agarics are, e.g. *Tricholoma auratum*, *T. albobrunneum*, *Hebeloma cylindrosporum*, *Russula paludosa*, *Cortinarius mucosus*, *Chroogomphus rutilus*, and *Suillus bovinus*. Some mycorrhizal agarics have a distinct optimum in young pine plantations on sandy soils, e.g. *Suillus variegatus*, *S. luteus*, *Cortinarius semisanguineus* and *Laccaria bicolor*. Pine forests with a dense sward of *Deschampsia flexuosa* or *Empetrum nigrum* are much more widespread

nowadays and much poorer in agarics. They do not have characteristic species. Dominant mycorrhizal species are *Lactarius hepaticus*, *L. rufus*, *Laccaria proxima*, and *Russula emetica* var. *sylvestris*. Pine forests with much *Rubus fruticosus* (s.l.) are growing on humose sands relatively rich in nitrogen and they are very poor in mycorrhizal fungi. A characteristic saprophyte of this type may be *Mycena amicta*.

The plantations of *Pinus sylvestris*, *P. pinaster*, and *P. nigra* in the coastal dunes of the Wadden- and Duindistrict contain some species which are lacking or much rarer in the inland forests, apparently due to the higher lime content of the dune sands. Examples are the mycorrhizal *Tricholoma myomyces*, *Russula cessans*, *Suillus collinitus*, and *S. granulatus*, the litter saprophyte *Mycena clavicularis* and, exclusively on cones of *Pinus pinaster*, *Mycena seynii*.

The ectomycorrhizal flora in *Larix* plantations is much poorer than in pine forests and dominated by ubiquitous species such as *Russula ochroleuca*, *Laccaria proxima*, *Xerocomus badius* and the conifer symbiont *Lactarius hepaticus*. The only widespread exclusive *Larix* associate is *Suillus grevillei*, whereas *Boletinus cavipes*, *Suillus aeruginascens*, and *Hygrophorus lucorum* are much rarer. The agaric flora on wood and litter is similar to other coniferous forests and does not contain characteristic elements.

Picea plantations are mainly found on poor, acid pleistocene sands (Drents, Gelders, Subcentreuroop-, and Kempens district). They are also poorer in mycorrhizal fungi than *Pinus* forests and dominated by approximately the same species. All characteristic symbionts are rare in the Netherlands and mainly found in the few *Picea* stands on more or less calcareous soils in the Duin-, Fluviatiel and Krijtdistrict and in the Flevopolders, e.g. *Lactarius deterrimus*, *Hygrophorus pustulatus*, *Russula nauseosa*, and *R. queletii*. An acidophytic mycorrizal symbiont such as *Hygrophorus olivaceoalbus*, widespread in the natural area of *Picea*, has been only recently found for the first time in the Netherlands. Characteristic agarics are also *Strobilurus esculentus* on cones and *Micromphale perforans* on needles, whereas *Clitocybe ditopa* is relatively common in *Picea* forests and differentiating with regard to other coniferous forests.

The widespread plantations of *Pseudotsuga menziesii* are even poorer in mycorrhizal fungi and dominated by the same ubiquists. Exclusive symbionts of this tree are completely lacking in the Netherlands and the saprophytic flora is not different from other coniferous forests.

8. AGARICS AND NATURE CONSERVATION

In the Netherlands, many larger animals and some phanerogams are protected by national law against collection and killing. Mushrooms and toadstools are only protected by local regulations in some municipalities which forbid collecting of any fungi. Such regulations are hardly effective since supervision is insufficient and, more important, because they ignore the real threats to the mycoflora, namely destruction of habitats.

More effective is the protection of specific areas such as nature reserves. At present, approximately 1500 km^2 (± 5 % of the total surface of the Netherlands) are nature reserves, owned by the state or by private organisations. These areas cover representative examples of almost all important habitat types of the Netherlands. They are usually selected on the basis of the fauna of larger animals, in particular birds, the flora of phanerogams and/or special geomorphological features. Usually the mycoflora does not play any role in the selection of nature reserves. The only example of a mainly mycological reserve is an old avenue of *Fagus* on river clay ('Wulperhorst', S. of Utrecht), famous for its richness in rare boletes and other large mycorrhizal fungi.

However, even the establishment of nature reserves does not guarantee the maintenance of a valuable (myco)flora and fauna. Many protected areas suffer from the influences of the surrounding agricultural landscape, such as deep drainage and eutrophication by penetrating fertilizers. In addition, the management of nature reserves is not always adequate. Moreover, all areas are influenced by the deposition of chemicals from polluted air.

The main problems concerning the protection of agarics will be treated below. More detailed information has been published in a special issue of Coolia (1978, nr. 4) and by Arnolds (1985).

For many species of agarics a strong statistically significant decline has been established during the last thirty years (Arnolds 1985). This decline is most prominent in two ecological groups, viz. the saprophytic species of grass- and heathlands and the ectomycorrhizal species. The reduction of grassland mycocoenoses is easily explained by the intensification of grassland use, including regular resowing and strong fertilization. Many species of *Hygrophorus* grasslands (see p. 22) have become rare. In the Netherlands only a few rich *Hygrophorus* grasslands remain,

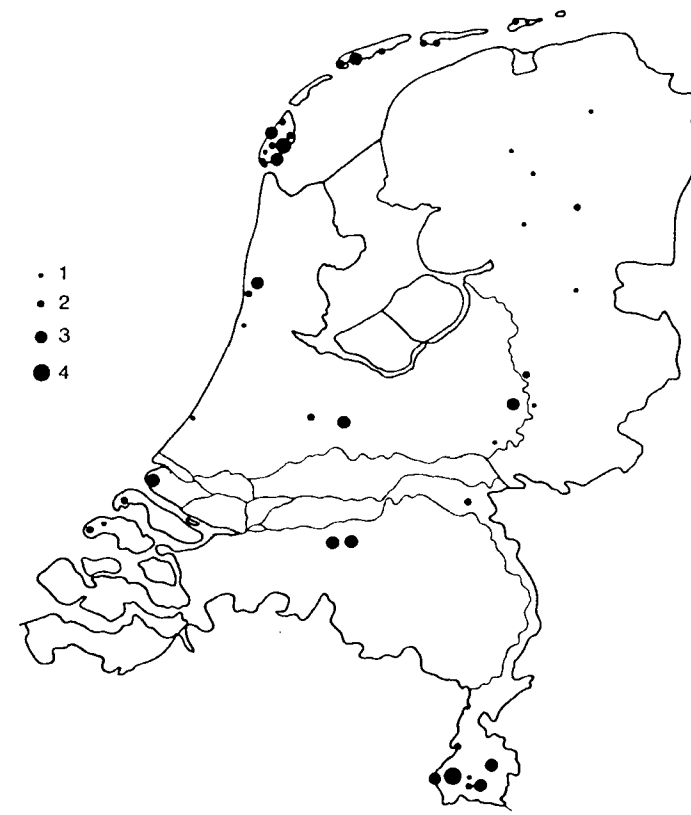

Fig. 27. The distribution in the Netherlands of grasslands characterized by the occurrence of at least five species of *Hygrocybe* and *Camarophyllopsis*; 1 = 5-6 species, 2 = 7-9 species, 3 = 10-15 species, 4 = > 15 species.

mapped in Figure 27. These grasslands comprise less than 0.1 % of the total grassland area and are only partly protected. Protection is urgent since the development of a rich and characteristic grassland mycoflora takes at least fifty years. An adequate management includes pasturing in low densities or regular mowing and removal of the hay, and the avoidance of the use of fertilizers and pesticides.

The decline of the ectomycorrhizal fungi is evident right down the line, but the most striking in forests of both *Quercus robur* and *Pinus sylvestris* on acid, oligotrophic sand poor in humus (*Dicrano-Quercetum*, *Cladonia-Pinus* forest), observed first in the south, later in the centre and finally in the north-east of the country. Many species have almost disappeared from the poor, pleistocene soils, but are still present on less acid, calcareous sands in the dunes and new polders. Mycorrhizal species with a very strong decrease are *Amanita gemmata*, *A. porphyria*, *A. pantherina*, *Boletus calopus*, *B. erythropus*, *Boletinus cavipes*, *Cortinarius armillatus*, *C. bolaris*, *C. elatior*, *C. hinnuleus*, *C. mucosus*, *C. pholideus*, *C. violaceocinereus*, *C. cinnabarinus*, *C. cinnamomeus* s.l., *C. semisanguineus*, *Gomphidius glutinosus*, *Chroogomphus rutilus*, *Gyroporus cyanescens*, *Hygrophorus eburneus*, *Lactarius piperatus*, *L. vellereus*, *L. vietus*, *Leccinum testaceoscabrum*, *Russula sardonia*, *R. paludosa*, *Suillus bovinus*, *S. grevillei*, *S. variegatus*, *Tricholoma albobrunneum*, *T. auratum*, *T. columbetta*, and *T. sulphureum*. Some striking mycorrhizal fungi have not been found since 1950 and are probably extinct, e.g. *Hygrophorus agathosmus*, *H. pudorinus* s.l., *H. russula*, *Tricholoma robustum*, *Cortinarius sebaceus*, *C. sodagnitus*, and *C. malicorius*.

This decline can be ascribed neither to changes in forest management or to forest succession, nor to the collecting of basidiocarps. Collecting of (edible) mushrooms has never been popular in the Netherlands, with a possible exception in the case of *Cantharellus cibarius*. For this species, a strong decline has been established but it could be demonstrated that this cannot be caused by collecting (Jansen & de Wit 1978, Jansen, van Dobben & de Wit 1985). Removal of basidiocarps can in fact only have marginal influence on the abundance of a species of macrofungi, as pointed out by, for example, Tjallingii (1978) and the 'Commissie Paddestoelen en Natuurbehoud' (1983).

Arnolds et al. (1985) have suggested that the decline of some ectomycorrhizal species is caused by acidification of the soil by air pollution ('acid precipitation'), among other things because the pattern of decline parallels the pattern of SO_2 concentration and because many species remain stable on calcareous soils. An even more important factor seems to be the increasing eutrophication of forest soils by accumulation of nitrogen from airborne NH_4 and NO. The reduction of mycorrhizal fungi coincides with the decrease of vitality of forest trees, in particular *Pinus* (Termorshuizen & Schaffers 1987). This example illuminates the ecological importance of agarics and their great value as bioindicators.

The changes in the saprophytic agarics on litter are less prominent (Arnolds 1985). Some species of rich soils are increasing, e.g. *Clitocybe nebularis*, *Agaricus arvensis*, *Stropharia cyanea* and *Clitocybe* spp.div. whereas some species of poor soils show a tendency to decline, e.g. *Clitopilus prunulus* and *Galerina* spp.div. The agarics on wood are generally increasing, apparently caused by the ageing of the forests and therefore the greater availability of stumps and other dead wood.

It is obvious that the protection of rare habitats such as coastal dunes, peat bogs, poor hayfields, wetlands and (semi)natural forests is useful and necessary for the maintenance of a varied and characteristic mycoflora. These habitats are usually also important for other organisms. However, some habitats deserve special attention since their mycological significance considerably exceeds the importance for other groups of organisms. Such areas do often not receive sufficient attention from nature conservationists. The special position of *Hygrophorus* grasslands has already been stressed. Another habitat worth mentioning is formed by the *Alnus* forests and *Salix* scrub on wet soils, rich in specialized fungi and in wood saprophytes and easily disturbed by desiccation and eutrophication. The *Dicrano-Quercetum* on dry, acid sand dunes is extremely poor in phanerogams, but the richest habitat in the Netherlands for mycorrhizal fungi. It is a very local association covering only small surfaces. Similarly the *Pinus* forests on dry sand dunes poor in humus (*Cladonia-Pinus* type) are extremely rich in specialized mycorrhizal fungi and worthy of protection. *Pinus* and *Picea* plantations on calcareous sands and clayey soils are rare in the Netherlands, but rich in rare fungi and may be worthy of protection in some cases too. Such forests are usually regarded as unwanted by nature conservationists as they have a negative impact on other components of the ecosystem, e.g. on the development and species diversity of the herb layer. A very interesting habitat for macrofungi is made up by old avenues of *Quercus* and *Fagus* on various soil types, hosting a rich mycorrhizal flora of spectacular and rare species. Road reconstructions easily lead to the destruction of this habitat.

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CHAPTER 3

Specific and infraspecific delimitation

THOMAS W. KUYPER

1. INTRODUCTION

All naturalists at least are convinced that variation between individual specimens in nature is not continuous, but shows discontinuities. These enable us to arrange these specimens in a hierarchical system of decreasing similarity with an increasing level of abstraction. There is also a basic level in this hierarchy and this basic or fundamental unit in the hierarchy is called the species. Species are generally held to exist in nature as a reality, independent of our ability to perceive them (Löther 1972, Wiley 1981). That species are those fundamental units is not fortuitous, but is a corollary of evolutionary theory. It is this fundamental reality that gives taxonomy, the analysis of biological diversity, its objective foundation.

However, this objectivity has not always been recognised. Adherents of a so-called nominalistic species concept deny the objective existence of species, and assert that species are only human abstractions. Bessey (1908) for instance wrote: 'Nature produces individuals and nothing more . . . species have no actual existence in nature. They are mental concepts and nothing more . . . species have been invented in order that we may refer to great numbers of individuals collectively.' And Burma (1954) claimed that 'all taxonomic units of whatever kind should be recognised explicitly for what they are – arbitrarily erected, man-made constructs, incautious use of which may result in obscuration to a degree which outweighs the convenience of recognising such units'.

Vestiges of nominalist thinking about species can be encountered in the relativistic position that 'a species is what a good taxonomist calls a species'. A consequence of this cynical definition is the belief that species may be split or lumped together according to the will of a taxonomist (Kuyper 1985).

Most naturalists would regard these assertions as being simply untrue. Species are not just mental concepts; there is no equivalent for it outside living nature. This reality of species is evident to all mycologists when we speak about *Laccaria amethystea* or *Rhodotus palmatus*, but the same applies to species of *Cortinarius* or *Entoloma*. The problem does not present itself in their existence, but in their recognition (see below).

Although most mycologists probably have a feeling as to what a species is, strictness in the definition of the species category, and in the criteria for species recognition, is necessary in order to obtain a common species concept for the Flora agaricina neerlandica.

Evolutionary theory did not exert much influence on systematic agaricology for a long time, and until recently mycologists seem to have adopted a typological (or essentialist) view about the nature of species. Characteristic of this view is the emphasis on the 'average', and the neglect of variation as a crucial aspect of the biology of the species. It is not surprising then that mycologists have been engaged in describing and formally naming every aberrant variant of a species. However, we need a more realistic view of fungi: as variable and evolving organisms that adapt to local conditions and change through time.

The introduction of a so-called biological species concept in mycology is therefore needed. This concept is called 'biological', not because it deals with biological taxa, but because the definition is biological, as it uses criteria that are meaningless outside the living world. According to this concept (Mayr 1970), species are groups of natural interbreeding populations that are reproductively isolated from other such groups.

Unfortunately, however, this biological species concept is hardly operational. It is therefore not surprising that Mayr (1970) initially referred to the correlation between morphological and genetic criteria when it comes to the application of the concept in practice. In a later wording, Mayr (1982) omitted reference to morphological criteria, but added that each species occupies a particular niche in nature, thus giving attention to ecological aspects in the maintenance of species integrity.

This latter formulation is reminiscent of the ecological species concept (Van Valen 1976). According to this definition a species is a lineage (or a closely related set of lineages) which occupies an adaptive zone minimally different from that of any other lineage in its range and which evolves separately from all lineages outside its range. This definition shows one major flaw, because Van Valen considered the existence of niches independent of the species that fill them.

The above-mentioned reformulations of the biological species concept must be considered as expressions of theoretical and practical inadequacy of the original concept. Rosenberg (1985) concluded that it could well be impossible to arrive at an unambiguous, non-trivial definition of the species category because it does not form a homogeneous class. He even went farther and concluded that particular species are not natural kinds, but must be considered individuals in the philosophical sense (Ghiselin 1975, Hull 1976). The main differences between natural kinds and individuals are listed below.

However, we should be aware of it that not all species in this Flora are individuals. Simplifying individuals to 'natural species' and natural kinds or classes to 'artificial species', we are forced to admit that we may have ended up in this Flora with a mixture of true, natural species and artificial species. And because of the

INDIVIDUALS	NATURAL KINDS
Exist in nature, independent of our ability to recognise them.	Are constructions of the human mind, have no real existence.
Can be characterised.	Are defined.
Have parts.	Have members.
Can evolve.	Cannot evolve through time, unless resulting in a different class.

limitations of Homo sapiens, 'a poor creature having weak eyes and blunt other senses' (Parmasto 1985), we cannot always tell the difference between them.

This somewhat frustrating conclusion has been well-phrased by Kemp (1985): 'If members of a fungal species can recognise themselves in the dark in the middle of such an apparently undesirable habitat as a midden is it not odd that we cannot do something similar above ground in equally well-heated but more effectively illuminated surroundings?'

Two types of criteria have been used for species recognition, viz. morphological and genetic criteria. Species concepts based on these criteria are often called morphological and genetic species concept respectively, and this somewhat inaccurate wording is accepted here.

2. Morphological species concept

Delimiting a species is performed by the use of a combination of critical characters on a comparative morphological basis (van Steenis 1957). A character in this respect may be defined as any attribute of form, structure, physiology or behaviour which is considered separately from the whole organism for a particular purpose such as comparison, identification or interpretation (Heywood 1967). In more general terms, any attribute of the organism that can be measured, counted or assessed otherwise, may be called a character.

The kind of characters employed is, of course, dependent upon the class of organisms concerned. Reasons for the use of different kinds of characters are largely practical, but the influence of tradition on character selection should not be underrated.

As an organism possesses an infinite number of characters, we must necessarily restrict ourselves, as it is impossible to study them all. It is therefore of the utmost importance to choose the relevant characters, i.e. the characters with a high information content. Character selection is primarily based upon current knowledge and hypotheses concerning these organisms, although intuition also plays its role.

Morphological taxonomy has been criticised as being unscientific, because it is supposed to contain a personal element and, for that reason, to be subjective. However, a closer analysis of its methodology (de Hoog 1983) shows that this claim is largely untrue. Basic to morphological taxonomy is the description of the pattern of the characters of the specimens under study.

The next step in the taxonomic process is ordering. We have stated above that an ordered pattern exists in nature, and our classificatory activities must therefore strive to express that pattern. Although this has been considered an art by some systematists, it is in fact an objective representation of reproducible statements.

In this respect, the classification is a kind of scientific hypothesis about this natural order and it possesses a certain information content. Therefore a classification is liable to produce predictions that can be falsified (Talbot 1971). This predictivity has two different aspects, viz. with regard to newly discovered specimens and with regard to additional characters. We can, therefore, compare different classifications and judge them according to their predictive ability by introducing additional specimens and/or characters. Classification A is falsified and must be replaced by another classification B, when the latter turns out to be more predictive than the former with regard to additional specimens and/or characters.

Consequently taxonomy, the making of a classification, is not a subjective business, as both description and ordering are largely objective and rational activities. There is no reason to disqualify morphological taxonomy for being subjective or unscientific.

The assertion that species are really existing, objective units and the notion that ordering is an objective procedure, do of course not always help us as regards the problem of species recognition by morphological means. This can sometimes be a real problem as will be acknowledged by every mycologist who tries to recognise species in *Cortinarius* or *Entoloma*.

It is self-evident that species must be diagnosable, that they must possess characters that are relatively unique to them, in order to be recognisable. Nothing is implied here about the level of difference that is necessary for specific recognition. We must of course also be aware of the existence of infraspecific variation, as will be elaborated below.

Distinction based on a single character, however, usually leads to artificial divisions and delimitation. Only a combination of interindependent characters ensure a natural division and distinction (van Steenis 1957). This can be generalised in the statement that good species differ in at least two, interindependent morphological characters. Taxa differing in one character only are therefore given infraspecific rank. This procedure has been followed by all contributors to this Flora.

3. Genetic species concept

A genetic species concept pertaining specifically to fungi has been given by Esser & Hoffmann (1977): 'Populations belong to different species when the failure to interbreed and to produce viable offspring in nature is not caused by genetic parameters operating in the completion of the sexual cycle.'

The genetic species concept has been introduced into the taxonomy of the Agaricales by Vandendries (1923). The concept gained wide acceptance after the detailed studies by Lange (1952) on the significance of intersterility for species delimitation in *Coprinus*. To date it has been applied to several genera in the Agaricales and other fungal groups. Adherents of this genetic species concept point out that it is superior to a morphological concept as it allows for experimental falsification, and therefore attains a higher degree of objectivity. However, the initial optimism with respect to its usefulness for determining species status

has been tempered during the last decade because of the following difficulties:

1. Organisms must be suitable for experiments, and for that reason must be grown in culture. So far it has been very difficult (and in most cases even impossible) to culture mycorrhizal fungi successfully. Fries & Mueller (1984) studied the incompatibility systems in the genus *Laccaria*, and Fries (1981, 1983) investigated homing reactions in the genus *Leccinum* as an aid in species recognition. This latter reaction is, however, not as reliable as a strict genetic test of compatibility versus incompatibility.

For the time being a genetic species concept seems hardly applicable to the group of mycorrhizal fungi, which comprises almost 50 % of the Agaricales. Several genera of saprotrophic fungi (e.g. *Hygrocybe*, the greater part of *Entoloma*) have also thus far not been grown successfully in culture.

The actual number of genera in which a genetic species concept has been investigated is (very) low indeed.

2. The criterion is only valid for organisms with sexual reproduction. It cannot be used in the delimitation of homothallic and amphithallic taxa, where we still have to rely on correlative morphological evidence in order to arrive at their taxonomic status (cf. Mayr 1970). Neither can it be applied to species that show haploid fruiting or apomixis (Prillinger 1982) such as several species of *Mycena* or the genus *Phytoconis*.

3. Intersterility of different populations is a necessary, but not a sufficient condition for the statement that those populations belong to different species. Some cases of intersterility can be explained by the phenomenon known as heterogenic incompatibility (Esser 1965, Hoffmann 1978). For that reason Esser & Hoffmann (1977) emended the definition of a genetic species as given above.

4. Interfertility – or rather what is demonstrated, intercompatibility – of two populations might also be insufficient for the taxonomic conclusion that these are conspecific. In most cases only plasmogamy and dikaryotisation are investigated, whereas subsequent karyogamy and the formation of viable offspring is neglected.

In the case of putative hybridisation between *Panaeolus campanulatus* and *P. fimicola* on account of dikaryotisation, this dikaryotic stage proved unstable and a return to the monokaryotic stage was finally observed (Vandendries 1923, 1933). Reproductive isolation can also be achieved without incompatibility. This may be the case in the genus *Omphalotus*, which consists of three morphologically and geographically well-delineated variants, showing complete interfertility under experimental conditions (Romagnesi 1979, Miller pers. comm.).

However, this argument might generally be rather unimportant as most isolating mechanisms in the fungi are prezygotic, not postzygotic (Lemke 1973).

5. As speciation in the genetic sense sometimes is a very gradual process, we could find 'species' which consist of partly interfertile, partly intersterile populations. Several examples of this phenomenon are known in the Aphyllophorales, e.g. *Peniophora malençonii* and *P. californica*, or *Amylostereum laevigatum* and *A. ferreum* (Boidin 1977, 1980). Both cases refer to taxa that have been geographically disjunct for a very long time, but still have not completely achieved genetic isolation.

6. Two 'species' might be completely intersterile, whereas both of them are interfertile with a third 'species'. This is known in *Trichaptum abietinum* (Macrae 1967) and in taxa of the *Armillaria mellea* complex (Anderson et al. 1980). In both cases, two completely intersterile American 'species' show fairly high compatibility with a third European 'species'.

Summarising the above statements, it would seem that application of genetic criteria is often superior to morphological criteria from a theoretical point of view, but that its practical application is beset with many difficulties. It is therefore not surprising that (almost) all mycologists, even when working with a genetic species concept, occasionally return to morphological criteria for delimitation in those cases where their own experiments fail to yield unambiguous results, or when their experiments are clearly contrary to a morphological concept (e.g. Kühner 1977).

4. THE SPECIES CONCEPT AS USED IN THE FLORA AGARICINA NEERLANDICA

After careful comparison of the various options for a common species concept, it was decided to use a strictly morphological concept for all genera and all species. This choice is based on operational arguments:

1. Only a morphological species concept can be applied unequivocally to all agarics. There are a few genera for which the application of a genetic species concept is feasible, but the simultaneous use of two different concepts could easily lead to an unbalanced taxonomy within the Flora. This is especially true when the genetic concept leads to more narrowly circumscribed species than the morphological concept, which seems to be the case in genera such as *Coprinus* and *Psathyrella* (Kits van Waveren 1985).

The above does not necessarily lead to the conclusion that data from genetic experiments are of no importance whatsoever to the practicing fungal taxonomist. As will be seen from the examples below, the introduction of experimental methods can often lead to more exact criteria for delimitation and judgment regarding taxonomic rank. We therefore recommend that information from such breeding tests be used wherever possible, but that their results be judged by comparison with morphological data, which take priority. Kühner (1977) seems to advocate the same practice.

2. Only a morphological species concept is useful for the general user of the Flora, who normally does not have the facilities necessary to execute genetic tests.

3. Although there seems to be a certain intuition and subjectivity in the ordering of descriptive morphological data into discrete species, resulting in the acceptance of both true, natural species and artificial species, it would seem that the application of the morphological concept is less beset with difficulties of interpretation than that of a genetic species concept would be.

5. EXAMPLES

Several examples are given to illustrate the application of a morphological species concept and the use of additional information obtained by breeding experiments:

1. The genus *Armillaria* has been considered a taxonomically difficult group because of the highly polymorphic nature of the *A. mellea* complex. Genetic experiments by Korhonen (1978) revealed the existence in Europe of five intersterile groups. Subsequent investigations (Romagnesi & Marxmüller 1983) yielded morphological criteria to recognise the five as species in the field.

2. A recent study of character variation within *Hypholoma fasciculare* revealed the existence of a small-sized variant with very crowded lamellae. Some of these collections were intercompatible and showed incompatibility with typical *H. fasciculare*, but one collection showed compatibility with typical *H. fasciculare*, being incompatible with the other dwarfish collections. This led Lamoure (1984) to the conclusion that two different dwarfish taxa were involved, morphologically unrecognisable but differing in their genetic behaviour. She proposed two different taxa, viz. *H. fasciculare* var. *pusillum* and *H. ambiguum*, for these dwarfish variants. Her taxonomic conclusions are not followed here, being in contradiction with morphological taxonomy. The dwarfish variant is probably best considered a variety of *H. fasciculare*.

3. The application of a genetic species concept in *Laccaria* was recently investigated by Fries & Mueller (1984). Generally speaking, their genetically delimited taxa correspond with the morphological species, except in the case of *L. laccata*, where two intersterile groups could be recognised. As no morphological differences could be found between these groups, a formal segregation was not proposed. Their taxonomic treatment is also accepted for the Flora (Mueller & Vellinga 1986).

4. The *Omphalina pyxidata* complex was elucidated by Lamoure (1974) and split into six species, primarily based on genetic behaviour, although subsequently small morphological differences between these have been found. However, character variation in this complex in the Netherlands indicates that it is impossible to recognise more than one morphological species (Kuyper in prep.), and her species are for that reason reduced to incompatible variants. It might be possible, of course, that several of these are restricted to the Alps and represent good species on account of unique morphological characters.

5. Although all collections of specimens belonging to the genus *Omphalotus* are intercompatible (Miller pers. comm.), there are three morphologically well-characterised taxa. As intermediates between these morphological variants have never been recorded, it seems plausible to assume that they are actually isolated, although they are fully interfertile in the laboratory. It is likely that this genus consists of true, allopatric species that are given specific rank (Kuyper in prep.).

6. Genetic investigations in the *Psathyrella candolleana* complex revealed the existence of four incompatible races, which were morphologically similar (Galland et al. 1979). As it is impossible to recognise these taxa with morphological means, they are reduced in this Flora into intersterile variants ('races') of one species (Kits van Waveren 1985).

The same reasoning applies to the three different intersterility groups in the *Psathyrella gracilis* group (Kemp 1985). Taxonomic matters are, however, much more complicated here, as Kits van Waveren (1985) recognised two species, viz. *P. gracilis* and *P. microrrhiza* while admitting that occasionally intermediates are encountered. Possibly a renewed search for taxonomically relevant characters will help in the unraveling of this complex.

6. PATTERNS OF INFRASPECIFIC VARIABILITY

After the formulation of a common morphological species concept for the Flora agaricina neerlandica, it seems logical to go one step further in order to study infraspecific variability and its hierarchical representation.

It is evident to the careful observer that there often is a pattern of infraspecific variation that can be recognised and classified. One of the reasons to designate this variability formally is that otherwise it might go unnoticed. But we should of course not forget that even conspicuous infraspecific variation might be biologically trivial and that it will never be possible to give an adequate and formal representation of the total structure of a species. For that reason we are forced to sail between the Scylla of typology and the Charybdis of relinquishing the classification of any infraspecific variation.

Some mycologists have indeed almost completely denied the usefulness of infraspecific categories. Orton (1960) for instance wrote: 'We do not yet know precisely what a species is in most genera of agarics (*Coprinus* is perhaps an exception), and even less what constitute infraspecific taxa.' He therefore decided to exclude these infraspecific taxa almost completely. However, a consequence of this attitude is that some taxa are given specific rank, but at the same time disqualified with the statement that they are 'admittedly weak species' (Hora 1960). This ultimately results in an unbalanced taxonomy and is therefore objectionable.

Although it is true that we hardly know what infraspecific taxa represent, and it might well be that we are classifying biologically trivial variation, we think that an infraspecific taxonomy can serve practical purposes and for that reason we should give criteria for our infraspecific taxa.

The International Code of Botanical Nomenclature recognises five infraspecific categories, viz. subspecies, variety, subvariety, form and subform. Only the categories subspecies, variety, and form have been used in mycology and will be considered in this essay. The (informal) category of forma specialis, widely used in the taxonomy of certain parasitic fungi (Hudson 1970), does not play a role in agaricology, and is likewise left out of discussion.

Every section of this chapter will begin with a historical sketch of the various ways in which this respective category has been used. It will become immediately clear that most mycologists did not bother to define their categories. And those mycologists who did explicitly define their categories, often contradicted each other.

After a comparison of the various definitions a common basis is sought for the use in this Flora. As far as possible, this use is consistent with its use in other branches of systematic botany.

6.1 Subspecies

A perusal of mycological literature will quickly show that the actual number of subspecies is very low, except in the work of

Konrad & Maublanc (1924-1937). This raises the question whether the subspecies concept of these authors differs from that of other mycologists. Although they did not provide a formal definition, it is clear that their concept was different. They used that category for what they regarded as extremely related species about which they had some reservations as regards their rank. Their ideas have not been followed by other mycologists, and are likewise not acceptable for this Flora.

Another concept of subspecies in agaricology has been given by Singer (1942). According to his dynamic view, the subspecies is to be regarded as a not-yet-species, a taxon half-way the process of speciation. His subspecies sometimes show reduced interfertility, and are characterised by some geographically and/or ecologically correlated morphological differentiation. His subspecies are stages in the evolutionary process of allopatric (geographic) and sympatric speciation; his varieties and forms on the other hand do not play an independent evolutionary role.

Davis & Heywood (1963) define the subspecies as a considerable segment of a species with a distinct area and more or less distinct morphology, often showing some intergradation. A comparable definition has been employed by Bas (1977) who stated that subspecies are constant variants within a species which have a geographical distribution differing from that of the typical variants. The word constant probably implies that no intergradation of characters occurs, although this is not stated explicitly. Romagnesi (1977a) and Høiland (1984) used more or less similar criteria for subspecies recognition.

Not only geographical differentiation but also ecological differentiation is included in the subspecies definitions by Kreisel (1974), Singer (1977a), and Arnolds (1983). Intergradation of characters is often allowed for. Such definitions resemble the original one by Singer (1942), although they give less explicit attention to the outcome of the anticipated evolutionary process.

Summarising the above concepts, we can conclude that modern mycologists use two different and hardly comparable criteria for subspecies recognition, viz. (i) morphological discontinuities (either absolute or showing some intergradation) and (ii) geographical and/or ecological segregation. This latter criterion is added because it is assumed that this differentiation lies at the basis of speciation. Without such geographical and/or ecological segregation these discontinuities would most probably be evaluated differently. The latter criterion therefore relies on assumptions about the speciation process, but it is rather uncertain whether these assumptions are valid (Kemp 1977, Kuyper 1986). The former criterion on the other hand, the observation of morphological discontinuities, is of course consistent with the requirements of a morphologically based taxonomy.

As we try to use a strictly morphological species concept in this Flora, the introduction of the subspecies category as defined above would certainly lead to difficulties. It is therefore fortunate that the subspecies category has hardly been used in agaricology, and that this concept could for the time being be discarded completely without upsetting present-day taxonomy. For this reason, we will use only the categories of variety and form for those infraspecific variants with morphological differences. The amount of intergradation determines their exact rank (see below). It should of course be rather limited, as delimitation of an (almost) continuous series of variants is arbitrary and has, therefore, no predictive value.

Geographical and/or ecological criteria would not play a role in determining the category, unless correlated with morphological differences.

6.2 Variety

In contrast with the diversity of definitions of the subspecies is the relative uniformity in the definition and use of the variety. Generally speaking the category variety is indiscriminately used for taxa that possess morphological character differences that are considered not large enough for specific rank (Høiland 1984). Admittedly this is a rather inaccurate definition, and it sometimes leads to a situation where this category is used for any infraspecific taxon where there is a lack of clarity with regard to its rank (Singer 1977a). This could easily result in a rather unbalanced taxonomy if many locally aberrant populations are elevated to the rank of variety, as was done in the genus *Laccaria* (Singer 1977b, cf. Mueller & Vellinga 1986).

We need therefore a more precise circumscription of the rank of variety. Bas (1977) restricted the category to constant variants within a species (mostly differing in one character only) occurring with the typical variant and of which the aberrant character is not connected with the corresponding character in the typical variant by a series of intermediates.

This definition does, however, not agree with that given by Davis & Heywood (1963), where distributional criteria, just as in the subspecies but on a far more restricted scale of local facies, seem to be dominant. This concept is better not applied in systematic mycology for exactly the same reasons as given above in the discussion of the subspecies. One of its main disadvantages is that this distributional hierarchical construction can be quite independent of morphological differentiation.

In this Flora we have adopted the definition as given by Bas (1977) with the complete exclusion of distributional and/or ecological criteria. We wish to stress again that intergradation of characters is not allowed for in this concept of the variety. For intergraded morphological variants the rank of form is used.

6.3 Form

As suggested above, the category of form is used for those cases where single character differences show some (limited) intergradation. The intergradation of morphological characters often implies that these differences are of less significance than those of varieties, although this needs not always be true.

6.4 Variant

It has been noted above that it will never be possible to give a complete and adequate representation of infraspecific variability under the formal rules of nomenclature. It should therefore not be our aim to name every slightly aberrant variant when this character difference is supposed to be genetically based.

We should probably benefit more from an informal category for such slightly aberrant variants. And for this category the term 'variant' is proposed here. As this informal rank has no official status under the rules of nomenclature, it can be rather loosely and informally applied. However, it should of course be clear that these variants should be genetically based. Even informal rec-

ognition of phenotypic differences, although they may easily be recognised, does not seem to serve a useful purpose. In most cases we are of course uncertain as to whether any character difference is genotypic or phenotypic, and in the absence of relevant experiments, our judgment may be rather subjective.

7. SYNOPSIS

The adoption of a morphological species concept for this Flora leads to the acceptance of only two infraspecific categories, and the choice between these two is mainly based on whether the infraspecific taxa show intergradation or not. Two categories, viz. variety and form are recognised, and are defined here as follows:

1. Varieties are constant infraspecific entities differing in one single character from each other and not showing intergradation. They may or may not occur together with the type variety, or show geographical and/or ecological segregation.

2. Forms are constant infraspecific entities like varieties but showing some limited amount of intergradation.

Furthermore the informal category 'variant' is accepted for all those infraspecific entities that can be usefully recognised but do not deserve formal classification and naming.

The category of subspecies is not applied, as its use relies heavily on theoretical considerations about speciation processes. Most subspecies would seem to deserve varietal rank in this classificatory system, whereas some would be reduced to forms.

This infraspecific hierarchy closely parallels those by De Candolle (1813) and Fries (1821), who also applied only the categories of variety and form. This agreement is not fortuitous; our taxonomic understanding is still built on the same morphological considerations, and the genetic species concept in practice hardly influences our ideas of infraspecific taxonomy.

Finally, a frequent misconception may be pointed out, viz. that it is the character that ultimately defines the rank of a taxon (cf. Romagnesi 1977b for a similar critique of generic concepts). It is sometimes stated that certain differences (for instance the presence of 2- versus 4-spored basidia) must be valued on a particular taxonomic level.

However, our considerations above make clear that the rank of those taxa must be judged in relation to other morphological characters and character constancy. After a careful analysis taxa based on such differences can turn out to be good species (as in *Entoloma* subsect. *Endochromonema*), varieties (as in *Inocybe hirtella*) or variants (as in *Hygrocybe conica*, where many collections consist of mixtures of basidiocarps with predominantly 2-spored and 4-spored basidia). In the genus *Mycena* many species are capable of haploid fruiting (cf. Prillinger 1982) and in this case the question of whether these haploid variants deserve autonomous status poses special problems. As haploid fruiting in this genus can be encountered in a large number of species, formal recognition could ultimately result in a doubling of the number of taxa, without increased insight into the taxonomic structure of the genus. Consequently there is good reason to deny any formal status to them (cf. Kühner 1977).

Romagnesi (1975) has proposed the term pseudovariety, which has no formal standing under the code of nomenclature, for those taxa that are morphologically similar, but genetically completely isolated because of differences in breeding behaviour. This occurs in taxa with heterothallic and amphithallic variants, or in taxa that differ only in basidial characters (bisporous versus tetrasporous basidia). Although genetically completely isolated, Romagnesi felt that these variants still did not deserve the rank of autonomous species, an opinion also held by Kühner (1977).

However, the introduction of the term pseudovariety does in our opinion not serve a useful purpose. What counts is our ability to recognise – morphologically – particular infraspecific entities, whatever the genetic nature of the differences of these entities might be. For that reason we believe that these pseudovarieties in the case of bisporous versus tetrasporous taxa can simply be classified as (true) varieties.

Several other characters could be correlated with this difference in the number of sterigmata, viz. spore-size (often by 20-25 % larger in specimens with bisporous basidia in comparison with tetrasporous basidia) and the number of nuclei in the spores. This latter character can also be of use in discriminating between different species with tetrasporous basidia as is the case in several species of *Hygrocybe* or in *Omphalina obscurata* (binucleate spores) and *O. velutipes* (uninucleate spores). In this latter case, however, there are several other differences between these taxa that indicate that they are correctly considered to be autonomous species. The value of this character is therefore dependent on its correlation with other characters.

The above conclusion is of course rather trivial; any experienced taxonomist knows that a particular character can be distinctive in one group, whereas it lacks all significance in another (cf. Stebbins 1974).

ACKNOWLEDGEMENTS

Even though theoretical considerations often seem to exert only limited influence on the actual contents of a flora (and the Flora agaricina neerlandica is probably no exception), they are important for our ideas about species, infraspecific taxa and genera. Therefore I appreciate the constructive discussions and criticisms of my colleagues R.Geesink, K.Høiland, C.Kalkman, E.Parmasto and R.Pöder, and of the collaborators to this Flora. This essay derives its main inspiration from the ideas of van Steenis (1957) about specific and infraspecific delimitations. I also feel obliged to R.A.Hoogland and D.A.Reid for linguistic improvements. To all of them I wish to express my sincere thanks.

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CHAPTER 4

Generic concepts in agarics and boleti

THOMAS W. KUYPER

The idea that a phenetically natural classification (based on correlation of all characters) corresponds with a cladistically natural classification (based on common possession of derived characters only) is widespread (e.g. Singer 1975). This idea is generally correct (Kalkman 1982), but several genera which are characterized by the common possession of primitive characters cannot lay claim to naturalness in the cladistic sense.

Much has been written in general terms about the genus, but few authors tried to define this category. This has probably been caused by the generally held belief that 'nature may make species, but man has made the genera' (Bisby & Ainsworth 1943). The genus then is a concept primarily intended to bring together species in a natural way.

There are two main criteria by which generic concepts have to be judged, viz. (i) naturalness and (ii) practicality and tradition. Unfortunately these two criteria sometimes conflict.

With respect to the criterion of naturalness, it is important at the outset to discriminate between naturalness and homogeneity of a taxon (Romagnesi 1977, van Steenis 1978). Unfortunately, these concepts have frequently been confused. Homogeneity refers only to the amount of variation within a certain taxon, not to its naturalness. To give one example: the genus *Entoloma* (Fr.) Kumm. is undoubtedly natural and holophyletic (strictly monophyletic, i.e. consisting of all descendants of a parental taxon, recognisable by the common possession of a uniquely derived character) as can be concluded from its unique spore structure. Recently the genus has been split up by some mycologists into several smaller genera. These new taxa are of course more homogeneous, but the naturalness and holophyletic nature of these segregate genera is questionable in some instances (Noordeloos 1987). The same reasoning probably holds true for *Cortinarius* (Pers.) S.F.Gray and its subdivisions (Høiland 1984).

Naturalness in the cladistic sense has not often been demonstrated for genera of Agaricales. In most cases holophyly is inferred from phenetic naturalness. Such procedure seems inevitable, considering our often limited knowledge of genera over their complete area and the difficulties inherent in cladistic methodology. Decisions on generic delimitation for the Flora agaricina neerlandica are based on knowledge of its constituent species over a limited part of its area (Europe). Some genera recognised in this Flora could therefore well be unsatisfactory in a world context, e.g. *Lepista* (Fr.) W.G.Sm. (questionably autonomous with regard to *Clitocybe* (Fr.) Staude) and *Porphyrellus* E.J.Gilb. (congeneric with *Tylopilus* P.Karst.?).

Inference of holophyly from phenetic naturalness can also lead one astray when the so-called reduced series are neglected. It seems likely that *Omphalina* Quél. is only a paraphyletic grouping (a monophyletic grouping that does not contain all descendants of a parental taxon, defined only by the common possession of a primitive character). Inclusion of *Arrhenia* Fr. would make this (combined) taxon holophyletic (Kuyper 1986). Reasons of practicality, however, lead to a deferment of such a decision in this case. On the other hand, there are sufficient practical reasons to include *Gloiocephala* Mass. in *Marasmius* (Fr.) Fr.

Recently several new genera of agarics have been erected with the argument that these new genera possess such striking characters that they form an autonomous natural grouping. Examples are the genera *Singerella* Harm. (separated from *Clitocybe* (Fr.) Staude), *Megatricholoma* Kost (separated from *Tricholoma* (Fr.) Staude), and *Inocybella* Zerov (separated from *Inocybe* (Fr.) Fr.). However, such procedure is only acceptable if not only the segregate genus, but also the remaining part of the original genus conform to the requirements of naturalness. It seems unlikely that this criterion is met in the cases referred to. This criterion has been met when the genera *Myxomphalia* Hora and *Gamundia* Raithelhuber (= *Stachyomphalina* H.E.Bigelow) were separated from *Fayodia* Kühner.

Several persistent taxonomic problems result from species that show characters apparently bridging the gap between otherwise natural genera. Although merging of genera in such cases sometimes represents a distinct amelioration (e.g. *Conocybe* Fay. with *Pholiotina* Fay.; *Pholiota* (Fr.) Kumm. with *Flammula* (Fr.) Kumm.), this is not always a good solution. When the number of so-called intermediate species is small with respect to the size of both genera, such generic lumping could be disadvantageous because (i) the predictability of other defining generic characters would decrease and hence the information content in such a classification; (ii) the delimitation from surrounding genera would also become more problematical. Metaphorically speaking, the lumping snowball would start rolling (Geesink 1984). It is convenient in such cases to wield the principle that the number of intermediate species should be proportional to the size of the groups (Davis & Heywood 1963). Classification of such intermediate species is always bound to be somewhat arbitrary. Such a situation is probably encountered in the delimitation of *Hypholoma* (Fr.) Kumm., *Psilocybe* (Fr.) Quél., and *Stropharia* (Fr.) Quél. (Smith 1979) or of *Collybia* (Fr.) Staude and *Marasmius* (Fr.) Fr. We must then content ourselves with genera with a polythetic set of characters, where each character is not present in all species but occurs only in the majority of its members. Such genera are difficult to characterize when constructing a determination key.

In such circumstances, practical considerations are very important because the category of the genus is historically tied up with that of the species and cannot be separated from it in the denomination of species. Raising infrageneric taxa to the rank of genus or reducing genera to the rank of infrageneric taxa should only be undertaken when there are new, strong taxonomic reasons for the change; otherwise it seems preferable to stick to the traditional concepts.

Summarising the above, we must conclude that much freedom has to be allowed to the contributors to the Flora agaricina neerlandica for generic delimitation. To date such liberty cannot be avoided. We hope, however, to have achieved a reasonable balance between tradition and innovation in our generic concepts.

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CHAPTER 5

Orders and families in agarics and boleti

C. BAS*

As none of the current classifications of the agarics and boleti in orders and families (Kühner 1980, Jülich 1981, Moser 1983, Locquin 1984, Singer 1986) is found fully satisfactory, the classification adopted in this Flora is at many points a (rather conservative) compromise between conflicting ideas in the classifications mentioned. In this chapter the choices that had to be made and which were often rather difficult are briefly discussed.

The number of orders and families of agarics and boleti recognized varies in most of the important recent publications in this field (Singer l.c., Moser l.c., Kühner l.c., Kreisel 1969, Henderson, Orton & Watling 1969) between rather narrow limits, viz. 15 to 17 families and 1 to 5 orders. In strong contrast, Jülich (l.c.) recognizes 43 families in 11 orders and Locquin (l.c.) ± 80 families in 25 orders. As these last two rather aberrant systems have been introduced with very scanty supporting arguments, they will rarely be mentioned in the following discussions, which will centre mainly round Singer's classification and the modifications proposed by Kühner.

Definitions of what is to be considered an order or a family are rare. Here an order is a group of families (or a single family) and a family a group of genera (or a single genus) that is distinguishable from the orders respectively families bearing the greatest resemblance to them, by one or more important characters or an important combination of characters (macroscopical, microscopical, electronmicroscopical, cytological and/or chemical). Important characters are characters with a relatively high correlation with other characters and hence with a certain predictive value.

The clause 'with a supposed common ancestry' is suppressed deliberately in the definition above, which makes the classification adopted in this flora phenetic and not phylogenetic. It goes, however, without saying that the group 'agarics and boleti' is not necessarily a monophyletic taxon.

In literature many series of related families and genera of agarics and boleti have been constructed of which quite a few could very well be phylogenetic lines, but quite often it is impossible to know in which direction these lines have to be read.

Probably few mycologists will deny a phylogenetic relation between *Polyporus* sensu stricto and *Pleurotus* via *Lentinus*, but whether *Polyporus* developed from agaricoid ancestors or *Pleurotus* from polyporoid ancestors is an open question.

Similar cases are represented by the many bridges that have appeared to exist between agaricoid and gastromycetoid fungi. Although probably the majority of mycologists are convinced that in these cases the gastromycetoid fungi have developed from their agaricoid counterparts (e.g. Heim 1971), the opposite opinion is also strongly defended (Singer 1986).

Such conflicting ideas must lead to strongly conflicting phylogenetic classifications without many possibilities of finding out which is correct. In this Flora, therefore, a phenetic system of orders and families has been adapted.

It should be mentioned that gastromycetoid genera are not admitted here in orders and families of agaricoid genera. This is an unavoidable consequence of accepting a phenetic system.

In addition, the existence of a gastromycetoid counterpart is in itself not considered sufficient reason for recognition of an independent family for an agaricoid genus. In such a situation, the similarities and dissimilarities between that agaricoid genus and the most closely similar genera of agarics are considered conclusive.

ORDERS

Singer unites all agarics and boleti in one order Agaricales, whereas Kühner accepts five orders, viz. Tricholomatales, Agaricales, Pluteales, Boletales and Russulales.

Russulales

In the present work, only two orders will be recognized, viz. Agaricales and Russulales. The gap between the Russulales and the rest of the agarics and boleti is much wider than the gaps supposed to exist between Kühner's other orders.

It is not only the combination of spores with a characteristic amyloid ornamentation and the prominent vascular hyphae and corresponding gloeocystidia that separates the Russulales from the other agarics, but above all the heteromerous context formed in such a unique manner (Reijnders 1976), viz. by the formation of rosettes of spherocysts around thin axial hyphae.

Boletales

The transition between agaricoid and boletoid fungi is considered too gradual to permit separation of the latter group on order level. The existence of several genera of 'agaricoid' boletes (*Paxillus*,

*The use of the plural 'we' in this chapter relates to the fact that its contents have been amply discussed and in broad outlines accepted by all members of the editorial team.

Gomphidius, *Phylloporus*) is in itself an indication of this.

The conflicting opinions on the taxonomic position of *Ripartites* (Singer: Paxillaceae; Kühner: Tricholomataceae) are also demonstrative of this situation. Moreover, *Hygrophoropsis*, considered by Singer and Kühner to belong to or near the Paxillaceae, has a cantharelloid development of the hymenophoral trama (Reijnders 1983: 2) very unlike that in Paxillaceae (see under that family), Gomphidiaceae, and Boletaceae. In addition, *Hygrophoropsis* is not without resemblances to *Cantharellula*, generally placed in the Tricholomataceae, with 'boletoid' but amyloid spores.

Pluteales

The order Pluteales erected by Kühner for Pluteaceae, Entolomataceae, and *Macrocystidia* is not accepted here. In our opinion spore wall characters are too heavily emphasized here and insufficiently correlated with other characters.

On the one hand, the morphological differences between the taxa mentioned are considerable, on the other the Entolomataceae seem to be more closely related to Tricholomataceae, via the genus *Lyophyllum*, than to Pluteaceae and *Macrocystidia* (see under Macrocystidiaceae). Many species of *Entoloma* and *Lyophyllum* have a gymnocarpic and stipitocarpic development of the basidiocarp, regular hymenophoral trama, grey-brown incrusting pigments, a strongly cyanophilous spore wall and a cutis-like pileipellis in common. Moreover farinaceous to rancid smell and taste are frequently present in both as are siderophilous granules in the basidia, although in the Entolomataceae much finer and not easily perceivable under the light microscope (Clémençon 1978: 89).

Recently Bennell, Watling & Kile (1985) demonstrated remarkable similarities between the structure of the spore wall in *Armillaria* (type: *A. mellea*) and that of ornamented spores in members of Kühner's 'Pluteales'. As in the latter, the ornamentation of the spores of *Armillaria* are caused by thickenings of one or both of the inner two layers of the spore wall. Bennell et al. refrained from moving *Armillaria* to the 'Pluteales', which would render this order very heterogeneous indeed. They seem to have shown, however, that the differences in the structure of the spore wall between 'Ttricholomatales' and 'Pluteales' are less fundamental than Kühner believes.

Tricholomatales versus Agaricales sensu stricto

There is a certain attraction in the proposition to group the majority of agarics with coloured spores in one order Agaricales s.s. (including the white-spored Agaricaceae and excluding the pink-spored and boletoid agarics) as proposed by Kühner.

As a consequence the simultaneously created order Tricholomatales comes to include the majority of the remaining genera with colourless or pale-coloured spores usually without an endosporium and usually containing only one nucleus, whereas the Agaricales s.s. would usually have spores with an endosporium and two nuclei. However, for all characters used to differentiate between these two orders, there are quite a few exceptions.

The group of three genera forming the core of tribus Cystodermateae (*Cystoderma*, *Squamanita* and *Phaeolepiota*) is so difficult to place that Kühner has it in the first (earlier published) part of his book (pp. 160, 164) in the Agaricales and in the later part in the Tricholomatales (see discussion under 'Squamanitaceae').

Another problem demonstrating the vagueness of the delimitation of the Tricholomatales versus the Agaricales is the position of the collybioid, veilless species of *Pseudobaeospora*. They are placed in tribus Cystodermataeae in the Agaricaceae by Singer and in tribus Tricholomeae in the Tricholomataceae by Kühner.

The dextrinoid nature of the spores being practically the only recorded character in which *Pseudobaeospora* species resemble the lepiotoid fungi, Kühner's solution would seem to be the best, if it were not for the fact that in our experience at least in some collections the inner wall of the spores is metachromatic in Cresyl blue (earlier observed in '*Collybia pilodii*' by Kühner 1954: 93). This points to the Agaricaceae. In several collections, however, we found the gills not really free but deeply marginately adnate, which agrees better with the Tricholomataceae.

All this brings us to the conclusion that the gap between the Tricholomataceae and the Agaricaceae is too narrow to warrant classification of these two families in different orders.

Families

Hygrophoraceae versus Tricholomataceae

The family Hygrophoraceae is a generally accepted one. This is very remarkable as it is poorly delimited from the Tricholomataceae. The main differentiating characters are (1) long and slender basidia with a length-width ratio > 6 (or, with Singer, the length of the basidia > 5.5 times the length of the spores) and (2) waxy lamellae.

The first character does not apply to a considerable number of species usually placed in the Hygrophoraceae. Arnolds (1974: 21, 100), recording exactly the range of the length-width ratio of the basidia of all species of Hygrophoraceae studied by him, found this range to be mostly 4.5-7.0, but in the 10 species of his section *Hygrocybe* only 2.5-6.0. In the monograph on *Hygrophorus* s.l. in North America by Hesler & Smith (1963), the length-width ratio of the basidia* is < 6 in about one-third of all the species (viz. 65 of the around 200 species treated: 17 % of sect. *Camarophyllus*, 46 % of sect. *Hygrocybe* and 12 % of sect. *Hygrophorus*). Moreover, several species in the Tricholomataceae have slender basidia, e.g. *Omphalina ericetorum* and *Clitocybe geotropa*.

The second character, the waxy lamellae, is very difficult to define as it is more in the nature of a subjective impression.

Now it is true that even amateur mycologists just starting out easily learn to recognize agarics as belonging to the Hygrophoraceae. Most of the species with short basidia are recognizable by a combination of other characters as belonging to this family (e.g. bright colours, thickish distant gills, viscid pileal surface, etc.) but in a number of cases, the decision whether a species belongs to the Hygrophoraceae or the Tricholomataceae seems rather arbitrary, as in the case of the species with short basidia of

*As Hesler & Smith did not record the length-width ratio of the basidia but only the ranges of length and width, the quotient of the largest length and the largest width of the basidia is taken here as criterion.

Camarophyllopsis versus *Dermoloma*. *Omphalina grossula* (= *O. abiegna*) with thickish very distant decurrent lamellae and yellow-green pigment but with non-hygrophoroid basidia and lignicolous habit, recently (Clémençon 1982: 43) moved to the Hygrophoraceae is another example of the uncertain dividing line between Hygroporaceae and Tricholomataceae. The same applies to a small group of species around *Hygrocybe lilacina* and *H. viola* with small brightly coloured basidiocarps, decurrent lamellae, relatively short basidia and irregular hymenophoral trama (Arnolds 1974: 68).

From these examples, it is clear that the Hygrophoraceae do not meet even the very simple requirements mentioned above for a group of genera to be recognized as a family. Therefore the Hygrophoraceae is merged here in the Tricholomataceae (assuming that the proposal for conservation of the name of this family by Pouzar (1985: 709) will be accepted), where it will probably deserve the rank of tribus.

Pleurotaceae

The Pleurotaceae are recognized here as a well-defined group of lamellate genera phenetically intermediate between the Tricholomataceae and the Polyporaceae. In this family, already recognized by van Overeem (1927), Kühner brings together the two genera *Pleurotus* (including *Phyllotopsis*) and *Lentinus* (including *Panus* sensu Sing. and *Faerberia* = *Geopetalum*) as a basis and adds *Schizophyllum*, *Resupinatus* (incl. *Hohenbuehelia*), *Nothopanus* (incl. *Pleurocybella* and *Cheimonophyllum*) and *Panellus** (incl. *Tectella*).

Singer joins his tribus Lentineae, comprising *Pleurotus*, *Lentinus*, *Panus*, *Phyllotopsis* and *Faerberia*, with his tribus Polyporeae in the family Polyporaceae.

In this Flora two major decisions have had to be taken. First whether we want to admit the genera of Singer's tribus Polyporeae to the order Agaricales as outlined above or not. Secondly which genera we shall allow to enter into Kühner's family Pleurotacaceae (alias Singer's tribus Lentineae).

As to the first problem, we have taken the formal point of view that basidiomycetes with tubular hymenophore and dimitic context are to be excluded from the Agaricales if this order is based on morphological grounds. Inclusion of such species as *Polyporus badius* with a context consisting of narrow, non-inflating generative hyphae and thick-walled, dendroid binding hyphae and a very late developing finely tubular hymenophore would make a morphological definition of the Agaricales impossible.

However, there are good reasons to consider *Lentinus* (Pegler's inclusion of *Panus* in this genus is accepted here) as belonging to the Aphyllophorales because of its dimitic context with not or hardly inflating generative hyphae and hyphal pegs in the hymenium of many of its species, notwithstanding its lamellate hymenophore. Nevertheless *Lentinus* is maintained here in the Agaricales on account of its great resemblance to the predominantly monomitic genus *Pleurotus* and the monomitic context of its young basidiocarps (according to Corner, 1981: 10, this state may last even till the basidiocarp is more than halfgrown).

*Kühner calls this genus *Panus*, but *Panus* is a nomen conservandum with *Agaricus conchatus* as the type species.

Our second problem is to circumscribe the remaining family which centres around *Pleurotus* and *Lentinus*, for which the name Pleurotaceae has to be used, and which essentially corresponds with Singer's tribus Lentineae in his family Polyporaceae.

Kühner and Singer agree on the inclusion of *Phyllotopsis* and *Faerberia*, the latter even reduced to a subgenus of *Lentinus* by Kühner. We have no problems with accepting these two taxa in the Pleurotaceae, maintaining, however, *Faerberia* as an independent genus, although several authors (Corner 1966, Singer & Clémençon 1972, Kühner 1980) have given anatomical and cytological evidence of its close relation to *Lentinus* (dimitic context, cantharelloid hymenophoral development, binucleate spores, etc.).

We cannot accept Kühner's arrangement of *Schizophyllum* in the Pleurotaceae and follow Donk (1964) and Singer in referring it to the Aphyllophorales on account of the lamella-like structures in this genus being absoluely distinct from the lamellae of true Agaricales. The primordial basidiocarp of Schizophyllum is a simple cyphelloid cup which rapidly becomes excessively lobbed at the margin after which the margins of the lobs become adpressed against each other, thus imitating true lamellae (see Wessels 1965: figs 1, 14, 15).

Kühner also includes in the Pleurotaceae *Resupinatus*, *Hohenbuehelia*, *Cheimonophyllum*, *Pleurocybella*, *Panellus* and *Tectella*, whereas Singer classifies these taxa in the Tricholomataceae. In this case, we prefer to follow Singer. Inclusion of these (all monomitic) genera in the Pleurotaceae floods this family with such a host of additional character-possibilities (e.g. amyloid spores, gelatinizing layers in the context, asterostromelloid or Rameales-structure of the pileipellis, etc.) that it becomes difficult to define and seems to loose its only right to existence as an independent family, viz. in being a clearly definable group of genera intermediate between the Tricholomataceae and the Polyporaceae s.str.

Notwithstanding the conspicuous thick-walled cystidia they have in common, to us *Faerberia* and *Hohenbuehelia* do not seem to be very close to each other because of the monomitic, frequently gelatinizing context and the agaricoid lamellae with regular trama and sterile edge with cheilocystidia of the latter genus.

Except for the irregular hymenophoral trama, we do not see any reason for connecting *Pleurocybella* with its cyphelloid primordial stages and globose spores with *Pleurotus*.

Marasmiaceae

One of the major differences between the classifications of the white- and pale-spored agarics by Singer and by Kühner is the segregation of the main body of collybioid, marasmioid, and mycenoid species in a family called Marasmiaceae by the latter author. In this way the Tricholomataceae would be restricted to genera with mainly fleshy, clitocybioid and tricholomatoid* basidiocarps with a simple pileipellis (usually a cutis) and rather

*It should be remembered here that Kühner has moved the pleurotoid genera in Singer's tribus Resupinateae and Panelleae of the Tricholomataceae to the Pleurotaceae; an arrangement not accepted in this flora.

rarely with cystidia and the Marasmiaceae would comprise mainly mycenoid and collybioid species with at least the stipe cartilagineous or corneous, in which there is usually a differentiated pileipellis (elements en brosse, hymeniderm, etc.) and cystidia are frequently present.

A clear dividing line between Kühner's Tricholomataceae and Marasmiaceae, however, is lacking. One of the problems, for instance, in our opinion is the intermediate position of the genus *Collybia*. Several species of this genus have a simple pileipellis, voluminous basidiocarps, and no cystidia and therefore are for us inseparable (on family level) from the core of the Tricholomataceae. On the other hand, *Collybia* has to be placed in the same family as *Marasmiellus* in view of the Rameales-structure in the pileipellis in a number of species and cheilocystidia resembling those of *Marasmiellus* in some.

More of such problems exist and show that the 'Marasmiaceae' are too entangled with the remaining Tricholomataceae to permit recognition as a separate family. For instance, the species united in *Rickenella* by several authors are placed in *Mycena* (Marasmiaceae) by Kühner and in *Gerronema* (remaining Tricholomataceae) by Singer. The classical '*Collybia platyphylla*' is placed in *Hydropus* subgenus *Megacollybia* (Marasmiaceae) by Kühner and in *Tricholomopsis* (remaining Tricholomataceae) by Singer. '*Collybia lacerata*' in *Hydropus* subgenus *Clitocybula* by Kühner and as genus *Clitocybula* in tribus Leucopaxilleae (remaining Tricholomataceae) by Singer.

We therefore prefer to maintain a large family Tricholomataceae subdivided into tribus more or less in the manner of Singer. The final decision on the subdividing of this family in this work will be taken later by the authors working on it for this flora.

Laccariaceae (or Hydnangiaceae)

The genus *Laccaria* is now placed by Singer in his subtribus Laccariinae in tribus Tricholomateae of the Tricholomataceae. Kühner unites it with the hypogeous genus *Hydnangium* in the Hydnangiaceae.

The similarities between *Laccaria* and *Hydnangium* seem undeniable. As in this flora, however, no families are accepted comprising agaricoid as well as hypogeous fungi, the choice here is between a separate family for *Laccaria* or maintaining this genus in the Tricholomataceae.

The chief reasons for excluding *Laccaria* from the Tricholomataceae would be the special type of ornamentation of its spores and to a lesser degree its binucleate spores.

The slender conical warts of the *Laccaria* species studied in this respect, are reported (Besson 1971, Kühner 1980: 518) to be formed within a thick mucilaginous perisporium, to be seated on an episporium which seems to have a different structure, and to be mutually unconnected. In one species, the warts have been found to consist of fibrils running from the base to the apex of the warts.

Leaving aside the ornamentation of the spores, *Laccaria* fits rather nicely in the Tricholomataceae because of more or less fleshy context, hardly differentiated pileipellis, stipitocarpic and weakly monovelangiocarpic development, abundant clamps, more or less adnate lamellae, and (sub)regular hymenophoral trama. As, moreover, at least in one sepcies the ornamentation of the spores is very weak (*L. trullisata*; see Bigelow & Rowley (1968: Fig. 5)) and several types of spore ornamentation have been allowed thus far in the Tricholomataceae, we prefer to keep *Laccaria* in this family.

Rhodotaceae

Although the single species of the genus *Rhodotus* has conspicuous basidiocarps with a curious set of characters (salmon pink colour, reticulately venose pileal surface, partly gelatinizing context, pale sordid buff, ornamented spores), it has a number of properties pointing towards the Tricholomataceae, such as uninucleate primary mycelium and spores, nodulose hilar scar, stipitocarpic and weakly paravelangiocarpic development of the basidiocarps, and abundant clamp-connections.

Neither the bilateral hymenophoral trama, nor the hymenidermal pileipellis, the partly gelatinized context and hymenophoral trama, and the slightly coloured ornamented spores are reasons to remove *Rhodotus* from the Tricholomataceae, where it is placed by Singer.

The structure of the ornamentation of the spores of *Rhodotus* is unique, as it consists of slender obtuse projections formed by the uniformly thick layers of perisporium and ectosporium and filled with lens-like thickenings of the episporium (Besson 1969, Kühner 1980: 508, Fig. 130). But in view of the characters mentioned above, it seems better placed as a separate subdivision of the Tricholomataceae as done by Singer.

According to Kühner (1980: 508), the spore wall structure of *Rhodotus* differs fundamentally from that of *Rhodocybe* (Entolomataceae), another genus with pinkish nodulose spores. There the warts (and in *Entoloma* and *Clitopilus* the ridges) on the spores are formed by local thickenings of a special layer, the epicorium situated between endosporium and episporium.

Reasons for classifying *Rhodotus* not too far distant from the former Hygrophoraceae are the relatively slender basidia (we found the length-width ratio to range from 5.3 to 6.5; the ratio between basidial length and spore length from 7.4 to 8.5), the distant thickish lamellae, and the presence of medallion clamps in the gelatinized subpellis.

Macrocystidiaceae

For Kühner, having brought together in one order the Entolomataceae, the Pluteaceae and *Macrocystidia*, there is no other solution than erecting a separate family for the last named taxon as this clearly does not fit in either of the two other families.

Having rejected the order Pluteales, we still have the choice of admitting the Macrocystidiaceae or of keeping *Macrocystidia* in the Tricholomataceae.

Not being convinced that the rather simple spore wall structure in *Macrocystidia* is so aberrant (according to Kühner an episporium over an endosporium and a very fugacious outer myxosporium) that it necessitates recognition of a family Macrocystidiaceae in addition to the Tricholomataceae, we maintain *Macrocystidia* in the latter family. It fits there reasonably well on account of its uninucleate spores, regular hymenophoral trama, abundant clamps, and emarginately adnate lamellae, but deviates in the rather dark pinkish ochraceous brown spore print (e.g. Munsell between 7.5 YR and 5 YR 6/6) and the presence of an endosporium in mature spores.

A recent study of the pileipellis of *Macrocystidia* in fresh

specimens revealed the presence above the brown cutis-like subpellis of a colourless, thin, somewhat irregular trichoderm of very narrow, distinctly gelatinizing hyphae and showed the prominent pileocystidia to be terminal members of these narrow hyphae. This is strongly suggestive of the pileipellis structure in *Flammulina*. Furthermore, as in that genus cystidia are abundant in the hymenium and in all dermal layers and the stipe is marasmioid (viz. consisting of brown hyphae with thickened walls of which the narrow exterior ones are embedded in a brownish substance), we are inclined to see in *Macrocystidia* a pink-brown spored relative of *Flammulina*, although the latter genus differs in having binucleate colourless spores. This is another argument for maintaining *Macrocystidia* in the Tricholomataceae.

Squamanitaceae

The small group of genera which centres around *Cystoderma* and *Squamanita* is named tribus Cystodermateae by both Singer and Kühner, but placed in the Agaricaceae by the former and in the Tricholomataceae by the latter author. Both authors include *Phaeolepiota* in this tribus, which Jülich (1981: 254) raised to the rank of family under the name Squamanitaceae. *Phaeolepiota*, however, is placed in the Cortinariaceae by Jülich.

Romagnesi (1980) also locates tribus Cystodermateae in the Tricholomataceae but widens its scope by adding the genera *Floccularia*, *Armillaria* (type: *A. mellea*) and *Leucocortinarius*. To us, *Armillaria* and *Leucocortinarius* (closely related to *Cortinarius*, we believe) seem to be completely out of place here. *Floccularia*, however, has earlier been suggested as a possible connection between *Squamanita* and the rest of the Tricholomataceae by Bas (1965: 357).

The yellow-brown species of *Squamanita* have very distinct acrophysalides in the procarpic tuber (Singer & Clémençon 1972, Bas unpublished), a type of cells till rather recently known only from the Amanitaceae. Tjon Sie Fat (unpublished report) discovered the same type of cells in the base of the stipe of *Floccularia*, which genus is therefore accepted here as a member of tribus Cystodermateae, but is certainly one of the most tricholomatoid members of that tribus, and by Kühner (1980: 836, 894) even classified in *Tricholoma* subgenus *Porpoloma*. This is one of the reasons for maintaining the Cystodermateae in the Tricholomataceae.

Notwithstanding the great resemblance of *Cystoderma* to *Cystolepiota* s.l. because of the outer veil consisting of spherocysts and the spore wall being cyanophilous, we are convinced that *Cystoderma* has to be placed in the Tricholomataceae on account of the more or less adnate lamellae (even subdecurrent in our material of *Cystoderma tricholomoides*), the continuous context of stipe and pileus, the nodulose hilum, the subhymenium of ramose hyphae, the homomorphous lamella-edge, the abundant clamps and the simple structure of the spore wall (consisting only of an episporium covered by a thin hardly differentiating myxosporium; Kühner 1980: 157).

The relationship of *Cystoderma* with *Squamanita* seems to be generally accepted now, which strengthens our opinion that tribus Cystodermateae belongs to the Tricholomataceae, since on account of its cutis-like pileipellis *Squamanita* is still more tricholomatoid than *Cystoderma*. In general, *Squamanita* has the same tricholomatoid characters as *Cystoderma*, but the exact structure of spore wall and hilum in *Squamanita* are still unknown. It should be mentioned however that in a few *Squamanita* species the inner layer of the spore wall is metachromatic in Cresyl blue and that one species, *S. fimbriata*, has a heteromorphous lamella-edge; two characters suggestive of the Agaricaceae.

It is difficult to see in *Phaeolepiota* anything else but a more complexly built relative of *Cystoderma*, although it differs from that genus by slightly coloured spores with an uneven surface (due to an irregularly wrinkling and loosening myxosporium), with a distinct endosporium, and with a hilum of the open-pore type (Pegler in litt.). Besides the habit of a giant *Cystoderma* and the characteristic type of velar covering of that genus, *Phaeolepiota* shares with *Cystoderma* the stipitocarpic-monovelangiocarpic development of the basidiocarp (Reijnders 1963), the binucleate spores with a cyanophilous wall (Kühner 1980: 61), and is devoid of cystidia as are most species of *Cystoderma* and *Squamanita*. Moreover, by means of chromatography Benedict & Bradley (1972: 1168) found a reasonable metabolic resemblance between *Phaeolepiota* and *Cystoderma* in a comparison with several species of *Pholiota*. For all these reasons, *Phaeolepiota* is accepted here in tribus Cystodermateae and thus in the Tricholomataceae and is not placed in the Cortinariaceae as suggested by Pegler & Young (1971: 116) on the grounds of supposed similarities in the structure of the spores and by Jülich (l.c.).

Agaricaceae

As explained above, we exclude from the Agaricaceae the genus *Pseudobaeospora* and tribus Cytodermateae. In our opinion, both taxa belong to the Tricholomataceae.

Cortinariaceae versus Strophariaceae

Kühner's concept of the Cortinariaceae differs from that of Singer in the exclusion of the genera *Gymnopilus*, *Galerina* and *Phaeocollybia*, which are transferred to the Strophariaceae. Kühner's main argument for this concept is the occurrence of styrylpyrones in *Gymnopilus*, a group of yellow pigments present in many species of the Strophariaceae, but supposedly absent from the genera maintained in his Cortinariaceae sensu stricto.

According to Kühner, the genus *Galerina*, although without styrylpyrones as far as known, then has to follow suit because of certain similarities between the spores of that genus and those of *Gymnopilus* (strong swelling of the endosporium after treatment with warm KOH and after that with diluted acetic acid). *Phaeocollybia*, in which several species have ornamented spores with a smooth plage as in many species of *Galerina* also has to be kept close to the latter genus.

Kühner points to an additional advantage of his rearrangement of genera, viz. that his reduced Cortinariaceae are strictly mycorrhizal and his extended Strophariaceae all non-mycorrhizal.

For us the transfer of *Gymnopilus*, *Galerina* and *Phaeocollybia* from the Cortinariaceae to the Strophariaceae seems undesirable for the following reasons:

(i) In *Galerina* and *Gymnopilus*, the inner sporewall is frequently dextrinoid as in many species of *Hebeloma* kept in the Cortinariaceae by Kühner. This reaction seems to be rare or lacking in the Strophariaceae sensu Singer.

(ii) In literature (e.g. Benedict & Bradly 1972), the suggestion can be found that styrylpyrones may be formed from lignin-derived substances, which probably means that styrylpyrones are to be expected particularly in lignicolous fungi. This agrees with the report of Gluckoff-Fiasson (in Kühner 1980: 282) in which styrylpyrones are said to occur also in Hymenochaetaceae. Therefore we do not object strongly to a lignicolous genus producing these substances also being placed in the Cortinariaceae. Moreover, styrylpyrones have been found in at least one species of *Cortinarius* (*C. flammuloides* Mos. & Horak from South America) and *C. renidens* Fr. occasionally contains pigments that could be styrylpyrones (Moser 1985).

(iii) Quite a few families (and even some genera) include both mycorrhizal and non-mycorrhizal species.

(iv) Kühner's classification has the disadvantage of introducing taxa with a preponderance of ornamented spores in a family in which ornamented spores thus far are very rare (two species of *Kuehneromyces*; Clémençon 1972, 1974).

(v) In the group of brown-spored agarics with small basidiocarps and an ornamentation of the spores resulting from a heterogeneous perisporium, particularly in *Galerina*, *Naucoria* (type: *N. escharoides*) and the small, hygrophanous species of *Cortinarius* subgenus *Telamonia*, the mutual resemblances are too great to allow distribution of these genera over two families.

Whereas *Cortinarius* and *Galerina* have strongly overlapping ranges of spore-colours around ochraceous to rusty red-brown, the former genus is ectomycorrhizal, has a rather homogeneous ornamentation of the spores, and rarely has cystidia; the latter genus is saprophytic, shows a wide range of spore wall structures, and always has cystidia. But if we also take *Naucoria* into consideration, the seeming gap between *Galerina* and *Cortinarius* looses much in importance.

Naucoria agrees with *Cortinarius* in the mycorrhizal way of life, but differs from both *Cortinarius* and *Galerina* in the more greyish brown spores. However, *Naucoria* resembles *Galerina* in type of basidiocarp, the abundance of cheilocystidia and in the spores showing a strong tendency to the formation of a loose perisporal sac, a character not uncommon in *Galerina* (and *Hebeloma*, a genus undoubtedly close to *Cortinarius*) but unknown thus far in the Strophariaceae.

Galerina permixta, possibly ectomycorrhizal with *Salix* (Arnolds, pers. comm.), seems to be the perfect intermediate between *Galerina* and *Naucoria*. On account of its heterocellular pileipellis and dark spore print colour it was originally described in *Naucoria*, but it has been transferred to *Galerina* by Pegler & Young (1975: 239) after the discovery of a plage on the smooth spores under S.E.M.

Therefore, although *Cortinarius* shows great diversity in types of basidiocarps and pigments, *Galerina* in spore wall-structures, and *Naucoria* in pileipellis-structures, these genera should be kept together in the Cortinariaceae.

In agreement with Kühner (1980: 270), we consider *Tubaria* and *Flammulaster* too closely related to be placed in different families as Singer does (respectively in the Crepidotaceae and the Strophariaceae), the only difference of importance being the more differentiated pileipellis in *Flammulaster*.

At the same time, we see no good reasons for placing *Tubaria* and *Flammulaster* in the Strophariaceae. In the Cortinariaceae, even in Kühner's narrow concept, a great variation of pileipellis structures is already present, particularly in *Naucoria*. In the genera forming the core of the Strophariaceae (*Stropharia*, *Hypholoma*, *Psilocybe* and *Pholiota*) this variation is insignificant, viz. usually a cutis and rarely a trichoderm (assuming that *Panaeolus* is excluded; see below). Also the very pale brownish to yellow-brown or brown spore print and the total lack of pleuro- and chrysocystidia in *Flammulaster* and *Tubaria* fit the Cortinariaceae better.

Kuyper (1986: 16) points to a certain resemblance between *Flammulaster* and some smooth-spored species without pleurocystidia (his subgenus *Mallocybe*) of *Inocybe*; another reason for keeping *Flammulaster* in the Cortinariaceae.

With Bayesian analysis, Machol & Singer (1971) comparing *Phaeomarasmius* (incl. *Flammulaster*) with subfamily Pholiotoideae, family Crepidotaceae, tribus Inocybeae and genus *Galerina*, came to the conclusion that *Phaeomarasmius* is closest to the Pholiotoideae and therefore belongs to the Strophariaceae. But in our case their results are no longer valid, because we have abolished the Crepidotaceae (see below) and placed its constituents in the Cortinariaceae whereas *Tubaria* in our opinion has to be placed in tribus Inocybeae or in a separate tribus together with *Flammulaster* and *Phaeomarasmius* s.str.

Crepidotaceae

Singer places *Crepidotus* together with *Tubaria*, *Simocybe*, *Melanomphalia* and *Pleurotellus* in a separate family, the Crepidotaceae.

Kühner refers *Crepidotus*, *Tubaria* and *Simocybe* to the Strophariaceae, each in a different tribus, viz. Crepidoteae, Tubarieae, and Bolbitieae and does not pass an opinion on *Pleurotellus* and *Melanomphalia*. Kühner's disposal of *Crepidotus* and *Tubaria* is probably at least partly a consequence of his transfer of *Gymnopilus* and *Galerina* to that family.

Just as we do not wish to follow Kühner in placing *Galerina* and *Gymnopilus* outside the Cortinariaceae, we do not wish to follow Singer in doing that with *Crepidotus*. Singer's main reason for setting *Crepidotus* apart seems to lie in his interpretation of the ornamentation of the spores. Meanwhile it has been demonstrated (e.g. by Pegler & Young 1972) that this ornamentation does not fundamentally differ from the one so frequently found in Cortinariaceae, being of perisporal origin.

As mentioned already above, we believe that *Tubaria* should be placed in the Cortinariaceae, not far from *Flammulaster*. The position of *Simocybe* is discussed under the Bolbitiaceae.

Bolbitiaceae

This family, of which the main body is formed by the genera *Bolbitius*, *Conocybe* and *Agrocybe*, is accepted by Singer, but reduced to tribus of the Strophariaceae by Kühner more or less as a consequence of the inclusion of *Panaeolus* in that family by the latter, a classification we do not favour. The position of *Panaeolus* is discussed under the Coprinaceae.

We consider the Bolbitiaceae a natural and homogeneous group of genera which deserves the rank of family and which can be relatively easily differentiated from the Cortinariaceae by the

combination of a hymeniform pileipellis and smooth spores,* from the Strophariaceae by the hymeniform pileipellis, and from the Coprinaceae by the colour of the spore print.

Simocybe (type: *S. centunculus*), with Singer a member of the Crepidotaceae, is brought into connection with *Agrocybe* by Romagnesi (1963: 339) and reduced to a subgenus of *Agrocybe* by Kühner, incorrectly we think. To us it seems that *Simocybe* cannot be placed anywhere else than close to *Flammulaster*, this means for us in the Cortinariaceae. Only different shades of brown in basidiocarps and spore print seem to keep the two genera apart. They certainly have overlapping ranges of pileipellis structures, as is very well demonstrated by Horak's illustrations of Australasian species of these genera (1979a, b, c and 1980a, b), only rarely approaching a true hymeniderm in *Simocybe*. In addition, *Simocybe* and *Flammulaster* both have smooth spores without a germ pore or more rarely with a very small germ pore, usually abundant cheilocystidia but never pleurocystidia, and the basidiocarps are usually small to very small. In *Agrocybe*, the pileipellis is always a closed hymeniderm or an epithelioid hymeniderm, the spores frequently have a germ pore, many species have pleurocystidia, about half of the species have a well-developed veil, and the basidiocarps of most species are medium-sized to large.

Coprinaceae

The family Coprinaceae sensu Singer consists of three subfamilies, viz. Coprinoideae, Psathyrelloideae and Panaeoloideae. The connection between the first two taxa is generally accepted, but the genus *Panaeolus* and its satellites are placed in tribus Bolbitieae of the Naucoriaceae by Kühner & Romagnesi (1953: 340) and in tribus Panaeoleae (next to tribus Bolbitieae) in the Strophariaceae by Kühner.

The main reasons for Kühner's placing of the Panaeoleae in the Strophariaceae are the presence of chrysocystidia in some of its species and a difference in the pigmentation of the spores between the Panaeoleae and the remaining Coprinaceae, viz. in concentrated H_2SO_4 pigment soluble in *Coprinus* and *Psathyrella* and non-soluble in the Panaeoleae. Earlier, Ola'h (1969: 35) in his monograph of *Panaeolus* took the same point of view.

We agree, however, with Singer's (1986: 534) arguments for accommodating *Panaeolus* and allies in the Coprinaceae. Although there is a chemical difference in pigmentation of the spores between *Panaeolus* and the other Coprinaceae, there is no indication that there is a chemical similarity between that pigmentation in *Panaeolus* and Strophariaceae or Bolbitiaceae, but spore print colour of *Panaeolus* is in much better agreement with that of the other Coprinaceae. Above all, however, it is the combination of a very dark purplish brown to black spore print and a hymeniform pileipellis that leads to *Panaeolus* fitting so well in the Coprinaceae, this in spite of the chrysocystidia present in a few species of the Panaeoleae. Clémençon (1976) subjected the relevant taxa to a simplified Bayesian analysis and also came to the conclusion that *Panaeolus* belongs to the Coprinaceae.

Hygrophoropsidaceae

The taxonomic position of the type genus of this family is discussed under Paxillaceae.

Omphalotaceae

This family is mentioned under Paxillaceae.

Paxillaceae

This family is accepted here with the exclusion of the white-spored genera *Omphalotus* and *Hygrophoropsis* and the brown-spored genus *Ripartites*.

Although we are aware of chemical resemblances between *Omphalotus* and *Hygrophoropsis* on the one hand and Paxillaceae and Boletaceae on the other, for the time being we prefer to keep these two genera in the Tricholomataceae on account of the clitocyboid habit combined with colourless, globose to ellipsoid spores, the not easily removable lamellae, and the almost regular hymenophoral trama in at least a part of the collections belonging to the former genus* and the cantharelloid development of the hymenophoral trama in the latter genus. According to Reijnders (1983: 2), the lamellae in *Hygrophoropsis* are primarily formed by a folding of the first smooth primordial hymenial layer. These folds are then filled with a loose tissue similar to that of the pileitrama. Also in later stages it is very difficult to make transverse sections of the lamellae as the hymenophoral trama has hardly any cohesion.

Recently, Kämmerer, Besl & Bresinsky (1985) erected on chemotaxonomic grounds the family Omphalotaceae, comprising the morphologically widely different genera *Omphalotus* and *Lampteromyces*, differentiated from the Paxillaceae only by physiological and chemotaxonomical characters. Although these authors may be on the right track, for the moment our feeling is that chemical and physiological characters are too strongly emphasized by them and are overruling important morphological differences. According to Nair, Carey & Rogerson (1983) sesquiterpenes of the type characteristic for *Omphalotus*, viz. illudoids, are found in a cone-inhabiting agaric ('*Marasmius conigenus*' = ?*Baeospora*) and in *Fomes*, *Coriolus* and *Stereum*, which makes one wonder what would be the result of a systematic scanning of wood-inhabiting agarics for the presence of these substances.

Ripartites is placed in the Paxillaceae by Machol & Singer (1971: 771) after Bayesian analysis of a comparison with Crepidotaceae, Tricholomataceae subtribus Clitocybinae, and Paxillaceae. The rather strongly coloured spore print and the open-pore type of the hilum of the spores of *Ripartites* are the main factors

*In our opinion, the genus *Descolea*, not present in Europe, with hymeniform pileipellis and ornamented spores, should be placed in the Cortinariaceae near *Rozites* as advocated by Horak (1971: 235) and not in the Bolbitiaceae as Singer does. The combination of a hymeniderm and ornamented spores also occurs in *Naucoria*.

*Our observations on the hymenophoral trama in material of *Omphalotus* from southern France disagree with those published by Bresinsky & Besl (1979: 104). In mature lamellae we found it regular and consisting of undulating strands of (thick-walled) hyphae with a 15-20 µm wide, densely ramose subhymenium, and without a trace of hymenopodium. In young lamellae (± 1 mm wide) the thick trama was regular and slightly divergent only in a narrow outer zone directly under the narrow subhymenium. This is in agreement with data supplied by Horak (1968: 423).

favouring placement in Paxillaceae to placement in subtribus Clitocybinae. Both these characters, however, occur frequently in other families and are often found correlated with thickened spore-walls.

Kühner maintains *Ripartites* in the Tricholomataceae because of the resemblance of the cyanophilous ornamentation of the spores with that in *Lepista* (where the spores are often somewhat more coloured than in the rest of the Tricholomataceae, be it always paler than in Ripartites except in one case where they are even darker than in *Ripartites*, viz. in *Clitocybe* (*Lepista*) *benekei* Bigelow & Smith (1970: 32)). Kühner, moreover, points to another character of *Ripartites* favouring this solution, viz. the absence of an endosporium, whereas the spores of Paxillaceae and Boletaceae always have an endosporium and those of the Tricholomataceae very rarely. In addition, the hymenophoral trama of *Ripartites* is regular in contrast to that in the Paxillaceae and Boletaceae.

Therefore we consider *Ripartites* a relative of *Lepista* differing from that genus mainly by a deeper coloured and more complex spore wall.

Gomphidiaceae

This family is generally accepted, but has been merged in the Boletaceae by Kühner. Although *Gomphidius* and allies are unmistakably related to the Boletaceae because of their bilateral hymenophoral trama, coloured boletoid spores, and chemical resemblances, they are not difficult to separate from that family by the combination of thickish, waxy, decurrent lamellae and an olivaceous grey to fuliginous or blackish spore print. In addition, all three species of the Gomphidiaceae in which the ontogeny of the basidiocarp has been studied have a metavelangiocarpous development (Reijnders 1963: 142), which means that they are primary angiocarpous but that the original universal veil is strongly augmented or even replaced by a secondary emanating veil in later stages of the development. Primary angiocarpy is very rare in the Boletaceae. For these reasons, we maintain the Gomphidiaceae as a separate family.

Strobilomycetaceae

Until very recently, Singer brought together the genera *Strobilomyces*, *Boletellus*, *Porphyrellus* and *Phylloboletellus* in the family Strobilomycetaceae chiefly characterized by ornamented spores and dark spore prints (mostly between almost black to fulgineous and grey-brown or dark olive), but had to admit in this family a number of exceptions which made the dividing line between the Strobilomycetaceae and the Boletaceae a rather blurred one. In fact its primary and auxilliary characters (such as type of discoloration of context, shape and size of spores, taste) faded in all directions. Species with smooth spores are allowed in *Strobilomyces* and *Boletellus* and are even in the majority in *Porphyrellus*. Spore print colour varied considerably both in the Strobilomycetaceae and the Boletaceae. In connection with this it is interesting to note that Singer himself (1975: 746) mentions that the spore print colour of *Porphyrellus* is close to that of some species of *Tylopilus*, *Leccinum* and other members of the Boletaceae.

As Singer repeatedly emphasized that one cannot make major decisions in bolete taxonomy without a sound knowledge of the tropical species, it is of some importance that Corner (1972), who studied living material of about 140 species of boleti from southeastern Asia, utterly rejects the family Strobilomycetaceae and even unites quite a number of currently accepted genera of boleti. Moreover McNabb (1967) mentions problems in classifying certain boletes from New Zealand in *Porphyrellus* or *Tylopilus*, and Smith & Thiers (1968: 949), during their studies of Michigan boletes, were unable to locate a hiatus between *Porphyrellus* and *Tylopilus* and merged the former genus in the latter, whereas the dividing line between the Strobilomycetaceae and the Boletaceae was supposed to be running between these two genera.

Another problem disclosed in literature is the delimitation of *Boletellus* formerly placed by Singer in the Strobilomycetaceae and *Xerocomus* (Boletaceae). Several authors have mentioned that some *Boletellus* species would fit nicely into *Xerocomus* were it not for having ornamented spores. This ornamentation varies from conspicuous wings to rather delicate ridges.

Perreau-Bertrand (1965: 4245, 1967: 680) as well as Pegler & Young (1971: 156) demonstrated the presence of faint longitudinal ridges on spores of *Xerocomus subtomentosus*, the type species of *Xerocomus* and a general similarity of spore wall structure in *Boletellus* and *Xerocomus*, suggesting a close relationship of these two genera. This is supported by the discovery of vague longitudinal ridges on the spores of a European taxon very close to *X. chrysenteron*, viz. *Boletus fragilipes* Martin (Hübsch 1982: 65). On account of all this, we wholeheartedly agree with Singer's (1986) recent but hardly elucidated merging of the Strobilomycetaceae in the Boletaceae.

SYNOPSIS AND SUMMARY

In the synopsis below the names of the orders and families to be treated in this work are given and the conclusions from this chapter concerning their scope are summarized.

I. AGARICALES F.Clem. emend.
Including: Tricholomatales Kühner, Pluteales Kühner, Boletales E.J.Gilb.

1. TRICHOLOMATACEAE R.Heim ex Pouz., nom. cons. prop.
Including: Hydnangiaceae Gäum. & Dodge emend. Pegl. & Young p.p. = Laccariaceae Jülich, Hygrophoraceae Lotsy, Hygrophoropsidaceae Kühner, Macrocystidiaceae Kühner, Marasmiaceae Kühner, Rhodotaceae Kühner, Squamanitaceae Jülich = tribus Cystodermataea Sing.
Resupinatus Nees, *Hohenbuehelia* S.Schulz., *Cheimonophyllum* Sing., *Pleurocybella* Sing., *Panellus* Fr., *Tectella* Earle
Pseudobaeospora Sing.
Phaeolepiota Maire
Hygrophoropsis (J.Schroet.) Maire, *Omphalotus* Fay., *Ripartites* P.Karst.
2. PLEUROTACEAE Kühner
Including: *Faerberia* Pouz. (= *Geopetalum* Pat.)
Excluding: *Resupinatus*, *Hohenbuehelia*, *Cheimonophyllum*, *Pleurocybella*, *Panellus*, *Tectella*
3. ENTOLOMATACEAE Kotl. & P.
4. AMANITACEAE R.Heim ex Pouz.
5. PLUTEACEAE Kotl. & P.

6. AGARICACEAE Fr.
   Excluding: tribus Cystodermateae
   Pseudobaeospora
7. CORTINARIACEAE Heim ex Pouz., nom. cons. prop.
   Including: Crepidotaceae Sing.
   Flammulaster Earle, *Galerina* Earle, *Gymnopilus* P.Karst., *Phaeocollybia* R.Heim, *Simocybe* P.Karst., *Tubaria* (W.G.Sm.) Gillet
   Excluding: *Phaeolepiota*
8. STROPHARIACEAE Sing. & Smith
   Excluding: Bolbitiaceae Sing.
   subfam. Panaeoloideae Sing.
   Crepidotus (Fr.) Kumm., *Flammulaster*, *Galerina*, *Gymnopilus*, *Phaeocollybia*, *Simocybe*, *Tubaria*
9. BOLBITIACEAE Sing.
   Excluding: subfam. Panaeoloideae
   Simocybe
10. COPRINACEAE Gäum.
    Including: subfam. Phanaeoloideae
11. PAXILLACEAE Lotsy
    Excluding: *Omphalotus*, *Hygrophoropsis*, *Ripartities*
12. GOMPHIDIACEAE Sing.
13. BOLETACEAE Chev.
    Including: Strobilomycetaceae E.J.Gilb.

II. RUSSULALES Kreisel

14. RUSSULACEAE Lotsy

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CHAPTER 6

Nomenclature

THOMAS W. KUYPER

It is a truism that mycology requires a precise and simple system of naming in order to spread the results of taxonomic research. Such a system for fungi is provided by the International Code of Botanical Nomenclature (Voss et al. 1983). According to its Preamble, the Code has several aims, viz. the provision of a stable method of naming taxonomic groups, the attempt to put the nomenclature of the past into order, and to provide for the nomenclature of the future. It is not, however, always sufficiently realised that a stable method sometimes conflicts with the stability of names-in-use.

The actual situation in mycological nomenclature seems to make plain that we have to live with this potential conflict that has at least partly arisen out of well-meant attempts to modify the Code in order to 'rescue' particular names. While admitting that name changes are almost always undesirable, it would seem that a stable method is more desirable. A growing uneasiness with such a changeful Code can nowadays be observed, and several proposals have been published to make future changes of the Code more difficult.

Mycological nomenclature has recently seen a dramatic change with the abandonment of special starting-points and the introduction of a so-called sanctioning system (Demoulin et al. 1981). This change has been deplored by a small number of mycologists as a change for the worse, but the majority of the mycological community seems to sympathise with this nomenclatural novelty, partly at least because the old system of starting-point nomenclature had turned out to be difficult to work with (cf. Kuyper & van Vuure 1985).

Although the advantages and disadvantages of sanction have been discussed by mycologists for more than a decade, the final introduction of this principle yielded several (unforeseen but not unforeseeable) difficulties (cf. Gams & Kuyper 1984). It was not always clear how these cases had to be handled when the first volume of this Flora was being written. Because of the novelty of the principle of sanction, no established custom was available. After the International Botanical Congress at Berlin, most of these cases were resolved, although a few ambiguities stil remain.

Nomenclatural uniformity, especially in these cases where relevant rules are absent or ambiguous, seems very desirable for a multi-authored flora such as this Flora agaricina neerlandica. Therefore much attention has been given to such a common, uniform nomenclature. This essay purports to sketch its outlines.

The present wording of Art. 13.1(d), stating that names adopted by Fries in the basic books (Systema mycologicum and Elenchus Fungorum) are sanctioned, i.e. are treated as if conserved, clearly indicates that not all names used by Fries are to be regarded as sanctioned. Adoption by Fries should be equivalent with explicit recognition as an autonomous taxon. But once a name has been adopted and hence sanctioned, the name remains sanctioned for ever and sanction cannot be withdrawn, even if Fries later changed his mind.

The article also indicates which books comprise the sanctioning work. The General Index (Fries 1832) is considered an integral part of the basic books. All names printed in Roman letters in this Index are therefore regarded as sanctioned, except in a very small number of cases where the Roman print has been erroneously used instead of italics. Fortunately, such cases of misprinting can rather easily be recognised, as the accepted and sanctioned name for the taxon is added in parentheses.

Sanctioned names are treated as if conserved against earlier homonyms and competing synonyms. While admitting that this is not a very fortunate description of what sanction really is, it makes clear that sanction aims at nomenclatural protection of names that would otherwise have been incorrect or illegitimate. However, one should not conclude from this that sanctioned names are for that reason always legitimate, because two types of illegitimate sanctioned names can be recognised, viz. sanctioned homonyms and sanctioned superfluous names. In the former case a sanctioned name is illegitimate under Art. 64.1 because it is a later homonym of another sanctioned name, whereas in the latter case a sanctioned name is illegitimate under Art. 63.1 because it is a homotypic, obligate synonym of another sanctioned name.

One example elucidates both possibilities: *Agaricus nitens* Batsch 1789: Fr. and *A. nitens* Vahl 1792: Fr. are both sanctioned, but under Art. 64.1, the latter name is an illegitimate homonym, its sanction notwithstanding. Fries himself was aware of this situation and he therefore proposed the nomen novum *A. luteonitens* Fr. 1821: Fr. for Vahl's species. However, Fries also changed the name of Batsch's species into *A. glauconitens* Fr. 1821: Fr., but this name is a homotypic synonym of the legitimate name *A. nitens* Batsch: Fr. and therefore superfluous under Art. 63.1 and hence illegitimate.

Questions regarding priority of sanctioned names have been much discussed. Finally the simple and straightforward procedure has been adopted that in cases both of serial and simultaneous sanction the sanctioned name based on the earliest validly published name takes precedence over later ones.

Much attention has been devoted in earlier publications (Korf 1983, Gams & Kuyper 1984) to a grammar of sanctioned names, and such a scheme need not be reproduced here. It is sufficient to

emphasize here that sanction is only valid in the rank used by the sanctioning author, and that this status should not be extended to ranks not assigned to it by Fries. This conclusion is also a corollary of Art. 60.1 where it is explicitly ruled that no name has priority outside its own rank.

Mention here is made of another device that seems useful in nomenclatural matters, viz. the arrow (→), introduced by Kuyper & van Vuure (1985). This sign is used to circumvent a disadvantageous aspect of Art. 72.1 where nomina nova are created, typified by the type of an earlier, validly published but illegitimate name, for which an author citation is indicated that obscures any reference to the validating author, contrary to Art. 46.1. Such author citation lacks information that is relevant to typification and obscures important bibliographic information. The use of the arrow is quite simple as will be demonstrated with *Agaricus sericeus* Bull. 1788, non *A. sericeus* Schaeff. 1774. The species is cited here as *Entoloma sericeum* (Bull. →) Quél. 1872 (or *Nolanea sericea* (Bull. → Quél.) P. D. Orton 1960). The original example, given by Kuyper & van Vuure (viz. *A. cervinus* Schaeff. 1774, non *A. cervinus* Hoffm 1789: Fr.), is not longer valid, because earlier names that are homonyms of sanctioned names, are now declared legitimate but unavailable. The usefulness of this arrow may become evident upon realisation that a large number of homonyms exist within the genus *Agaricus*.

One of the deleterious side-effects of the introduction of the sanctioning system has been the simultaneous adoption of Art. 7.17 that deals with the typification of sanctioned names. According to this article typification of sanctioned names may be based on anything associated with the name in the basic books. Although this article seems to have been added to promote nomenclatural stability, it can lead to the contrary for even the superseding of a holotype is made possible. Generally speaking this article permits subjective typification. In this respect the analogy with Art. 10.1, which forbids such subjective typification, seems useful. One should therefore consider the type (if existent) of the validating author, and not the species Fries thought to have at hand. Such subjective typification would have been acceptable under a special starting-point nomenclature. But sanction should be considered solely as nomenclatural protection, with the abandonment of taxonomic protection. For that reason, all sanctioned names in this Flora are typified according to the (original) protologue. Only in a very few circumstances have sanctioned names been exempted from automatic typification under Art. 7.9 and 7.11.

Some mycologists fear that to abandon Art. 7.17 would lead to substantial nomenclatural instability. However, matters are not so bad. Old descriptions are often rather short, and almost always lack important information about microscopical and microchemical characters. In that sense we are in the same position as Fries when we try to interpret these old names. And although Fries was sometimes hindered by his dogmatism, his interpretations (and often emendations) in the basic books are generally rather good.

Every mycologist who has tried to interpret old names on the basis of a description (and sometimes an illustration), will accept the view that in most cases we cannot do more than conclude that the present interpretation does not contradict the protologue. This provides sufficient justification for the retention of certain names for the sake of stability, and it should serve as a guideline for neotypification, but it is hardly acceptable as an argument for the introduction of a new combination.

Responsible taxonomists and nomenclaturalists should restrict themselves in renaming taxa only to cases in which the present interpretation of a species is seriously at odds with the protologue, or when the present name is invalid or illegitimate. Voluntary selfrestraint seems therefore necessary. We have to live with this simple, but sometimes unfortunate, truth.

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Scope, methods and presentation

C. BAS

Scope

The 'Flora agaricina neerlandica' contains keys to, correct names of, concise synonymies for, descriptions and illustrations of, and distributional data on agarics and boleti (Agaricales sensu lato and Russulales) occurring in the Netherlands. Fór practical reasons, the genera of so-called cyphelloid fungi are excluded.

Extralimital taxa of which occurrence in the Netherlands can be expected on account of their ecology and/or geographical distribution are included in the keys, while only a short diagnostic description, concise synonymy, and references to selected descriptions and illustrations are given.

Fungi that spontaneously establish themselves in the Netherlands after human intervention (e.g. mycorrhizal symbionts of the introduced *Larix* species as *Suillus grevillei*) are considered indigenous. Hothouse fungi are not treated except some species of *Leucocoprinus* frequently found in flowerpots in houses.

Descriptions

In principle all descriptions are based on observations referring to material from the Netherlands. In cases where this material is not representative, however, obervations on other collections from north-western Europe are sometimes included. Collections revised for this flora have been marked with special labels added to them.

If authentic observations, particularly on macroscopic characters are lacking, data are taken from literature, but this is then explicitly indicated with references to the sources of information.

Sizes of spores are measured in tenths of a µm but rounded off to halves of µm. Sizes of basidia, cystidia, and other microscopical elements are measured and given in µm, unless they are narrower or smaller than 10 µm, which case they are treated as the spores.

Ecological and distributional data

Extensive notes on ecology and geographical distribution, both within and outside the Netherlands, are given, but distribution maps are not included.

Only in the cases of very rare species (five or fewer localities known in the Netherlands) are individual localities enumerated.

Frequency classes (very rare, rare, rather rare, rather common, common, very common) are estimated from the number of collections from the Netherlands studied and the number of reliable references in literature.

Illustrations

All species are illustrated by line-drawings of basidiocarps, spores and cystidia (if present), if necessary complemented by drawings of other microscopical characters. The magnifications of these drawings are:

basidiocarps × 1 (unless indicated otherwise)
spores × 1500
cystidia and basidia × 1000 (unless indicated otherwise)
tissues × 500 (unless indicated otherwise)

For the abbreviations used in the illustrations, see the list of abbreviations at the end of this chapter.

Formulae

For formulae of chemical reagents and stains, the reader is referred to current mycological literature (e.g. Kühner & Romagnesi, Flore analytique, 1953; Moser, Röhrlinge und Blätterpilze, 1983; Singer, Agaricales in modern taxonomy, 1986).

Nomenclature

In nomenclatural matters, close adherence to the latest edition of the 'International Code of Botanical Nomenclature' is aimed at. For the procedures followed in cases in which the Code is not perfectly clear, particularly in connection with sanctioned names, see Chapter 6.

Synonymy is not complete, but restricted to synonyms that have appeared in modern monographs, wellknown floras, Dutch mycological literature, and popular books with a wide distribution. A similar selection is made from the misapplied and excluded names.

Names of pteridophytes and phanerogams mentioned are in accordance with Heukels/Van der Meijden (1983), Flora van Nederland, 20th ed., Groningen.

New names and new taxa

New names found to be required and new taxa discovered in the course of the investigations carried out for this flora, are not published in the flora itself, but in a series of separate notes titled 'Notulae ad Floram agaricinam neerlandicam' appearing in the journal Persoonia. In these Notulae the more lengthy discussions on taxonomic and nomenclatural problems are also placed.

Aug. – August
cc – caulocystidia
ch – cheilocystidia
Dec. – December
diagn. – diagnosis
emend. – emendatus (= corrected)
excl. – excluded
f. – forma
Feb. – February
Fig., fig. – Figure, figure
Figs, figs – Figures, figures
Jan. – January
K. & W. – Kornerup, A. & Wanscher, J.H., Methuen handbook of colour, Farver i farver
L = – number of lamellae
l = – number of lamellulae
loc. cit. – loco citato (= in the place cited)
misappl. – misapplied
Mu. – Munsell soil colour charts
Nov. – November
Oct. – October
ph – hairs of pileus
pl – pleurocystidia
pl. – plate
pp – pileipellis or elements of pileipellis
p.p. – pro parte
Q – quotient of length and width or breadth
$\bar{Q}$ – average quotient
sect. – section
sel. – selected
Sept. – September
sh – hairs of stipe
subgen. – subgenus
subsect. – subsection
subsp. – subspecies
var. – variety
vern. – vernacular

CHAPTER 8

Glossary

Else C. VELLINGA

abrupt papilla – (on pileus) (Fig. 29.30).
abruptly bulbous – (base of stipe) (Fig. 31.18).
acrophysalidic – (tissue) consisting of connective hyphae and abundant, large, terminal, inflated elements ('acrophysalides').
acuminate – (cystidia) tapering from inwardly curved sides off to a point (Fig. 34.39).
acute – (cystidia) tapering off to a sharp point (Fig. 34.40); – (spore apex) pointed (Fig. 33.30).
acute papilla – (on pileus) (Fig. 29.31).
adnate – (lamellae) broadly attached to stipe (Fig. 30.21), see also narrowly adnate.
adnexed – (lamellae) rounded towards stipe (Fig. 30.19).
allantoid – (spores) with adaxial side concave and parallel to abaxial side (Fig. 33.21).
amygdaliform – (spores) with adaxial side, straight or less convex than abaxial side (Fig. 33.18, 33.19).
amyloid – (spore wall, spore ornamentation, hyphal walls), staining greyish to blackish blue in Melzer's reagent.
anastomosing – (lamellae) provided with irregular transverse connections (Fig. 30.4).
angiocarpy – a type of development of the basidiocarp in which at some stages the developing hymenium is situated in a closed cavity; see also primary and secondary angiocarpy.
apex – (of spores) summit (Fig. 32.4A).
apical – (spores) situated at the tip.
appendage – (of spores) see hilar appendage.
appendiculate – (margin of pileus) with small appendages (Fig. 29.48).
applanate – (pileus) flattened, flat (Figs 29.7, 29.19).
arachnoid – (pileus and stipe, surfaces or velum) cobwebby.
arcuate – (lamellae) with concave lamella edge (Figs 30.15, 30.16).
areolate-rimose – (pileus surface) marked with numerous superficial clefts or cracks forming angular patches.
ascending – (hyphae) curving upward.
aseptate – (hyphae) without septa.
bacilliform – (spores) l/w = l/b > 3.0 (Fig. 33.7).
balistosporic basidium – a basidium that actively discharges its spores.
basidiocarp – fruit-body producing spores on basidia.
bilateral – see divergent.
binding hyphae – branching, rarely septate, thick-walled, narrow hyphae binding the other elements of a tissue together.
binucleate – with two nuclei.
breadth – (of spore), largest distance between sides as seen from frontal view (Fig. 32.2).
broadly clavate – (cystidia) clavate with Q < 1.5 (Fig. 34.14).
broadly conical – (pileus) (Fig. 29.13), see also truncately broadly conical; – (cystidia) conical with Q < 1.5 (Fig. 34.18.).
broadly cylindrical – (cystidia) cylindrical, with Q < 2 (Fig. 34.11).
broadly ellipsoid – (spores) l/w = l.b = 1.15-1.3 (Fig. 33.3); – (cystidia) Q = 1.15-1.3 (Fig. 34.3).
broadly fistulose – (stipe) with very wide tube (Fig. 31.12).
broadly fusiform – (spores) fusiform with l/w or l/b = 1.5-2.0 (Fig. 33.12); – (cystidia) fusiform with Q = 1.5-2.0 (Fig. 34.21), see also very broadly fusiform.
broadly lageniform – (cystidia) (Fig. 34.26).
broadly utriform – (cystidia) (Fig. 34.29).
broadly ventricose – (lamellae) (Fig. 30.14).
brosse – see en brosse.
bulbous – (base of stipe) enlarged (Fig. 31.17), see also abruptly bulbous and marginately bulbous.
campanulate – (pileus) bell-shaped (Fig. 29.12).
capitate – (apex of cystidia) having a distinct and abrupt knob (Fig. 34.44).
caulocystidium – cystidium situated on surface of stipe.
central – (stipe) attached to centre of pileus (Fig. 31.1); – (germ pore) situated at the central tip of the spore (Fig. 33.27).
chambered – (stipe) with several cavities (Fig. 31.13).
cheilocystidium – cystidium situated on edge of lamella or tube.
chrysocystidium – cystidium with yellow amorphous body or bodies in contents after treatment with NH_4OH or KOH.
circular – (pileus) round (Fig. 29.1).
clavate – club-shaped (stipe) (Fig. 31.8); – (cystidia), Q = 1.5-4 (Fig. 34.13), see also narrowly clavate and broadly clavate.
clitocyboid – see omphalioid.
collarium – a tube around, but free from, the apex of the stipe to which the lamellae are attached (Fig. 30.5).
colliculose – (pileus surface) covered with hillock-like elevations.
collybioid – (habit) characterized by pileus neither umbilicate, nor conical; lamellae free or adnate; context tough; context of pileus continuous with context of stipe (Figs 28.2, 28.3).
concave – (pileus) (Fig. 29.21).
congophilus – (spore wall) accumulating Congo Red.
conical – cone shaped (pileus) (Fig. 29.14), see also broadly conical and narrowly conical, truncately broadly conical, truncately conical, and obtusely conical; – (cystidia) Q = 1.5-4 (Fig. 34.17), see also narrowly conical and broadly conical.
connate – (stipes) grown together at their bases.
connective hyphae – usually narrow undifferentiated hyphae of the context of a basidiocarp connecting all other elements (used in opposite of fundamental hyphae).
constriction – see median constriction.
convex – (pileus) (Fig. 29.9).
costate – (pileus and stipe surfaces) with ridges.
crenate – with rounded teeth (margin of pileus) (Fig. 29.45); – (lamella edge) (Fig. 30.33).
crenulate – minutely crenate (margin of pileus) (Fig. 29.46); – (lamella edge) (Fig. 30.34).

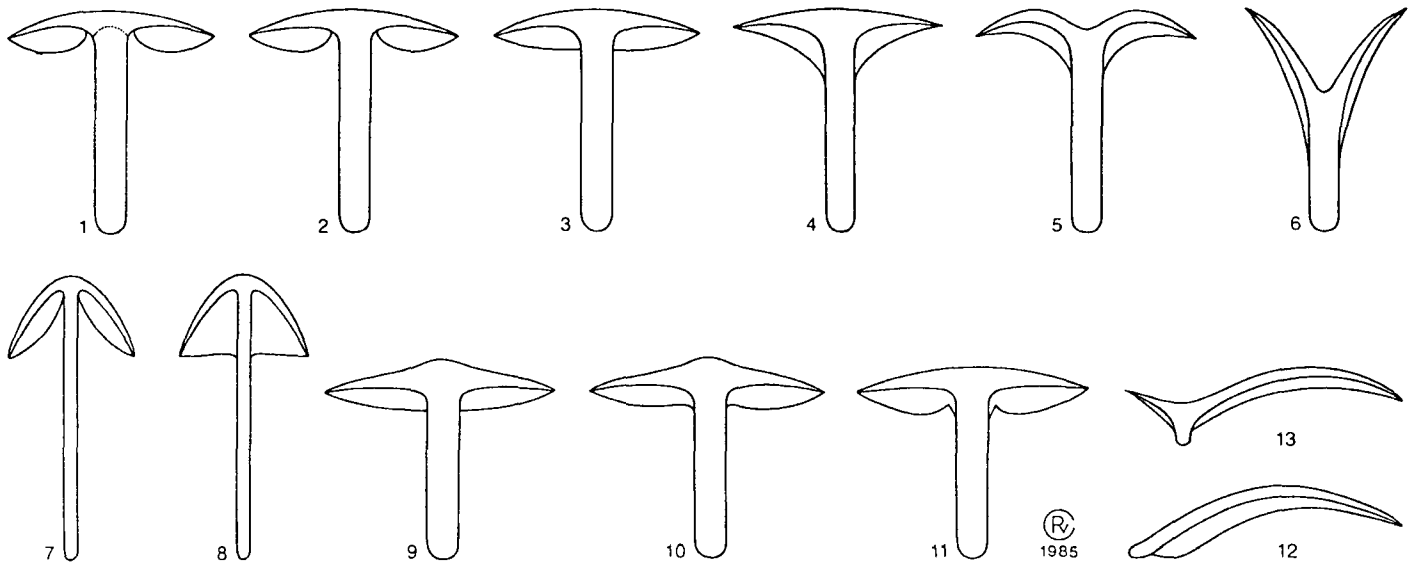

Fig. 28. Habit: 1. pluteoid; 2, 3. collybioid; 4-6. omphalioid; 7, 8. mycenoid; 9-11. tricholomatoid; 12, 13. pleurotoid.

crepidotoid – see pleurotoid.
curved – (stipe) bent from substrate upwards as to adjust to the gravitations.
cutis – a pileipellis consisting of repent non-gelatinizing hyphae (Fig. 36.1).
cyanophilous – (spore wall) accumulating Cotton Blue.
cylindrical – (stipe) circular in cross-section and of equal diameter from apex to base (Fig. 31.4); – (spores) l/w = l/b = 2.0-3.0, in outline with parallel sides; – (cystidia) Q = 2-4 (Fig. 34.10), see also narrowly cylindrical and broadly cylindrical.
cystidium – sterile, differentiated, terminal element in the hymenium, or on the surfaces of the basidiocarp.
decurrent – (lamellae) descending down the stipe (angle lamellae-stipe 40-60°) (Fig. 30.28), see also deeply decurrent.
decurrent tooth – (of lamellae) (Figs 30.25, 30.26).
deeply decurrent – (lamellae) (angle lamellae-stipe < 40°) (Fig. 30.29).
deeply infundibuliform – (pileus) (Fig. 29.23).
deeply umbilicate – (pileus) with deep abrupt depression (Fig. 29.28).
deflexed – (margin of pileus) bent downwards (Fig. 29.37).
deliquescent – (lamellae and/or basidiocarps) becoming liquid after maturing.
depressed – (pileus) with central depression/sinking (Fig. 29.25), see also slightly depressed.
depression – (of pileus), see depressed; – (of spores), see suprahilar depression.
derm – a pileipellis consisting of erect elements, or of ascending elements, see trichoderm and hymeniderm.
dextrinoid – (spore wall, hyphal walls) staining red to reddish brown in Melzer's reagent.
dimitic – (tissues) consisting of generative hyphae and skeletal hyphae or binding hyphae.
diverticulate – (cystidia) with short finger-like excrescences (Fig. 34.45).
divergent (= bilateral) – (hymenophoral trama) having downward hyphae turning outward from a median line (Fig. 35.5, 35.6).
eccentric – (stipe) not attached to centre of pileus (Fig. 31.2) – (germ pore) situated at the abaxial side of the spore (Fig. 33.26).
ectosporium – the very thin outer layer of the basidiospore wall.
ellipsoid – (spores) l/w = l/b = 1.3-1.6 (Fig. 33.4); – (cystidia) Q = 1.3-1.6 (Fig. 34.2), see also broadly ellipsoid.
emarginate – (lamellae) notched near the stipe (Fig. 30.23).
en brosse – (of cystidia) with excrescences, diverticulate (Fig. 34.45).
endosporium – the electron transparent inner layer of the basidiospore wall at the inside of the episporium, but lacking in many white- and pale-spored taxa.
entire – (lamella edge) straight, smooth, and glabrous (Figs 30.30, 30.38).
episporium – the electron opaque fundamental layer present in all basidiospores of the Hymenomycetes; it is the innermost layer of the spore wall when the endosporium is lacking.
epithelioid hymeniderm – a hymeniderm made up of elements with Q = 1.0-1.15 (Fig. 36.9).
epithelium – a pileipellis made up of globose to broadly ellipsoid elements in more than one layer deep; see regular epithelium and irregular epithelium.
equal – (stipe) of equal diameter from apex to base.
erect – (hyphae or projections of hyphae) perpendicular to surface of pileus.
eroded – irregularly toothed (margin of pileus) (Fig. 29.47); – (of lamella edge) (Fig. 30.37).
euhymeniderm – a hymeniderm made up of elements with Q = 1.15-6 (Fig. 36.8).
eusporium – the inner set of firm and resistant layers of the basidiospore wall, consisting of the episporium and the endosporium.
even – (lamella edge) straight, smooth and glabrous, entire (Figs 30.30, 30.38).
exceeding – (margin of pileus with regard to lamellae) (Fig. 29.42).
exosporium – a layer of the basidiospore wall between perisporium and episporium, frequently responsible for the ornamentation of spores.
fasciculate – (basidiocarps) growing in a bundle.
felted – (pileus, stipe surfaces, and volva) composed of, or covered with, densely compressed, matted hairs or fibrils.
fertile – (lamella edge) composed of basidia only.
fibrillose – (pileus and stipe surfaces) covered with thin, thread-like fibres.
filiform – (cystidia) very long and narrowly cylindrical.
fimbriate – (lamella edge with regular hair-like projections (Fig. 30.39).

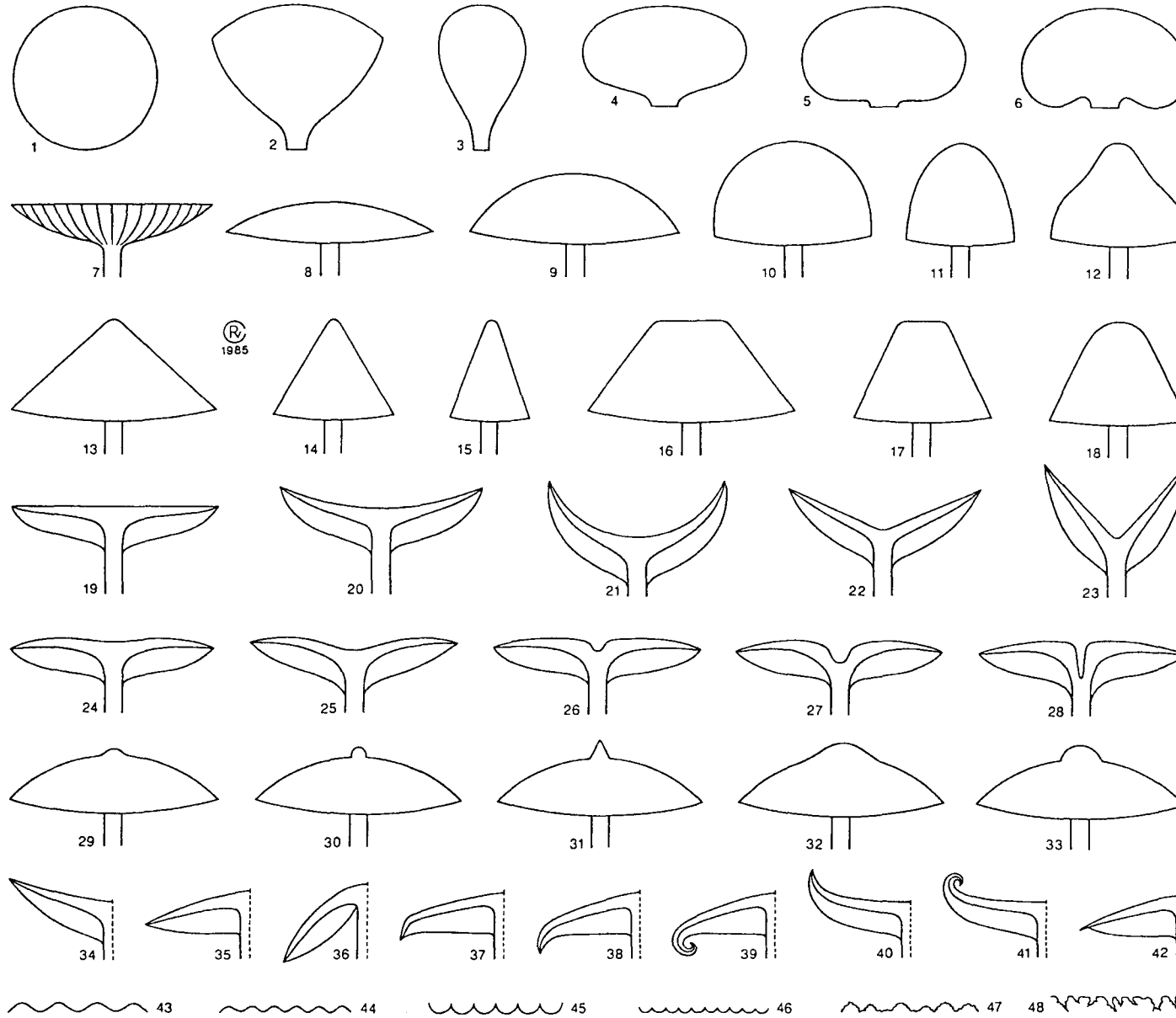

Fig. 29. Pileus. – 1-6. *Shape when seen from above:* 1. circular; 2. flabelliform; 3. spathuliform; 4, 5. rounded flabelliform; 6. reniform. – 7-23. *Shape when seen from aside:* 7. applanate; 8. plano-convex; 9. convex; 10. hemispherical; 11. paraboloid; 12. campanulate; 13. broadly conical; 14. conical; 15. narrowly conical; 16. truncately broadly conical; 17. truncately conical; 18. obtusely conical; 19. applanate; 20. plano-concave; 21. concave; 22. infundibuliform; 23. deeply infundibuliform. – 24-33. *Shape of centre:* 24. slightly depressed; 25. depressed; 26. subumbilicate; 27. umbilicate; 28. deeply umbilicate; 29. with papilla; 30. with abrupt papilla; 31. with acute papilla; 32. subumbonate; 33. umbonate. – 34-42. *Aspects of margin:* 34-36. straight; 37. deflexed; 38. inflexed; 39. involute; 40. reflexed; 41. revolute; 42. exceeding lamellae. – 43-48. *Shape of margin:* 43. undate; 44. undulate; 45. crenate; 46. crenulate; 47. eroded; 48. appendiculate.

fissurate – (pileus and stipe surfaces) with deep and/or distinct clefts.
fistulose – (stipe) hollow (Fig. 31.11), see also broadly fistulose.
flabelliform – (pileus) fan-shaped (Fig. 29.2), see also rounded flabelliform.
flexuose – (stipe) full of bends; – (cystidia) cylindrical but with bends (Fig. 34.36).
floccose – (pileus and stipe surfaces) covered with tufts of soft hairs.
flocculose – (pileus and stipe surfaces) minutely floccose.
free – (lamellae) not attached to stipe (Fig. 30.18).
fringed – (lamella edge) with irregular appendages.
frontal view – (of spores) (Fig. 32.2).
fundamental hyphae – the inflated hyphae giving the fleshy basidiocarp its firmness.
fusiform – spindle shaped, tapering at both ends, (spores) with l/w or l/b = 2.0-4.0 (Fig. 33.13); – (cystidia) with Q = 2.0-4.0 (Fig. 34.20), see also narrowly, broadly, and very broadly fusiform.
furcate – (lamellae) forked (Fig. 30.2).
generative hyphae – the basic type of septate, thin- to thick-walled, branching hyphae, present in all (young) basidiocarps, from which all differentiated hyphae arise (used in opposite of binding and skeletal hyphae).
germ pore – (of spores) apical thin-walled spot in spore wall (Fig.

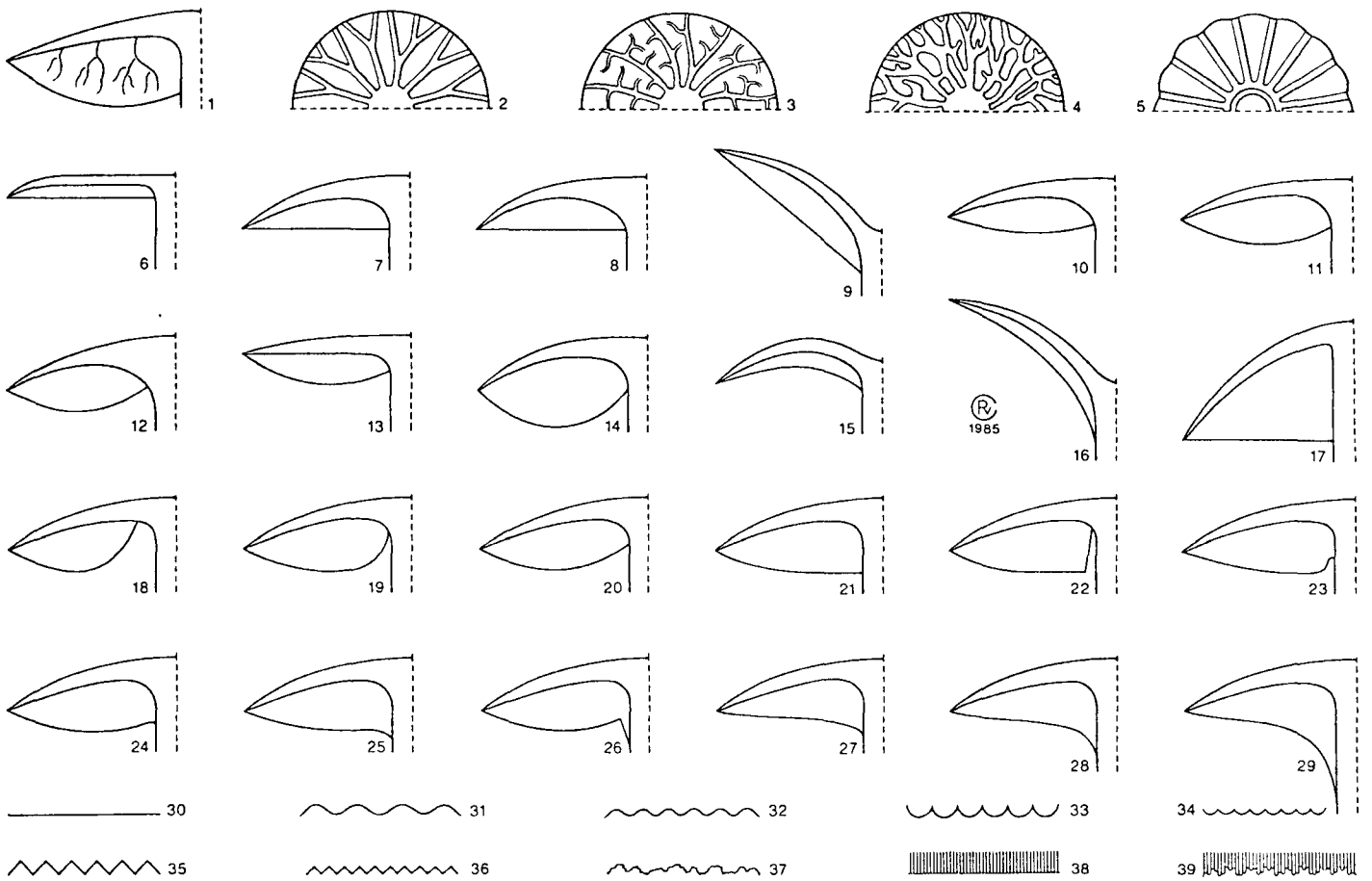

Fig. 30. Lamellae: 1. transvenose. – 2-5. *Seen from below:* 2. furcate; 3. intervenose; 4. anastomosing; 5. collarium. – 6-17. *Shape:* 6. linear; 7-9. segmentiform; 10. subventricose; 11-13. ventricose; 14. broadly ventricose; 15, 16. arcuate; 17. triangular. – 18-29. *Attachment:* 18. free; 19. adnexed. 20. narrowly adnate; 21. adnate; 22. seceding; 23. emarginate; 24. sinuate; 25. adnate with decurrent tooth; 26. emarginate with decurrent tooth; 27. subdecurrent; 28. decurrent; 29. deeply decurrent. – 30-39. *Lamella edge:* 30. even or entire; 31. undate; 32. undulate; 33. crenate; 34. crenulate; 35. serrate; 36. serrulate; 37. eroded; 38. even (strongly magnified); 39. fimbriate (strongly magnified).

32.6E), see also central and eccentric germ pore.

glabrous – (pileus and stipe surfaces) bald.

globose – spherical, (spores) l/w = l/b = 0.95-1.05 (Fig. 33.1); – (cystidia) Q = 1.0-1.05 (Fig. 34.5).

granulose – (pileus and stipe surfaces) covered with (or composed of) minute grains.

gregarious – (basidiocarps) growing in a group.

guttule – droplet (Fig. 32.6G).

gymnocarpy – a type of development of the basidiocarp in which the hymenium is exposed from initiation till maturity.

hemispherical – (pileus) with shape of a half sphere (Fig. 29.10).

heterogeneous – (lamella edge) composed of cystidia and basidia.

heteromerous – (tissue) consisting of hyphae and 'nests' of sphero-cysts.

hexagonal – (spores) six-angled (Figs 33.22, 33.23).

hilar appendage – (of spores) short process at basal end of spore, by which it was attached to sterigma (Fig. 32.4C).

hilum – scar left on the hilar appendage of the basidiospore after its discharge from the sterigma.

hirsute – (pileus and stipe surfaces) covered with rather long, rather coarse hairs (coarser than in pubescent, less coarse than in hispid).

hispid – (pileus and stipe surfaces) covered with long or short, erect, stiff hairs or bristles.

hispidulous – (pileus and stipe surfaces) minutely hispid.

homoiomerous – (tissue) consisting of hyphae and without nests of spherocysts.

hymeniderm – a derm made up of non-septate elements originating at the same level, see also epithelioid hymeniderm, and transition between hymeniderm and epithelium.

imbricate – (basidiocarps) growing immediately above each other.

incrusted – see incrusting.

incrusting – (pigment) situated on the outer side of the wall, and visible as bands, granules or patches.

inflated – (hyphae) swollen, not cylindrical.

inflexed – (margin of pileus) bent inwards (Fig. 29.38).

infundibuliform – (pileus) funnel-shaped (Fig. 29.22), see also deeply infundibuliform.

intercellular – (pigment) situated between the elements.

intervenose – (lamellae) provided with veins between the lamellae (Fig. 30.3).

intracellular – (pigment) situated inside the elements.

intricate trichoderm – a trichoderm made up of interwoven elements (Fig. 36.4).

inverse – (hymenophoral trama) having downward convergent hyphae, i.e. turning inward to a median line (Fig. 35.4).

involute – (margin of pileus) rolled in (Fig. 29.39).

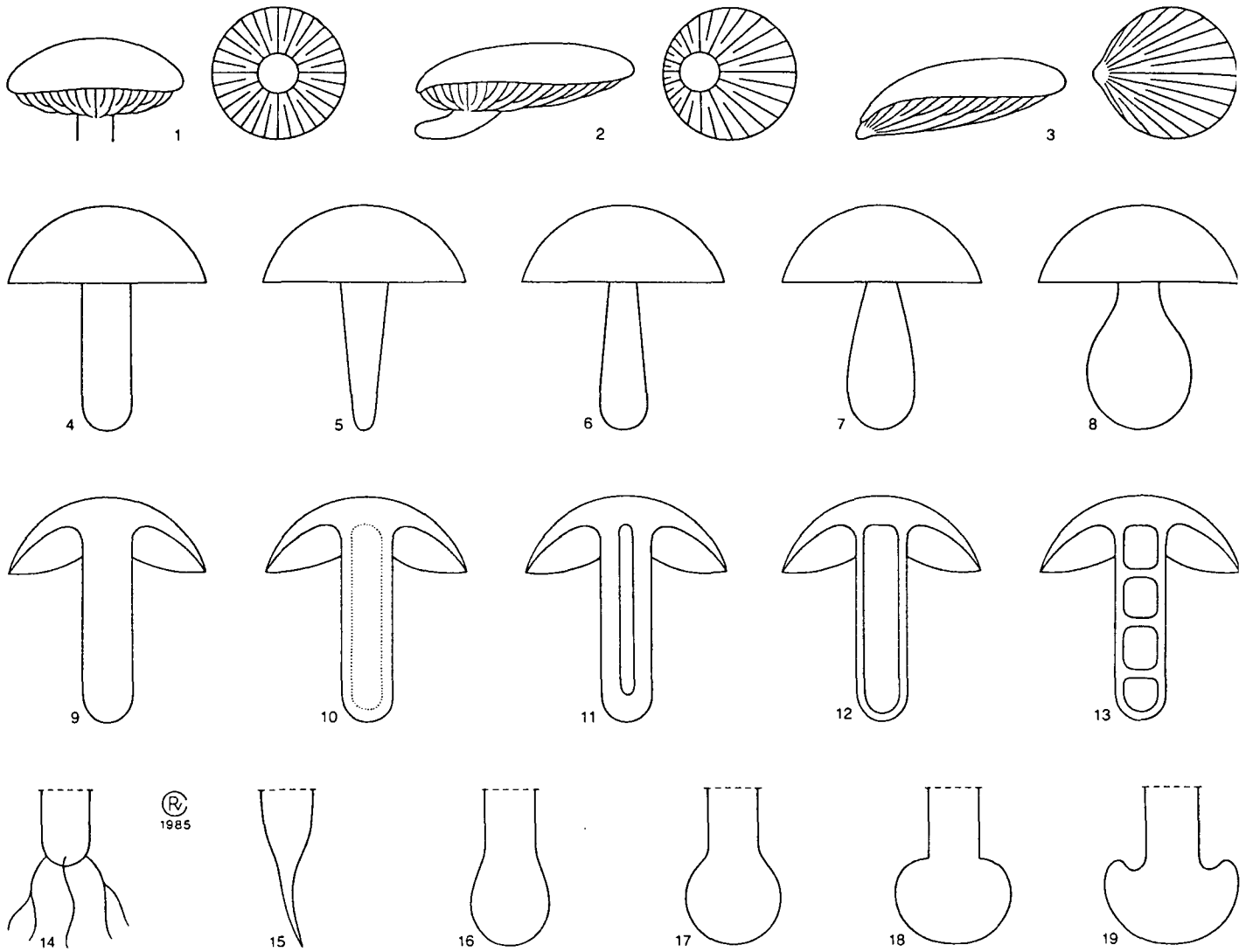

Fig. 31. Stipe. – 1-3. *Insertion:* 1. central; 2. eccentric; 3. lateral and reduced. – 4-13. *Shape and structure:* 4. cylindrical; 5. tapering downwards; 6 tapering upwards; 7. subclavate; 8. clavate; 9. solid; 10. stuffed; 11. fistulose; 12. broadly fistulose; 13. chambered. – 14-19. *Base:* 14. witl rhizomorphs; 15. with pseudorrhiza; 16. subbulbous; 17. bulbous; 18. abruptly bulbous; 19. marginately bulbous.

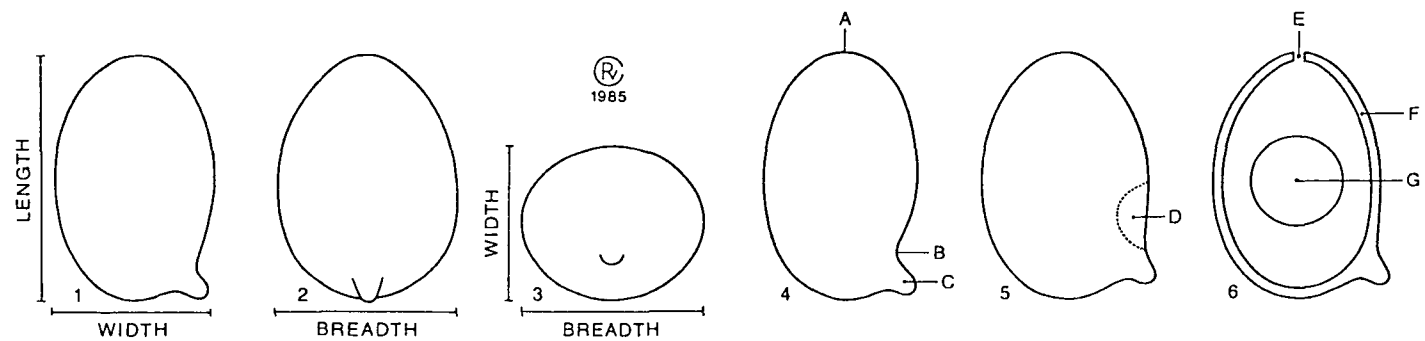

Fig. 32. Spore characters: 1. side-view; 2. frontal view; 3. polar view; 4. A. apex, B. suprahilar depression, C. hilar appendage; 5. D. suprahilar plage 6. E. germ pore, F. thickened wall, G. guttule.

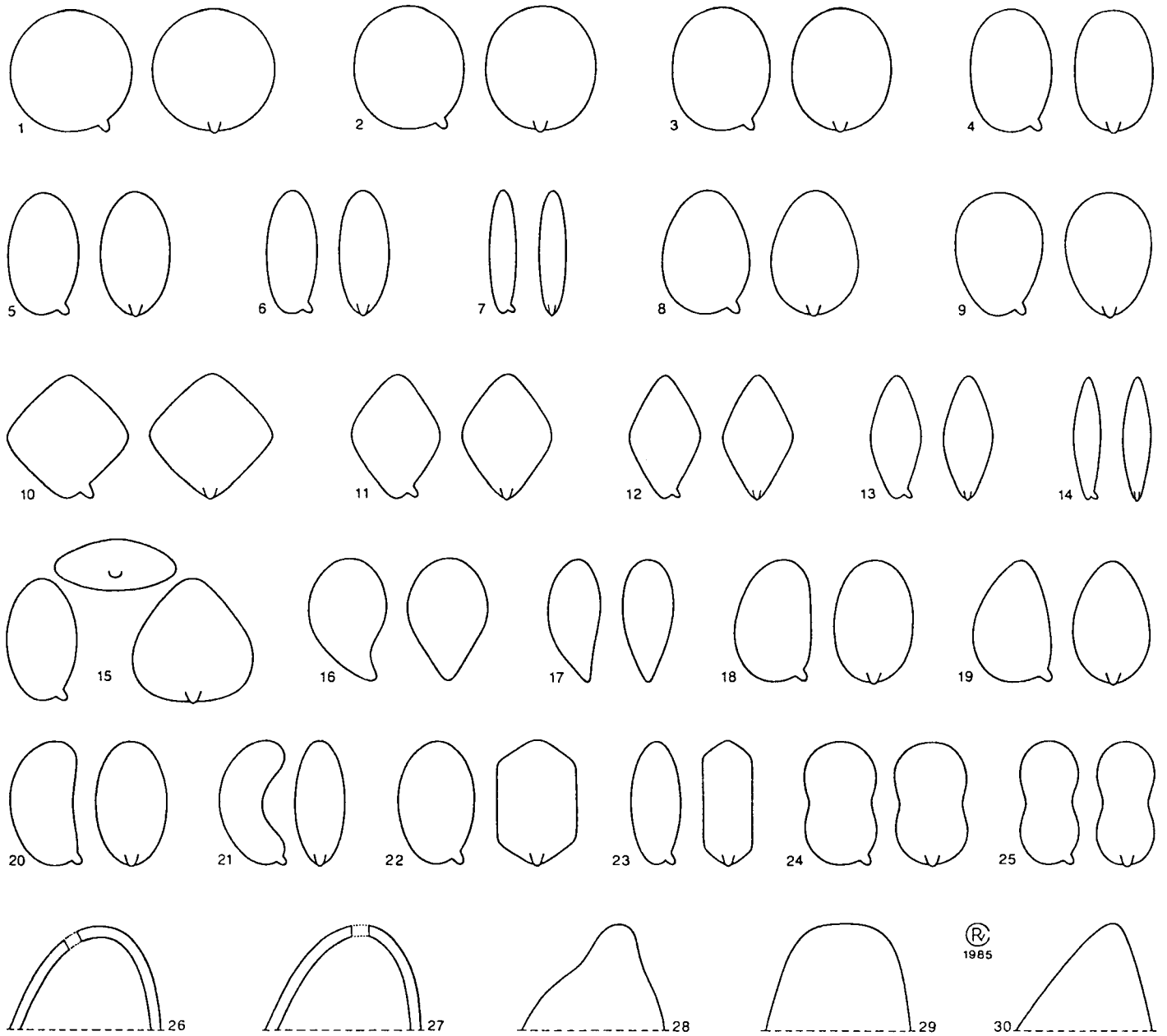

Fig. 33. Spores. – 1-25. *General shape:* 1. globose; 2. subglobose; 3. broadly ellipsoid; 4. ellipsoid; 5. oblong; 6. subcylindrical; 7. bacilliform; 8. ovoid; 9. obovoid; 10. quadrangular; 11. very broadly fusiform; 12. broadly fusiform; 13. fusiform. 14. narrowly fusiform; 15. oblong in side view, rounded triangular in frontal view, oblong in polar view; 16. lacrymoid (ellipsoid with suprahilar depression); 17. lacrymoid (subcylindrical with suprahilar depression); 18. amygdaliform in side view, ellipsoid in frontal view; 19. amygdaliform with acute apex in side view, ovoid in frontal view; 20. phaseoliform in side view, oblong in frontal view; 21. allantoid in side view, subcylindrical in frontal view; 22. oblong in side view, hexagonal in frontal view; 23. subcylindrical in side view, hexagonal in frontal view; 24. ellipsoid with median constriction; 25. oblong with median constriction. – 26-30. *Apex:* 26. with eccentric germ pore; 27. with central germ pore; 28. with apical papilla; 29. truncate; 30. acute.

irregular – (hymenophoral trama) having interwoven hyphae (Fig. 35.3).

irregular epithelium – an epithelium made up of irregularly disposed elements (Fig. 36.12).

irregular trichoderm – (Fig. 36.5).

ixocutis – a cutis made up of gelatinizing hyphae (Fig. 36.2).

ixotrichoderm – a trichoderm, made up of gelatinizing elements (Fig. 36.6).

lacrymoid – (spores) with confluent hilar appendage (Figs 33.16, 33.17).

lageniform – (cystidia) characterized by neck narrower than half width of cell body (Fig. 34.25), see also narrowly lageniform and broadly lageniform.

lamellate – (hymenophore) consisting of lamellae (= gills).

lanate – (pileus and stipe surfaces) (= woolly) covered with long, soft, matted hairs.

lateral – (stipe) attached to one side of pileus (Fig. 31.3).

lecythiform – (cystidia) lageniform and abruptly capitate (Fig. 34.33).

length – (of spores) distance from apex to bottom as seen in side view (Fig. 32.1).

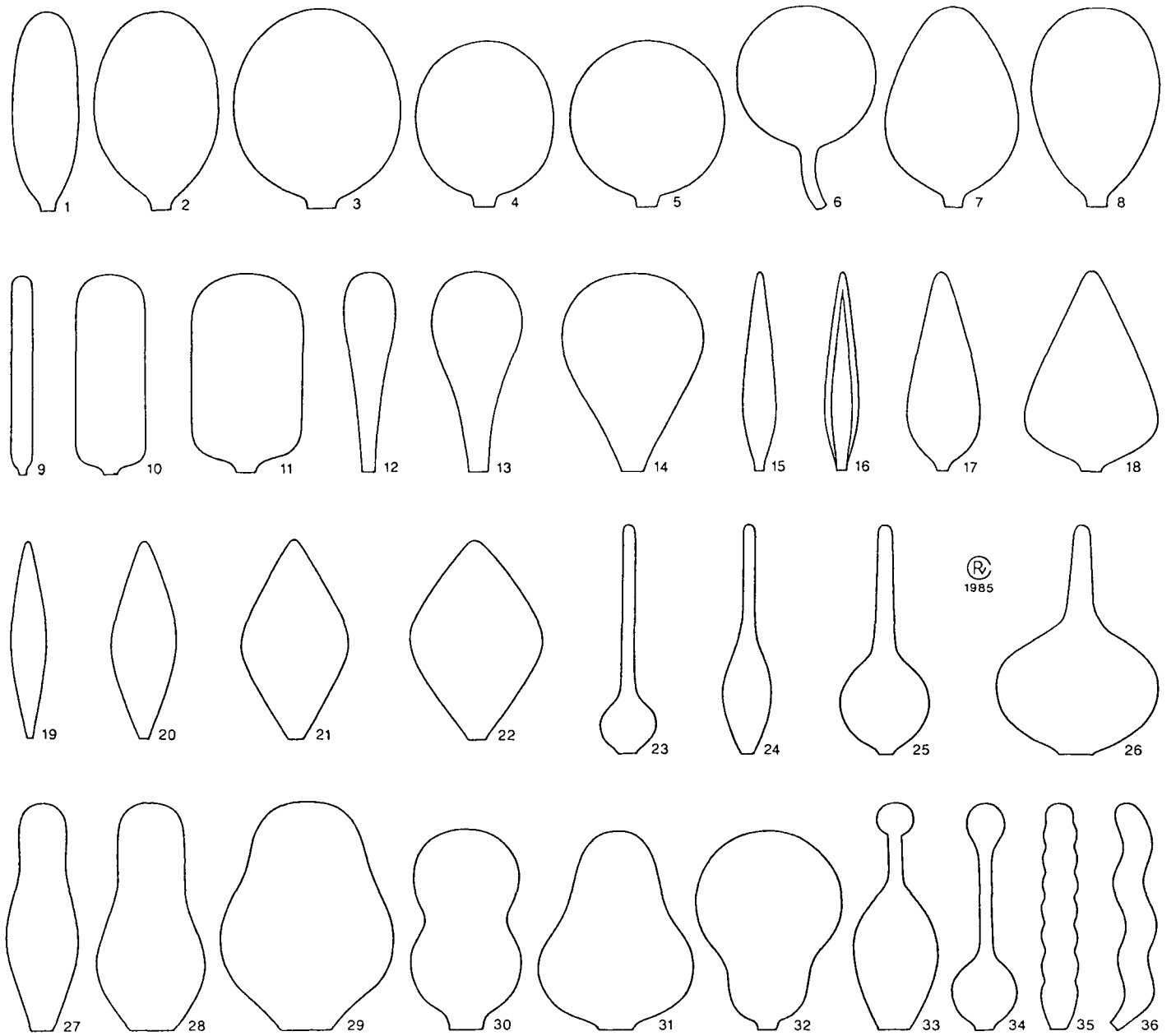

Fig. 34a. Cystidia. – 1-36. *General shape:* 1. oblong; 2. ellipsoid; 3. broadly ellipsoid; 4. subglobose; 5. globose; 6. spheropedunculate; 7. ovoid; 8. obovoid; 9. narrowly cylindrical; 10. cylindrical; 11. broadly cylindrical; 12. narrowly clavate; 13. clavate; 14. broadly clavate; 15. narrowly conical; 16. setiform; 17. conical; 18. broadly conical; 19. narrowly fusiform; 20. fusiform; 21. broadly fusiform; 22. very broadly fusiform; 23. nettle hair-shaped; 24. narrowly lageniform; 25. lageniform; 26. broadly lageniform; 27. narrowly utriform; 28. utriform; 29. broadly utriform; 30. with median constriction; 31. pyriform; 32. obpyriform; 33. lecythiform; 34. tibiiform; 35. moniliform; 36. flexuose.

lignicolous – growing on wood.

linear – (lamellae) with straight lamella edge and parallel upper side (Fig. 30.6).

marginately bulbous – (base of stipe) provided with a bulb with a raised border (Fig. 31.19).

marmorate – (pileus and stipe surfaces, and context) (= marbled) faintly and irregularly striped or innately veined.

medallion clamp – a clamp connection with an opening between the clamp connection itself and the elements connected by it.

median constriction – transverse contraction in the middle, (of spores) (Figs 33.24, 33.25); – (of cystidia) (Fig. 34.30).

metachromatic – (spore wall) turning reddish to violet in solution of Chresyl Blue in H_2O.

micaceous – (pileus surface) with glistening particles or spots.

moniliform – (cystidia) cylindrical but contracted at regular intervals, like a string of beads (Fig. 34.35).

monomitic – (tissue) built up of one type of hyphae.

monovelangiocarpy – a type of angiocarpic development of the basidiocarp in which only a universal veil participates.

mucilaginous – consisting of mucilage (= viscous substance).

mucous – (pileus and stipe surfaces) slimy.

mucronate – (cystidia) with small abrupt, acute or blunt protuberance at apex (Fig. 34.37).

mycenoid – (habit) characterized by pileus conical to paraboloid; lamellae free to adnate; stipe usually long and slender; context usually brittle (Figs 28.7, 28.8).

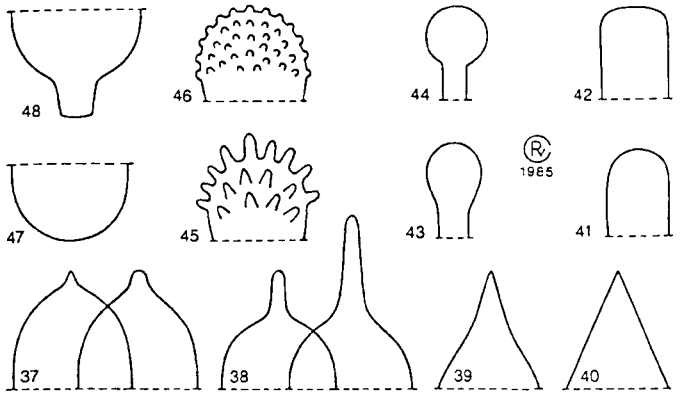

Fig. 34b. Cystidia. – 37-44. *Apex:* 37. mucronate; 38. rostrate; 39. acuminate; 40. acute; 41. obtuse; 42. truncate; 43. subcapitate; 44. capitate. – 45-46. *Surface:* 45. diverticulate; 46. verrucose. – 47-48. Base: 47. sessile; 48. pedunculate or pedicellate.

myxosporium – the set of often mucilaginous layers on the outside of the basidiospore wall enveloping the eusporium; its components are ectosporium, perisporium and exosporium.
narrowly adnate – (lamellae) (Fig. 30.20).
narrowly clavate – (cystidia) clavate with Q > 4 (Fig. 34.12).
narrowly conical – (pileus) (Fig. 29.15); – (cystidia) conical with Q > 4 (Fig. 34.15).
narrowly cylindrical – (cystidia) cylindrical with Q > 4 (Fig. 34.9).
narrowly fusiform – (spores) fusiform with l/w or l/b > 4.0 (Fig. 33.14); – (cystidia) fusiform with Q > 4 (Fig. 34.19).
narrowly lageniform – (cystidia) (Fig. 34.24).
narrowly utriform – (cystidia) (Fig. 34.27).
nettle hair-shaped – (cystidia) lageniform with long narrow slender neck (Fig. 34.23).
nodulose type of hilum – hilum an approximately circular area covered with protuberances (frequent in thin-walled spores).
non-amyloid – (spore wall, spore ornamentation, hyphal walls) not changing colour or becoming yellowish in Melzer's reagent.
oblong – (spores) l/w = l/b = 1.6-2.0 (Fig. 33.5); – (cystidia) Q ≥ 1.6 (Fig. 34.1).
obovoid – reversely ovoid, with the broadest and widest part uppermost, (spores) (Fig. 33.9); – (cystidia) (Fig. 34.8).
obpyriform – (cystidia) reversely pyriform, with the broadest and widest part uppermost (Fig. 34.32).
obtuse – (apex of cystidia) rounded (Fig. 34.41).
obtusely conical – (pileus) conical with rounded apex (Fig. 29.18).
omphalioid – (including omphalinoid and clitocyboid) (habit) characterized by pileus plano-convex to deeply infundibuliform; lamellae decurrent (Figs 28.4, 28.5, 28.6).
omphalinoid – see omphalioid.
opaque – (pileus) not translucent.
open pore type of hilum – hilum with a depression or perforation at one side and sometimes a perforation or tear at the other side of the hilar appendage often connected by a slit (frequent in thick-walled spores).
ovoid – egg-shaped (spores) (Fig. 33.8); – (cystidia) (Fig. 34.7).
papilla – small nipple-like protuberance, (on pileus) (Fig. 29.29); – (on spores) (Fig. 33.28), see also abrupt and acute papilla.
papillate – (pileus surface) covered with papils.
paravelangiocarpy – a type of angiocarpic development of the basidiocarp in which only a partial veil participates.
patent – (hyphae or projections of hyphae) perpendicular to surface of stipe.
paraboloid – (pileus) (Fig. 29.11).
parietal – (pigment) situated in the hyphal wall.
pedicellate – (cystidia) provided with a stalk (Fig. 34.48).
pedunculate – (cystidia) provided with a stalk (Fig. 34.48).
pellicle – an easily peeling ixocutis.
perisporium – the often mucilaginous layer of the basidiospore wall just inside the ectosporium; sometimes early disappearing, sometimes filling the spaces between exosporal ornamentations.
phaseoliform – (spore) with concave adaxial side, not parallel to abaxial side (Fig. 33.20).
pileocystidium – cystidium situated on surface of pileus.
pileipellis – cortical layer(s) of pileus.
plage – (of spores), see suprahilar plage.
plano-concave – (pileus) slightly concave (Fig. 29.20).
plano-convex – (pileus) slightly convex (Fig. 29.8).
pleurocystidium – cystidium situated on sides of the hymenophore (lamella or tube).
plicate – (pileus) folded radially, like a fan.
pleurotoid – (including crepidotoid), (habit) characterized by stipe absent or lateral (Figs 28.12, 28.13).
pluteoid – (habit) characterized by lamellae free; context of pileus discontinuous with context of stipe; stipe usually longer than diameter of pileus (Fig. 28.1).
polar view – (of spores) (Fig. 32.3).
primary angiocarpy – a type of angiocarpic development in which the primordial hymenium is initiated in a closed cavity.
primary mycelium – the uninucleate mycelium produced by a germinating basidiospore.
primordium – a very young, not fully differentiated basidiocarp.
protocarpic tuber – a non-persisting fleshy tuber on which one or more basidiocarps may develop.
pseudoryhiza – a root-like extension of the stipe (Fig. 31.15).
pruinose – (pileus, lamella and stipe surfaces) covered with a (often white or whitish) powdery 'bloom'.
pseudocystidium – differentiated prolongation of vascular hypha into the hymenium.
pubescent – (pileus and stipe surfaces) (= downy) covered with short, soft, fine hairs.
pulverulent – (pileus and stipe surfaces) covered with powder.
pyriform – (cystidia) pear-shaped (Fig. 34.31).
quadrangular – (spores) with shape of rectangle or square; l/w or l/b ≤ 1.15 (Fig. 33.10).
radially rimose - (pileus surface) marked with numerous, superficial, radial clefts or cracks.
Rameales-structure – (of pileipellis) with irregularly shaped and arranged, nodose or en brosse or diverticulate elements.
reduced – (stipe) very short (Fig. 31.3).
reflexed – (margin of pileus) bent upwards (Fig. 29.40).
regular – (hymenophoral trama) having parallel hyphae (Fig. 35.1).
regular epithelium – an epithelium made up of elements in erect rows (Fig. 36.11).
reniform – (pileus) kidney-shaped (Fig. 29.6).
repent – (hyphae) creeping, not ascending.
reticulately venose – (pileus surface) marked with anastomosing veins forming angular patches.
revolute – (margin of pileus) rolled back (Fig. 29.41).
rhizomorph – a visible root-like mycelial strand (Fig. 31.14).
rimose – see radially rimose; areolate-rimose.
rimulose – (pileus surface) minutely rimose.
rostrate – (cystidia) provided with a beak-like extension at apex (Fig. 34.38).
rounded flabelliform – (pileus) (Figs 29.4, 29.5).
rounded triangular – (spores) rounded three-angled (Fig. 33.15).

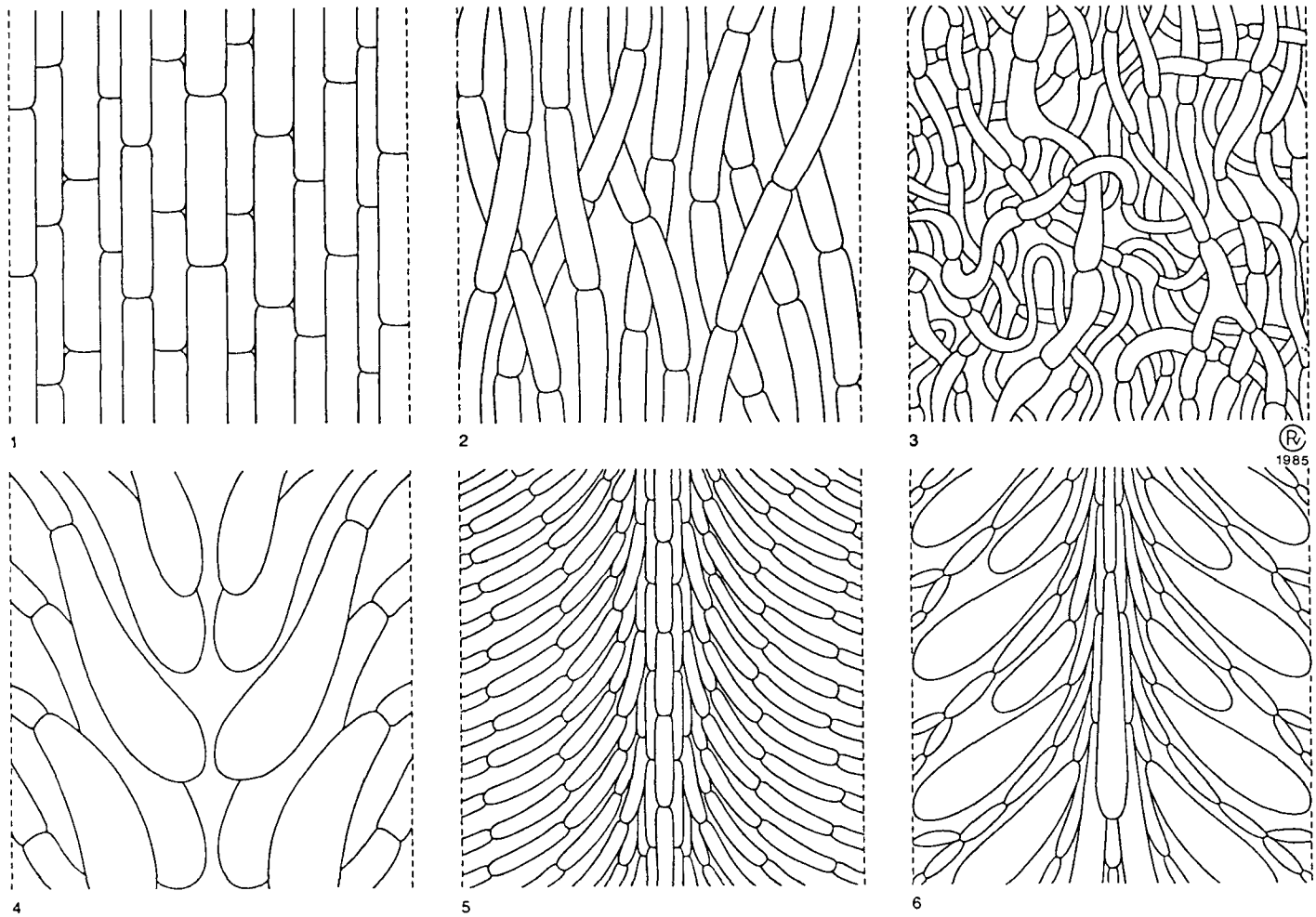

Fig. 35. Hymenophoral trama: 1. regular; 2. subregular; 3. irregular; 4. inverse; 5. divergent (*Hygrophorus*-type); 6. divergent (*Amanita*-type).

rugose – (pileus surface) irregularly wrinkled.
sarcodimitic – (tissue) consisting of generative hyphae and chains of very long, thin- to thick-walled elements ('sarcoskeletals').
sarcoskeletals – see sarcodimitic.
sclerotium – a (long) persisting compact mycelial body from which a basidiocarp arises.
seceding – (lamellae) at first attached to stipe, but later separating from it (Fig. 30.22).
secondary angiocarpy – a type of angiocarpic development in which in its later stages the primordial hymenium is enveloped by hyphae originating from the stipe and/or the pileus.
segmentiform – (lamellae) with straight lamella edge and convex upper side (Figs 30.7, 30.8, 30.9).
septate – (hyphae) with septa.
sericeous – (pileus and stipe surfaces) (= silky) covered with fine, straight, adpressed, glossy hairs or fibrils.
serrate – (lamella edge) toothed like a saw (Fig. 30.35).
serrulate – (lamella edge) minutely serrate (Fig. 30.36).
sessile – (cystidia) without a stalk (Fig. 34.47).
setiform – (cystidia) narrowly conical with thickened wall (Fig. 34.16).
side view – (of spores) (Fig. 32.1).
siderophilous – (particles in basidia) turning blackish purple or blackish violet in acetocarmine in presence of metal ions.
sinuate – (lamellae) having a concave indentation near the stipe (Fig. 30.24).
skeletal hyphae – aseptate, thick-walled, straight or slightly flexuous hyphae.
slightly depressed – (pileus) with shallow central depression (Fig. 29.24).
smooth – (pileus and stipe surfaces) without elevations, ridges, grooves, veins, etc.
solid – (stipe) made up of homogeneous tissue (Fig. 31.9).
solitary – (basidiocarps) single.
spathuliform – (pileus) elliptic or oblong tapering gradually towards stipe (Fig. 29.3).
spheropedunculate – (cystidia) globose or subglobose with long stalk (Fig. 34.6).
squamose – (pileus and stipe surfaces) covered with coarse (adpressed) scales.
squamulose – (pileus and stipe surfaces) covered with minute scales.
squarrose – (pileus and stipe surfaces) covered with projecting coarse scales.
squarrulose – (pileus and stipe surfaces) covered with small projecting scales.
statismosporic basidium – a basidium that does not discharge its spores; they simply break off from the sterigmata.
sterile – (lamella edge) composed of cystidia only.

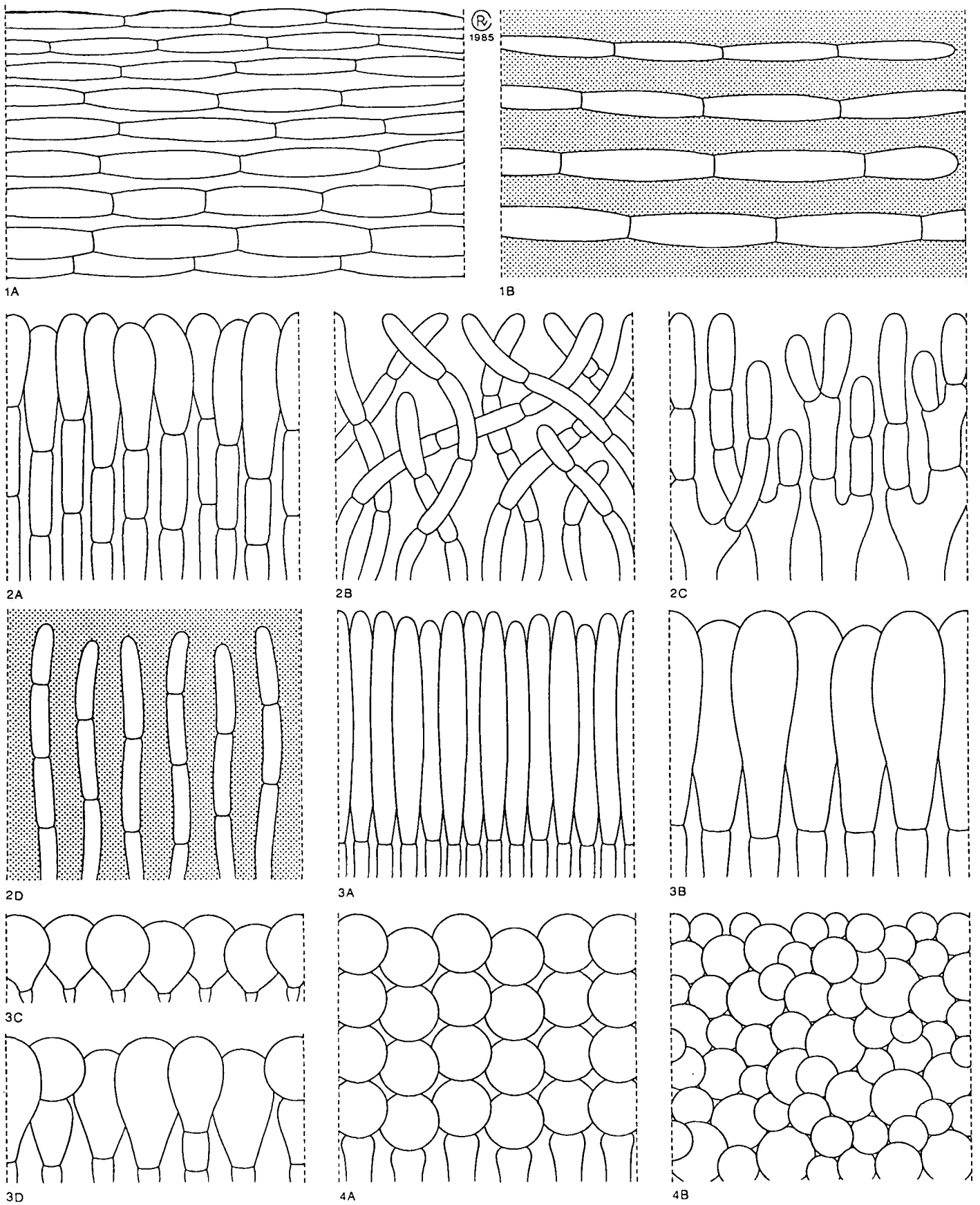

Fig. 36. Pileipellis structures: 1A. cutis; 1B. ixocutis; 2A. trichoderm; 2B. intricate trichoderm; 2C. irregular trichoderm; 2D. ixotrichoderm; 3A. trichohymeniderm; 3B. euhymeniderm; 3C. epithelioid hymeniderm; 3D. transition between hymeniderm and epithelium; 4A. regular epithelium; 4B. irregular epithelium.

stipitipellis – cortical layer of stipe.
stipitocarpy – a type of development of the basidiocarp in which the first differentiating hyphae of the primordium are those of the stipe.
straight – (margin of pileus) not bent upwards or inwards (Figs 29.34, 29.35, 29.36).
striate – (pileus and stipe surfaces) marked with regular lines.
strigose – (pileus and stipe surfaces) covered with long, coarse or thick, rather stiff hairs.
stuffed – (stipe) having central part filled with tissue different from tissue in outer part (Fig. 31.10).
subbulbous – (base of stipe) slightly bulbous (Fig. 31.16).
subcapitate – (apex of cystidia) having a knob (Fig. 34.43).
subclavate – (stipe) slightly club-shaped (Fig.31.7).
subcylindrical – (spores) l/w = l/b = 2.0-3.0 (Fig. 33.6).
subdecurrent – (lamellae) slightly decurrent, (angle lamellae-stipe 60-80°) (Fig. 30.27).
subglobose – nearly spherical, (spores) l/w = l/b = 1.05-1.15 (Fig. 33.2); – (cystidia) Q = 1.05-1.15 (Fig. 34.4).
subgregarious – (basidiocarps) growing in a small group or growing in a group of widespread specimens.
subregular – (hymenophoral trama) having slightly flexuose, nearly parallel hyphae (Fig. 35.2).
subpellis – lower layer of pileipellis.
subumbilicate – (pileus) having a small navel-like depression (Fig. 29.26).
subumbonate – (pileus) with low broad umbo (Fig. 29.32).
subventricose – (lamellae) with slightly convex lamella edge (Fig. 30.10).
sulcate – (pileus and stipe surfaces) with grooves.
suprahilar depression – (of spores) sinking just above the hilar appendage (Fig. 32.4B).
suprahilar plage – (of spores) rounded, smooth area just above hilar appendage (Fig. 32.5D).
tapering downwards – (stipe) becoming narrower from apex to base (Fig. 31.5).
tapering upwards – (stipe) becoming narrower from base to apex (Fig. 31.6).
thick-walled – (spores) (Fig. 32.6F).
tibiiform – (cystidia) lageniform with long neck and capitate (Fig. 34.34).
tomentose – (pileus and stipe surfaces) densely covered with matted (more or less adpressed), soft hairs.
tooth – (of lamellae), see decurrent tooth.
transition between hymeniderm and epithelium – (Fig. 36.10).
transvenose – (lamellae) provided with veins on the surface (Fig. 30.1).
triangular – (lamellae) (Fig. 30.17); – (spores), see rounded triangular.
trichoderm – a pileipellis made up of erect straight elements, septate and/or not originating at the same level (Fig. 36.3); see also intricate and irregular trichoderm.
trichohymeniderm – a hymeniderm made up of elements with Q > 6 (Fig. 36.7).
tricholomatoid – (habit) characterized by lamellae neither free, nor decurrent; stipe ± as long as diameter of pileus; context fleshy; context of pileus continuous with context of stipe (Figs 28.9, 28.10, 28.11).
truncate – ending abruptly as if cut off, (apex of spore) (Fig. 33.29); – (apex of cystidia) (Fig. 34.42).
truncately broadly conical – (pileus) broadly conical with as if cut off apex (Fig. 29.16).
truncately conical – (pileus) conical with as if cut off apex (Fig. 29.17).
tubular – (hymenophore) consisting of tubes.
twisted – (stipe) fibrils arranged spirally round axis because of base of stipe being rotated with regard to apex.
umbilicate – (pileus) having a navel-like depression (Fig. 29.27), see also deeply umbilicate.
umbo – (on pileus) broad rounded knob (Fig. 29.33).
umbonate – (pileus) with broad rounded knob (Fig. 29.33).
undate – waved (margin of pileus) (Fig. 29.43); – (lamella edge) (Fig. 30.31).
undulate – minutely undate (margin of pileus) (Fig. 29.44); – (lamella edge) (Fig. 30.32).
uniguttulate – (spores)with one droplet (Fig.32.6).
uninucleate – with one nucleus.
utriform – (cystidia) characterized by neck broader than half width of cell body (Fig. 34.28), see also narrowly utriform and broadly utriform.
vascular hypha – usually aseptate, often irregular, flexuose hypha with refractive contents.
velutinous – (pileus and stipe surfaces) (= velvety) densely covered with fine, short, erect hairs.
venose – (pileus surface) with vein-like wrinkles, see also reticulately venose.
ventricose – (lamellae) with convex lamella edge (Figs 30.11, 30.12, 30.13), see also broadly ventricose.
verrucose – (pileus and stipe surfaces) covered with wart-like elevations; – (cystidia) with small hollow or solid protuberances (Fig. 34.46).
very broadly fusiform – (spores) fusiform with l/w or l/b = 1.15-1.5 (Fig. 33.11); – (cystidia), fusiform with Q < 1.5 (Fig. 34.22).
villose – (pileus and stipe surfaces) covered with fairly long, soft, ± straight, not interwoven hairs.
virgate – (pileus and stipe surfaces) streaked.
viscid – (pileus and stipe surfaces) sticky, glutinous or gelatinous.
width – (of spores) largest distance between sides as seen in side-view (Fig. 32.1).

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Abbreviations of authors' names in this volume

ELSE C. VELLINGA

The abbreviations of authors' names in other branches of botanical taxonomy have also been taken into account. Abbreviations in combinations of authors' names may differ from those of single names.

Arnolds – E.J.M. Arnolds
A. & S. – J.B. von Albertini & L.D. von Schweinitz
Atk. – G.F. Atkinson
Barbier – M. Barbier
Barkman – J.J. Barkman
T.Baroni – T.J. Baroni
Batsch – A.J.G.C. Batsch
Batt. – G.A. Battara
Beeli – M. Beeli
Berk. – M.J. Berkeley
B. & Br. – M.J. Berkeley & C.E. Broome
B. & C. – M.J.Berkeley & M.A. Curtis
Bertero – C.G. Bertero
H.E.Bigelow – H.E. Bigelow
Boetje-van Ruyven – M.T.S. Boetje-van Ruyven
Bolt. – J. Bolton
M.Bon – M. Bon
Bon & Chevassut – M. Bon & G. Chevassut
Boud. – J.L.E. Boudier
Bres. – G. Bresadola
Bres. & Schulz. – G. Bresadola & S. Schulzer von Müggenburg
Britz. – M. Britzelmayr
Bull. – J.B.F. Bulliard
Cetto – B. Cetto
Chev. – F.F. Chevallier
F.Clem. – F.E. Clements
Clémençon – H. Clémençon
Cohn – F. Cohn
Cooke – M.C. Cooke
Corner – E.J.H. Corner
Courtecuisse – R. Courtecuisse
Dähncke & Dähncke – R.M. Dähncke & S.M. Dähncke
DC. – A.P. de Candolle
DC. & Lam. – A.P. de Candolle & J.B.A.P.M. de Lamarck
Dennis – R.W.G. Dennis
Dennis, Orton & Hora – R.W.G. Dennis, P.D. Orton & F.B. Hora
Ditm. – L.P.F. Ditmar
Donk – M.A. Donk
Døssing – L. Døssing
Earle – F.S. Earle
Einh. – A. Einhellinger
J.B. Ell. – J.B. Ellis
J.Favre – J. Favre
Fay. – V. Fayod
Fitzp. – H.M. Fitzpatrick
Fr. – E.M. Fries
Gaüm. – E. Gaümann
Gaüm. & Dodge – E. Gäumann & C.W. Dodge
E.J.Gilb. – E.J. Gilbert
Gillet – C.C. Gillet
S.F.Gray – S.F. Gray
Guern. – de Guernisac
Gulden – G. Gulden
Gulden & Markussen – G. Gulden & J. Markussen
Harm. – H. Harmaja
R.Heim – R. Heim
Heinem. – P. Heinemann
P.Henn. – P.C. Hennings
Herink – J.A. Herink
Hesler – L.R. Hesler
Höhn. – F.X.R. von Höhnel
Hoffm. – G.F. Hoffmann
Hora – F.B. Hora
Horak – E. Horak
Huds. – W. Hudson
Huijsman – H.S.C. Huijsman
Imler – L. Imler
S.Ito – S. Ito
Jacq. – N.J. von Jacquin
H.Jahn – H. Jahn
Joss. – M. Josserand
Jülich – W. Jülich
Kalchbr. – K. Kalchbrenner
P.Karst – P.A. Karsten
Kits – E. Kits van Waveren
Konr. – P. Konrad
Konr. & M. – P. Konrad & A. Maublanc
Kost – G. Kost
Kotl. & P. – F. Kotlaba & Z. Pouzar
Kreisel – H. Kreisel
Krieglsteiner – G.J. Krieglsteiner
Kubička – J. Kubička
Kühner – R. Kühner
Kühn. & Bours. – R. Kühner & J. Boursier
Kühn. & Lamoure – R. Kühner & D. Lamoure
Kühn. & Romagn. – R. Kühner & H. Romagnesi
Kumm. – P. Kummer
Kuyp. – Th.W. Kuyper
L. – C. Linnaeus
J.Lange – J.E. Lange
M.Lange – M. Lange
Lange & Sivertsen – M. Lange & S. Sivertsen
Larg. – D.L. Largent
Larg. & Benedict – D.L. Largent & R.G.Benedict
Lasch – W.G. Lasch
Lloyd – C.G. Lloyd

Locq. – M. Locquin
Longyear – B.O. Longyear
Lotsy – J.P. Lotsy
Lundell – S. Lundell
Maire – R.C.J.E. Maire
Mal. & Bert. – J.L.G. Malençon & R. Bertault
Malenç. – J.L.G. Malençon
Marchand – A. Marchand
Mass. – G.E. Massee
Mazzer – S.J. Mazzer
Michael, Hennig & Kreisel – E. Michael, B. Hennig & H. Kreisel
O.K.Miller – O.K. Miller Jr.
F.Møller – F.H. Møller
Mont. – J.P.F.C. Montagne
Morg. – A.P. Morgan
Mos. – M. Moser
Murrill – W.A. Murrill
Nath.-W. – T. Nathorst-Windahl
Naveau – R. Naveau
Nees – C.G.D. Nees von Esenbeck
Neuh. – W. Neuhoff
Noordel. – M.E. Noordeloos
Noul. & Dass. – J.B. Noulet & A. Dassier
O.K. – C.E.O. Kuntze
P.D.Orton – P.D. Orton
Over. – C. van Overeem
Pat. – N.T. Patouillard
Paul. – J.J. Paulet
A.Pears. – A.A. Pearson
Pears. & Dennis – A.A. Pearson & R.W.G. Dennis
Peck – C.H. Peck
Pegl. – D.N. Pegler
Pegl. & Young – D.N. Pegler & T.W.K. Young
Pers. – C.H. Persoon
Petch – T. Petch
R.Phillips – R. Phillips
Pilát – A. Pilát
Poirault & Roze – J.P.F. Poirault & E. Roze
Pouz. – Z. Pouzar
Quél. – L. Quélet
Raithelhuber – J. Raithelhuber
Rea – C. Rea
D.Reid – D.A. Reid
Reijnders – A.F.M. Reijnders
Richon & Roze – C.E. Richon & E. Roze
Rick. – A. Ricken
Rolland – L.L. Rolland
Romagn. – H. Romagnesi
Romagn. & Favre – H. Romagnesi & J. Favre
Roussel – H.F.A. de Roussel
Ryman & Holmåsen – S. Ryman & I. Holmåsen
Sacc. – P.A. Saccardo
Sacc. & Cub. – P.A. Saccardo & G. Cuboni
Sacc. & Trav. – P.A. Saccardo & C.B.Traverso
Sacc. & Trott. – P.A. Saccardo & A. Trotter
Saunders, Smith & Bennett – W.W.Saunders, W.G. Smith & A.A. Bennett
Schaeff. – J.C. Shaeffer
Schavey – J. Schavey
Schrad. – H.A. Schrader
Schroet. – J. Schroeter
O.v.Schulmann – O. v. Schulmann
S.Schulz. – S. Schulzer von Müggenburg
Schum. – H.C.F. Schumacher
Scop. – G.A. Scopoli
Sing. – R. Singer
Sing. & Smith – R. Singer & A.H. Smith
Sm. – J.E. Smith
A.H.Smith – A.H. Smith
W.G.Sm. – W.G. Smith
Sow – J. Sowerby
Speg. – C.L. Spegazzini
St-Am. – J.F.B. de Saint-Amans
Staude – F. Staude
Thiers – H.D. Thiers
Trimb. – J. Trimbach
Velen. – J. Velenovský
Weinm. – J.A. Weinmann
Wint. – H.G. Winter
Winterhoff – W. Winterhoff
With. – W. Withering
Zerov – D.K. Zerov

CHAPTER 10

Bibliographic abbreviations in this volume

MACHIEL E. NOORDELOOS

a. *Books*

Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands – Ecology and coenology of macrofungi in grasslands and moist heathlands in Drenthe, the Netherlands. In Biblthca mycol. 90.

Batsch, Elench. Fung. Contin. 1 – Elenchus fungorum continuatio prima.

Berk., Outl. Brit. Fungol. – Outlines of British fungology.

B. & Br., Notic. Brit. Fungi – Notices of British fungi.

Boud., Ic. mycol. – Incones mycologicae ou iconographie des champignons de France.

Bres., Fungi trident. – Fungi tridentini novi, vel nondum delineati, descripti, et iconibus illustrati.

Bres., Iconogr. mycol. – Iconographia mycologica.

Britz., Hymenomyc. Südbayern – Hymenomyceten aus Südbayern.

Bull., Herb. France – Herbier de la France.

Bull., Hist. Champ. France – Histoire des champignons de la France.

Cetto, Funghi Vero – I funghi dal vero.

Cohn, Krypt.-Fl. Schlesien – Kryptogamenflora von Schlesien.

Cooke, Ill. Brit. Fungi – Illustrations of British fungi (Hymenomycetes).

Dähncke & Dähncke, 700 Pilze – 700 Pilze in Farbfotos.

DC. & Lam., Fl. franç. – Flore française.

J.Favre, Assoc. fong. Hauts-Marais – Les associastions fongiques des hauts-marais jurassiens et de quelques régions voisines. In Mat. Fl. crypt. Suisse 10(3).

J.Favre, Champ. sup. Zone alpine – Les champignons supérieurs de la zone alpine du Parc National suisse. In Ergebn. wiss. Unters. schweiz. NatnParks, n.F. V, 33.

J.Favre, Cat. descr. Champ. sup. Zone subalpine – Catalogue descriptif des champignons supérieurs de la zone subalpine du Parc National suisse. In Ergebn. wiss. Unters. schweiz. NatnParks, n.F. VI, 42.

Fr., Observ. mycol. – Observationes mycologicae.

Fr., Syst. mycol. – Systema mycologicum.

Fr., Spicilegium – Spicilegium plantarum neglectarum.

Fr., Epicr. – Epicrisis systematis mycologici, seu synopsis hymenomycetum.

Fr., Monogr. Hymenomyc. Sueciae – Monographia hymenomycetum Sueciae.

Fr., Ic. sel. Hymenomyc. – Icones selectae hymenomycetum nondum delineatorum.

Fr., Hymenomyc. eur. – Hymenomycetes europaei epicriseos systematis mycologici editio altera.

Gillet, Hyménomycètes – Les hyménomycètes ou description de tous les champignons (fungi) qui croissent en France.

R.Heim, Genre Inocybe – Le genre Inocybe. In Encycl. mycol. 1.

Horak, Syn. Gen. Agar. – Synopsis generum Agaricalium (Die Gattungstypen der Agaricales). In Beitr. Kryptog.Fl. Schweiz 13.

S.Ito, Mycol. Fl. Japan – Mycological flora of Japan.

H.Jahn, Pilze Holz – Pilze die an Holz wachsen.

Kalchbr., Ic. sel. Hymenomyc. Hungariae – Icones selectae hymenomycetum Hungariae.

P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp. – Rysslands, Finlands och den Skandinaviska halföns hattsvampar. In Bidr. Känn. Finl. Nat. Folk 32.

P.Karst., Symb. Mycol. fenn. – Symbolae ad mycologiam fennicam.

Konr. & M., Ic. sel. Fung. – Icones selectae fungorum.

Konr. & M., Rév. Hyménomyc. France – Révision des hyménomycètes de France et des pays limitrophes.

Konr. & M., Agaricales – Les Agaricales. In Encycl. mycol. 14 (vol. 1); 20 (vol. 2).

Kühn. & Romagn., Fl. anal. Champ. sup. – Flore analytique des champignons supérieurs.

Kühn. & Romagn., Compl. Fl. anal. – Compléments à la 'Flore analytique'.

Kumm., Führ. Pilzk. – Der Führer in die Pilzkunde.

L., Spec. Pl. – Species plantarum.

J.Lange, Fl. agar. dan. – Flora agaricina danica.

Larg., Gen. Leptonia Pac. Coast United States – The genus *Leptonia* on the Pacific Coast of the United States. In Biblthca mycol. 55.

Mal. & Bert., Fl. Champ. sup. Maroc – Flore des champignons supérieurs de Maroc.

Marchand, Champ. Nord Midi – Champignons du nord et du midi.

Mazzer, Monogr. Stud. Gen. Pouzarella – A monographic study of the genus *Pouzarella*, a new genus in the Rhodophyllaceae, Agaricales, Basidiomycetes. In Biblthca mycol. 46.

Michael, Hennig & Kreisel, Handb. Pilzfr. – Handbuch für Pilzfreunde.

E.Møller, Fungi Faeröes – Fungi of the Faeröes.

Mos., Blätter- und Bauchpilze – Blätter- und Bauchpilze. In Gams, Kl. Kryptog. Fl. 2 (1. Aufl.); 2b (2. Aufl.).

Mos., Röhrlinge-Blätterpilze – Röhrlinge und Blätterpilze (Agaricales). In Gams, Kl. Kryptog. Fl. 2b/2.

Mos., Guida Det. Funghi – Guida alla determinazione dei funghi.

Murrill, N.Amer. Fl. – North American flora.

Noul. & Dass., Champ. comest. susp. vén. – Traité des champignons comestibles, suspects et vénéneux.

Pers., Ic. Descr. Fung. – Icones et descriptiones fungorum minus cognitorum.

Pers., Syn. meth. Fung. – Synopsis methodica fungorum.

R.Phillips, Mushr. other Fungi – Mushrooms and other fungi in Great Britain and Europe.

Quél., Champ. Jura Vosges – Les champignons du Jura et des Vosges.

Quél., Enchir. Fung. – Enchiridion fungorum in Europa media et praesertim in Gallia vigentium.

Quél., Fl. mycol. France – Flore mycologique de la France et des pays limitrophes.

Rea, Brit. Basidiomyc. – British Basidiomycetae.

Richon & Roze, Atl. Champ. comest. vén. – Atlas des champignons

comestibles et vénéneux de la France et des pays circonvoisins.
Rick., Blätterpilze – Die Blätterpilze (Agaricaceae) Deutschlands und der angrenzenden Länder, besonders Oesterreichs und der Schweiz.
Romagn., Rhodoph. Madagascar – Les rhodophylles de Madagascar.
Romagn., Nouv. Atl. Champ. – Nouvel atlas des champignons.
Ryman & Holmåsen, Svampar – Svampar.
Sacc., Syll. Fung. – Sylloge fungorum omnium hucusque cognitorum.
Saunders, Smith & Bennett, Mycol. Ill. – Mycological illustrations being figures and descriptions of new and rare hymenomycetous fungi.
Schaeff., Fung. Bavariae – Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur icones.
Schum., Enum. Plant. – Enumeratio plantarum in partibus Saellandiae septentrionalis et orientalis.
Scop., Fl. carn. – Flora carniolica.
Sing., Agaricales mod. Taxon. – The Agaricales in modern taxonomy.
Sow., Col. Figs. Engl. Fungi – Coloured figures of English fungi or mushrooms.
Velen., Ceské Houby – Ceské houby.
Velen., Novit. mycol. – Novitates mycologicae.
Velen., Novit. mycol. nov. – Novitates mycologicae novissimae.
With., Arr. Brit. Pl. – An arrangement of British plants.

b. *Journals & series*

Acta Horti Gotoburg. – Acta Horti Gotoburgensis.
Acta bot. neerl. – Acta botanica neerlandica.
Acta Mus. nat. Prag. – Acta Musei nationalis Pragae.
Agarica – Agarica.
Amer. Nat. – American Naturalist.
Ann. Bot. Mem. – Annals of Botany Memoirs.
Ann. mycol. – Annales mycologici.
Annls Sci. nat., Bot. – Annales des Sciences naturelles, sér. II, Botanique.
Annls Mag. nat. Hist. – Annals and Magazine of natural History.
Archs. néerl. Sci. – Archives néerlandaises des Sciences exactes et naturelles.
Beih. Nova Hedwigia – Beihefte zur Nova Hedwigia.
Beih. Sydowia – Beihefte zur Sydowia.
Beih. Z. Mykol. – Beihefte zur Zeitschrift für Mykologie.
Beitr. KryptogFl. Schweiz – Beiträge zur Kryptogamenflora der Schweiz.
Ber. bayer. bot. Ges. – Berichte der bayerischen botanischen Gesellschaft zur Erforschung der einheimischen Flora.
Ber. naturhist. Ver. Augsburg – Berichte des naturhistorischen Vereins Augsburg.
Ber. naturhist. Ver. Schwaben, Augsburg – Berichte des naturhistorischen Vereins für Schwaben e. V., Augsburg.
Biblthca mycol. – Bibliotheca mycologica.
Bidr. Känn. Finl. Nat. Folk – Bidrag till Kännedom om Finlands Natur och Folk.
Biol. J.Linn. Soc. – Biological Journal of the Linnean Society.
Boletus – Boletus.
Bot. Tidsskr. – Botanisk Tidsskrift.
Bot. Zbl. – Botanisches Zentralblatt.
Botaniste – Le Botaniste.
Bothalia – Bothalia.
Br. Fung. Fl. – British Fungus Flora.
Bull. bot. Gdns Buitenz. – Bulletin of the botanical Gardens, Buitenzorg.
Bull. Br. mycol. Soc. – Bulletin of the British mycological Society.
Bull. Jard. bot. Buitenz. – Bulletin du Jardin botanique, Buitenzorg.
Bull. N.Y. bot. Gard. – Bulletin of the New York botanical Garden.
Bull. Soc. Amis Sci. nat. Rouen – Bulletin de la Société des Amis des Sciences naturelles, Rouen.
Bull. Soc. bot. Fr. – Bulletin de la Société botanique de France.
Bull. Soc. Nat. Oyonnax – Bulletin de la Société des Naturalistes d'Oyonnax.
Bull. trimest. Soc. mycol. Fr. – Bulletin trimestriel de la Société mycologique de France.
C.r. Ass. franc. Av. Sci. – Compte rendu de l'Association française pour l'Avancement des Sciences.
C.r. hebd. Séanc. Acad. Sci., Paris – Compte rendu hebdomadaire des Séances de l'Académie des Sciences, Paris.
Can. J. Bot. – Canadian Journal of Botany.
Ceská Mykol. – Ceská Mykologie.
Collect. bot. – Collectanea Botanica.
Coolia – Coolia.
Cryptog. Mycol. – Cryptogamie, Mycologie.
Dansk bot. Ark. – Dansk botanisk Arkiv.
Doc. mycol. – Documents mycologiques.
Encycl. mycol. – Encyclopédie mycologique.
Ergebn. wiss. Unters. schweiz. NatnParks – Ergebnisse der wissenschaftlichen Untersuchungen des schweizerischen Nationalparks.
Exper. mycol. – Experimental mycology.
Feddes Repertorium – Feddes Repertorium.
Fl. males. – Flora malesiana.
Friesia – Friesia.
Fung. rar. Ic. col. – Fungorum rariorum Icones coloratae.
Gorteria – Gorteria.
Hedwigia – Hedwigia.
Int. J. Mycol. Lich. – International Journal for Mycology and Lichenology.
Karstenia – Karstenia.
Kl. Kryptog. Fl. – Kleine Kryptogamenflora.
Leiden bot. Ser. – Leiden botanical Series.
Levende Natuur. – De levende Natuur.
Lilloa – Lilloa.
Linnaea – Linnaea.
Madroño – Madroño.
Mat. Fl. cryptog. Suisse – Matériaux pour la Flora cryptogamique Suisse.
Meddn Soc. Fauna Fl. fenn. – Meddelanden af Societatis pro Fauna et Flora fennica.
Meded. Ned. mycol. Vereen. – Mededelingen van de Nederlandsche mycologische Vereeniging.
Mém. Acad. R. Belg. Cl. Sci. – Mémoires de l'Académie Royale de Belgique, Classe des Sciences.
Mém. Inst. Roy. Sci. nat. Belg. – Mémoires de l'Institut Royale pour les Sciences naturelles de la Belgique.
Mém. Soc. Emul. Montbéliard – Mémoires de la Société d'Émulation de Montbéliard.
Mich. Bot. – The Michigan Botanist.
Mycologia – Mycologia.
Mycotaxon – Mycotaxon.
Mykologia – Mykologia.
N.Zeal. J. Bot. – New Zealand Journal of Botany.
Natura – Natura.
Natuurw. Tijdschr. – Natuurwetenschappelijk Tijdschrift.
Ned. kruidk. archf – Nederlandsch kruidkundig Archief.
Nord. J. Bot. – Nordic Journal of Botany.
Norw. J. Bot. – Norwegian Journal of Botany.
Northwest Science – Northwest Science.

Notes R. bot. Gdn Edinb. – Notes of the Royal botanic Garden, Edinburgh.
Nova Hedwigia – Nova Hedwigia.
Op. bot. – Opera botanica.
Persoonia – Persoonia.
Pl. Syst. Evol. – Plant Systematics and Evolution.
Proc. Indian Acad. Sci. (Plant Sci.) – Proceedings of the Indian Academy of Sciences (Plant Science).
Publcions Inst. bot., Barcelona – Publicacions de l'Institut botánic, Barcelona.
Regn. veget. – Regnum vegetabile.
Rev. Mycol. – Revue de Mycologie.
Schweiz. Z. Pilzk. – Schweizerische Zeitschrift für Pilzkunde.
Sterbeeckia – Sterbeeckia.
Svensk bot. Tidskr. – Svensk botanisk Tidskrift.
Sydowia – Sydowia.
Syst. Zool. – Systematic Zoology.
Taxon – Taxon.
Tijdschr. nat. Gesch. Physiol. – Tijdschrift voor natuurlijke Geschiedenis en Physiologie.
Torreya – Torreya.
Trans. Br. mycol. Soc. – Transactions of the British mycological Society.
Trans. Mich. Acad. Sci. – Transactions of the Michigan Academy of Sciences.
Trav. sci. Parc. nat. Vanoise – Travaux scientifiques du Parc national de la Vanoise.
Vegetatio – Vegetatio.
Verh. Mitt. Siebenb. Ver. Naturw. – Verhandlungen und Mitteilungen des siebenburgischen Vereins für Naturwissenschaften zu Hermannstadt.
Verh. zool. bot. Ges. Wien – Verhandlungen des Zoologisch-Botanischen Vereins Wien.
Wetensch. Meded. K.N.N.V. – Wetenschappelijke Mededelingen van de Koninklijke Nederlandse Natuurhistorische Vereniging.
Westf. Pilzbr. – Westfälische Pilzbriefe.
Z. Mykol. – Zeitschrift für Mykologie.
Z. Pilzk. – Zeitschrift für Pilzkunde.

B

Taxonomic Part

Preliminary key to orders and families of agarics and boleti as conceived in this work and as occurring in the Netherlands and adjacent regions (cyphelloid genera excepted)

C. Bas

It is difficult to construct a key with which for every single agaric genus or species the family to which it belongs can be determined. Particularly the large families show such a great range of character possibilities that a family key tends to become very complex. The most workable solution probably is to compose a relatively simple key covering the majority of cases and to key out the remaining genera and species in more than one family. This flora being published, however, in several volumes, it is tried here to include quite a number of exceptional cases. This key will probably be revised in future volumes.

1. Context heteromerous. . . . . RUSSULALES: *RUSSULACEAE*
1. Context homoiomerous and usually monomitic, rarely acrophysalidic, dimitic, sarcodimitic or sarcotrimitic. . . AGARICALES
2. Hymenophore tubular. . . . . *BOLETACEAE*
2. Hymenophore lamellate.
3. Hymenophoral trama inverse or distinctly divergent.
4. Hymenophoral trama inverse; spore print brownish pink, pinkish brown or red-brown; lamellae free. . . . *PLUTEACEAE*
4. Hymenophoral trama divergent; spore print colour variable, but never with reddish tinges; lamellae free to decurrent.
5. Spore print white or pale coloured.
6. Trama of stipe acrophysalidic; lamellae free or nearly so. . . . . *AMANITACEAE*
6. Trama of stipe regular; lamellae broadly adnate to decurrent.
TRICHOLOMATACEAE p.p. *(Hygrophorus, Catathelasma)*
5. Spore print ochraceous to blackish.
7. Spore print dark: blackish, fuligineous or olivaceous grey. . . . . *GOMPHIDIACEAE*
7. Spore print lighter: ochraceous rust to olivaceous ochre.
8. Spores ellipsoid ($Q \leq 2$). . . . . *PAXILLACEAE*
8. Spores fusiform ($Q > 2$). . . . . *BOLETACEAE* p.p. *(Phylloporus)*
3. Hymenophoral trama irregular, subregular or regular, at most slightly divergent in narrow outer zones or divergent only in early primordial stages.
9. Spore print nearly always white to cream or buff, more rarely pale yellowish, pinkish, pure pink or pale violaceous.
10. Stipe with marginate bulb; habit of a *Cortinarius* of subgenus *Phlegmacium*.
CORTINARIACEAE p.p. *(Leucocortinarius)*
10. Stipe without marginate bulb.
11. Vascular hyphae turning bluish in sulfovanillin; spores amyloid; basidiocarps pleurotoid to omphalioid.
AURISCALPIACEAE (Lentinellus). (Belongs to Aphylophorales; in this flora treated in an appendix to the Tricholomataceae.)
11. Vascular hyphae, if present, not reacting upon sulfovanillin.
12. Basidiocarp very small and pleurotoid; spores with thickened wall and minute germ pore.
STROPHARIACEAE p.p. *(Melanotus phillipsii)*
12. Not with this combination of characters.
13. Basidiocarps pleurotoid to more rarely omphalioid, lignicolous or on roots of umbellifers; spores inamyloid, oblong to cylindrical, fusiform or allantoid ($Q > 2$); context never distinctly gelatinized, often with thick-walled hyphae, sometimes dimitic; basidiocarp rarely omphalioid and terrestrial or carbonicolous but then with furcate vein-like lamellae, dimitic context and thick-walled pointed cystidia (*Faerberia* = *Geopetalum*). . . . . *PLEUROTACEAE*
13. Basidiocarps usually tricholomatoid, omphalioid, collybioid, mycenoid or pluteoid; if pleurotoid then spores amyloid (*Panellus*) and/or context partly or completely gelatinized (*Hohenbuehelia*, *Resupinatus*) and/or spores ornamented (*Rhodotus*) and/or spores globose to ellipsoid (*Pleurocybella*, *Cheimonophyllum*, etc.) or lacrymoid (*Arrhenia*) and/or growing on mosses; if omphalioid then mostly terrestrial or on mosses and without thick-walled hyphae and cystidia, if omphalioid and lignicolous then Q of spores < 2 and/or trama without thick-walled hyphae. Context never dimitic.
14. Spores thick-walled, amygdaliform and dextrinoid; pileipellis an ixocutis. . . *CORTINARIACEAE* p.p. *(Hebelomina)*
14. Not with this combination of characters.

15. Spores with more or less thickened, frequently dextrinoid, always smooth wall, sometimes with germ pore; lamellae free; veil(s) often well developed; rarely spores not dextrinoid, but then pileipellis a hymeniderm or epithelium.
AGARICACEAE p.p. (white- and pale-spored genera)

15. Spores inamyloid or amyloid, very rarely dextrinoid but then pileipellis not an epithelium or hymeniderm (*Pseudobaeospora*, *Hygrophoropsis*) and/or lamellae not free (*Cystoderma*); spore wall usually thin, sometimes thickened, sometimes ornamented, never with germ pore. Veils often absent or poorly developed. . . . *TRICHOLOMATACEAE*

9. Spore print nearly always deeply coloured, brownish pink, brown, olivaceous brown, violet, purple grey or black, rarely pale brown, deep ochraceous or greenish.

16. Spore print brownish pink; spores angular in all views or angular only in apical view or verrucose but then basidiocarp not pleurotoid. . . . . *ENTOLOMATACEAE*

16. Spore print rarely brownish pink and then basidiocarp pleurotoid and spores not angular or basidiocarp collybioid and covered with large thin-walled conical cystidia; spores smooth or ornamented, sometimes angular to nodulose but then spore print brown to grey-brown.

17. Pileipellis a true hymeniderm; spore print ochraceous to red-brown or grey-brown, rarely dark brown; spores nearly always smooth, frequently with germ pore; if minutely rough then cheilocystidia lecythiform (if pileipellis a false hymeniderm because of crowded but loosely arranged pileocystidia, see *Simocybe* in Cortinariaceae; if pileipellis a false epithelium because of loosely arranged chains of incrusted inflated elements, see *Flammulaster* in Cortinariaceae).
BOLBITIACEAE

17. Pileipellis often of a different type, if pileipellis a hymeniderm or epithelium then spores not smooth and cystidia not lecythiform or spore print black, grey, fuscous purplish, lilacinous brown, vinaceous brown or greenish.

18. Spore print chocolate brown, very rarely bluish green or greyish green; lamellae free; spores smooth or very rarely minutely rough; basidiocarp non-hygrophanous, non-deliquescent; chrysocystidia and pleurocystidia absent; pileus a dry cutis or rarely an epithelium. . . . . *AGARICACEAE* p.p. (dark spored genera).

18. Spore print a different colour or basidiocarp hygrophanous or deliquescent or lamellae not free or pleuro- or chrysocystidia present or pileipellis a hymeniderm or ixocutis.

19. Pileipellis often a hymeniderm or epithelium, less frequently a cutis but then spores discolouring to slate colour in concentrated H_2SO_4 and basidiocarp usually deliquescent; spore print black, grey, fuscous or purplish, rarely paler lilacinous brown or vinaceous brown; spores nearly always smooth, very rarely rough and then spore print purplish fuscous, frequently with germ pore, more rarely without and then discolouring in H_2SO_4; chrysocystidia rarely present but then pileipellis a hymeniderm. . . . . *COPRINACEAE*

19. Pileipellis very rarely a true hymeniderm or epithelium but then spore print brown without vinaceous, lilacinous or violaceous tinges or deep ochraceous; basidiocarp never deliquescent; spores never discolouring to slate colour in H_2SO_4, with or without germ pore; chrysocystidia sometimes present but then pileipellis a cutis or ixocutis.

20. Pileus, stipe, and lamellae with large, thin-walled, conical cystidia; spore print rather dark pinkish ochraceous brown.
TRICHOLOMATACEAE p.p. *(Macrocystidia)*

20. Without such cystidia on pileus, stipe, and lamellae.

21. Pileus, stipe, and underside of ascending ring with epithelioid covering; spore print deep ochraceous; basidiocarp large and terrestrial. . . . . *TRICHOLOMATACEAE* p.p. *(Phaeolepiota)*

21. Not with this combination of characters.

22. Spores small, roundish, and with cyanophilous warts; lamellae (sub)decurrent.
TRICHOLOMATACEAE p.p. *(Ripartites)*

22. Not with this combination of characters.

23. Spore print ochraceous to red-brown, grey-brown, olivaceous brown or brownish pink, never purplish, lilacinous, violaceous, grey or blackish; spores rough or smooth, more rarely nodulose, angular or spinulose; chrysocystidia absent; frequently ectomycorrhizal, never fimicolous; if (sub)fasciculate on wood then spores rough or pileus thin-fleshed and spores not small (6-7.5 µm) and truncate from broad germ pore or pileipellis with incrusted inflated or thick-walled elements. . . . . *CORTINARIACEAE*

23. Spore print violaceous, purplish brown, grey or blackish or ranging from ochraceous brown to rusty brown or grey-brown but then chrysocystidia or pleurocystidia with yellow contents often present and/or basidiocarp fleshy and (sub)fasciculate on wood or rather thin-fleshed, hygrophanous and fasciculate on wood but then with small (6-7.5 µm) truncate spores with large germ pore; never ectomycorrhizal; spores always smooth under light microscope. . . . . *STROPHARIACEAE*

AGARICALES F. Clem. emend. Rea

AGARICALES F.Clem., Genera Fungi: 102. 1909; emend. Rea, Brit. Basidiomyc.: XI. 1922. – BOLETALES E.J.Gilb., Les Bolets: 105. 1931. – PLUTEALES Kühner in Bull. mens. Soc. linn. Lyon 48: 37. 1979. – TRICHOLOMATALES Kühner, loc. cit.: 613. 1979. – AMANITALES Jülich, High. Taxa Basidiomyc.: 243. 1981. – CORTINARIALES Locq. ex Jülich, loc. cit.: 345. 1981. – ENTOLOMATALES Jülich, loc. cit.: 346. 1981.

Spores born on and forcibly discharged (hence production of a spore print possible) from sterigmata on one-celled basidia forming a hymenium; hymenophore mostly lamellate, more rarely tubular (basidiocarps then always fleshy) or smooth (then situated at the lower sureface of a pileate basidiocarp or at the inside of small to very small, hanging, cup-like or tubular basidiocarps); context usually fleshy and putrescent, more rarely membranous, leathery or cartilagenous, never with vascular hyphae turning blue-grey to blackish blue in sulfoaldehydes, nearly always monomitic, but very rarely dimitic and then basidiocarp pleurotoid with lamellate hymenophore or omphalioid with hymenophore smooth to rugulose. – Type family: *Agaricaceae* Fr.

For discussions on the delimitation of the Agaricales in this flora, the reader is referred to the first part of Chapter V.

The cyphellaceous fungi, although at least partly certainly belonging to the Agaricales, have been omitted from this work because they are poorly represented in the Netherlands, both in nature and in herbaria, and consequently poorly known.

Because of the strongly agaricoid habit of its basidiocarps the genus *Lentinellus*, now generally thought to belong to the Auriscalpiaceae in the Aphyllophorales, but by Kühner (1980, Hyménomyc. agaricoid: 900) hesitatingly placed in the Russulales, is treated in this work in an appendix to the Tricholomataceae.

Entolomataceae Kotl. & P.

MACHIEL E. NOORDELOOS

Rhodophyllaceae Sing. in Lilloa 22: 601. ('1949') 1951 (invalid). – *Clitopilaceae* P.D.Orton in Dennis, Orton & Hora in Trans. Br. mycol. Soc. 43, suppl.: 6. 1960 (invalid). – *Entolomataceae* Kotl. & P. in Česká Mykol. 26: 218. 1972.

SELECTED LITERATURE – Noordel. in Persoonia 11: 122. 1981; Romagn. in Beih. Nova Hedwigia 59: 25-77. 1979; Sing., Agaricales mod. Taxon., Ed. 4: 698-699. 1986.

Basidiocarps pleurotoid, collybioid, omphalioid, mycenoid or tricholomatoid; spore-print pink to pinkish brown; spores thin- to relatively thick-walled, hyaline or stramineous as seen under light microscope, angular in apical view or in all views or verruculose on account of the presence of ridges and warts caused by a special formation of the endosporium. – Type genus: *Entoloma* (Fr.) Kumm.

KEY TO THE GENERA

1. Spores more or less rough, verruculose or pustulate. . . . . 1. **Rhodocybe**
1. Spores angular, at least in polar view.
2. Spore smooth and ellipsoid in side-view, angular in polar view because of the presence of 3 to 12 longitudinal ridges. **2. Clitopilus**
2. Spores angular in all views, entirely covered by facets outlined by ridges. . . . . 3. **Entoloma**

1. RHODOCYBE Maire in Bull. trimest. Soc. mycol. Fr. 40: 298. ('1924') 1926

Pluteospora Maire in Bull. trimest. Soc. mycol. Fr. 50: XXVII. ('1934') 1935. – *Clitopilopsis* Maire in Publcions Inst. bot., Barcelona 3(4): 82. 1937. – *Hirneola* Velen., Novit. mycol.: 73. 1939, non *Hirneola* Fr., 1848.

SELECTED LITERATURE - T.Baroni in Beih. Nova Hedwigia 67. 1981; Kühn. & Lamoure in Bull. trimest Soc. mycol. Fr. 87: 15-23. 1971; Noordel. in Persoonia 12: 38-49. 1983.

Habit pleurotoid, omphalioid, collybioid, mycenoid or tricholomatoid; pileus white, yellow, ochraceous, yellow-brown, red-brown or grey, usually smooth; pileipellis a cutis, an ixocutis or a trichoderm, made up of cylindrical to inflated hyphae with incrusting or membranal pigments; lamellae adnate, emarginate or decurrent, when mature with pink tinge; spores pink in deposit, angular in polar view, weakly to strongly undulate-pustulate in all views, more rarely appearing smooth under the light microscope; lamella edge fertile or heterogeneous, rarely sterile; cheilocystidia, if present, filamentous, sometimes septate; pseudocystidia occasionally present; clamp-connections absent, except for the species in sect. *Rhodophana*. – Type species: *R. caelata* (Fr.) Maire.

HABITAT & DISTRIBUTION – Solitary or in small groups, rarely fasciculate, usually in or near deciduous or coniferous forest, less frequently found in grassland. Widespread, cosmopolitan.

KEY TO THE SPECIES

1. Hymenial pseudocystidia present, very obvious, filled with yellowish, refringent granules. . . . . 1. **R. caelata**
1. Hymenial pseudocystidia absent.
2. Basidiocarps small, collybioid or mycenoid; pileus and stipe with yellow, orange or reddish tinges; clamp-connections present.
3. Basidiocarps yellow to yellow-brown; spores (4.0-) 4.5-7.0 × 3.0-4.0 (-4.5) µm. . . . . 3. **R. melleopallens**
3. Basidiocarps orange-brown to red-brown; spores 7.0-10.0 × 5.0-5.5 µm. . . . . 2. **R. nitellina**

2. Basidiocarps omphalioid or tricholomatoid with grey or grey-brown colours, if red-brown then habit tricholomatoid; clamp-connections always absent.
4. Pileus white, occasionally tinged cream-colour at centre when old. . . . . 6. **R. fallax**
4. Pileus distinctly coloured.
5. Pileus flesh-coloured or reddish; stipe white or with same colour as pileus. . . . . 8. **R. gemina**
5. Pileus grey to grey-brown.
6. Spores 6.0-9.0 × 4.0-6.0 µm, ellipsoid to subglobose in side-view, hardly angular or pustulate; cheilocystidia present, 30-50 × 4-9 µm, usually septate. . . . . 7. **R. hirneola**
6. Spores 4.5-7.0 (-8.0) µm long, distinctly pustulate; cheilocystidia absent.
7. Smell none; taste mild; spores 5.5-6.5 × 3.5-4.5 µm. . . . . 5. **R. parilis**
7. Smell farinaceous; taste usually bitter; spores (4.5-) 5.0-7.0 (-8.0) × (3.5-) 4.0-5.5 (-6.0) µm. . . . . 4. **R. popinalis**

Sect. **Rhodocybe**

Hymenial pseudocystidia present, usually with refringent and coloured contents.

1. Rhodocybe caelata (Fr.) Maire in Bull. trimest. Soc. mycol. Fr. 40: 298. ('1924') 1926. – Fig. 37.

Agaricus caelatus Fr., Epicr.: 42. 1838; *Tricholoma caelatum* (Fr.) Gillet, Hyménomycètes: 114. 1874; *Clitopilus caelatus* (Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953 (not valid, basionym not mentioned). – *Agaricus retostus* subsp. *arenicola* Fr., Ic. sel. Hymenomyc.: 78. 1874; *Omphalina arenicola* (Fr.) P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp.: 131. 1879; *Rhodocybe arenicola* (Fr.) Lange & Sivertsen in Bot. Tidsskr. 62: 198. 1966. – *Rhodocybe dubia* J.Favre, Cat. descr. Champ. sup. Zone subalpine: 587. 1960. – *Rhodocybe australis* Sing. in Beih. Nova Hedwigia 29: 335. 1969.

SEL. ICON. – Ryman & Holmåsen, Svampar: 372. 1984.

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 47-49, figs. 11-14, 64-65, 113, 115-117, 148. 1981; Lange & Sivertsen in Bot. Tidsskr. 62: 198. 1966 (as *R. arenicola*); Kühn. & Lamoure in Bull. trimest. Soc. mycol. Fr. 87: 15-23. 1971.

Pileus 5-20(-30) mm, convex, then applanate, with or without (slightly) depressed centre, with involute then more or less straight margin, weakly hygrophanous, not translucently striate, dark grey or grey-brown (Mu. 10 YR 3/1-2) paler at margin (10 YR 5-6/4), finely pubescent, often with micaceous sheen, becoming minutely, often concentrically, areolate-rimose, but often glabrescent with age, slightly pallescent on drying. Lamellae, L = 20-25, l = 1-3(-5), moderately distant, broadly adnate, often with decurrent tooth to subdecurrent, sometimes transvenose or intervenose, arcuate then segmentiform, finally ventricose, up to 3.5 mm broad, cream-colour then pinkish (10 YR 8/3-4 then 7.5 YR 8/3-4) with entire, concolorous edge. Stipe 20-40 × 2-3 mm, cylindrical, sometimes flexuose, solid then fistulose, sepiaceous or grey-brown (10 YR 4-5/3-4), minutely pubescent at first, glabrescent with age, then almost polished, remaining pruinose at apex only. Context thin, concolorous with surface or slightly paler in pileus, fibrous, paler than surface in stipe. Smell not distinct. Taste mild.

Spores (6.5-) 7.0-9.0 × 4.0-5.0 µm, Q = 1.5-2.0, $\overline{Q}$ = 1.75, ellipsoid to oblong, minutely nodulose-pustulate in outline. Basidia 18-32 × 6-9 µm, 4-spored, clampless. Lamella edge heterogeneous. Pseudocystidia abundant, cylindrical to clavate, sometimes with conical tip, 4-12 µm wide, with yellowish, granular contents. Pileipellis a dry cutis of narrow, cylindrical hyphae, 3.5-7 µm wide; subpellis irregular, made up of strongly interwoven, tightly packed cylindrical hyphae. Pigment incrusting in subpellis and pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In grassland, preferably on poor, acid, sandy soils; in *Juniperus* heaths. Rare. July-Nov. Wide-spread in Europe and North America, recorded from grassland and forest, sometimes growing on forest litter.

The Netherlands' collections of *Rhodocybe caelata* agree very well with the description of Lange & Sivertsen (l.c.) as *R. arenicola*. There seems no reason, however, to consider the latter as being distinct from typical *R. caelata*, which grows on slightly richer substrates and accordingly has a slightly more robust, more or less tricholomatoid habit.

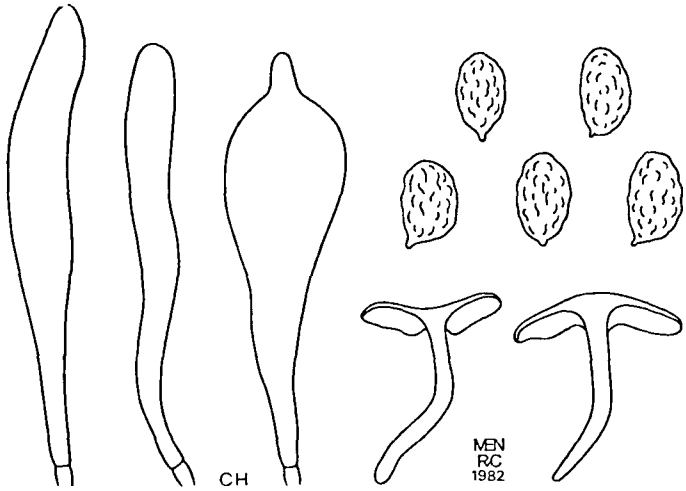

Fig. 37. *Rhodocybe caelata*.

Sect. **Rhodophana** (Kühner) Sing.

Basidiocarps mycenoid or collybioid with vivid yellow or reddish colours; clamp-connections present; hymenial cystidia or pseudocystidia absent.

2. Rhodocybe nitellina (Fr.) Sing. in Mycologia 38: 687. 1946. – Fig. 38.

Agaricus nitellinus Fr., Epicr.: 80. 1838; *Collybia nitellina* (Fr.) Quél. in Mém. Soc. Émul. Montbéliard, sér. II, 5: 434. 1875 (Champ. Jura Vosges 3); *Rhodopaxillus nitellinus* (Fr.) Sing. in Ann. mycol. 34: 332. 1936. – *Collybia cuprea* J.Favre in Cat. descr. Champ. sup. Zone subalpine: 401. 1960; *Rhodocybe cuprea* (J.Favre) Horak in Sydowia 31: 73. ('1978') 1979.

SEL. ICON. – Bres., Iconogr. mycol. 5: pl. 209. 1928; Konr. & M., Ic. sel. Fung. 3: pl. 200, fig. 1. 1928.

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 65-67, fig. 96-99. 1981; Horak in Sydowia 31: 73. ('1978') 1979 (as *R. cuprea*).

Pileus 10-25 mm, conico-convex to convex, becoming applanate with age, usually with weak, rounded papilla, rarely subdepressed at centre, with inflexed then straight margin, hygrophanous, when moist orange-brown to red-brown (Mu. 2.5 YR 3-4/6, 5 YR 5/8, 7.5 YR 5/8), darker at centre (2.5 YR 2-3/4, 5 YR 4/6), translucently striate up to 2/3 of radius, strongly pallescent on drying to pale orange-brown (7.5 YR 6/6-8, 10 YR 6/8), at centre long remaining dark, smooth, glabrous or with a slight villosity near margin. Lamellae, L = 20-40, l = 1-5, moderately crowded, adnate or slightly emarginate, sometimes with decurrent tooth, sometimes sinuate, segmentiform to ventricose, up to 4 mm broad, pale brownish cream (10 YR 7-8/4), then pinkish brown (to almost 7.5 YR 6/6), with entire, concolorous edge. Stipe 20-45 × 0.5-3 mm, cylindrical, tapering or broadened towards base, often flexuose, solid then narrowly fistulose, concolorous with pileus or paler, smooth, sometimes sparsely pruinose at apex, at base slightly villose with pallid mycelium. Context thin, concolorous with surface in cortex, paler in inner parts. Smell strong, sometimes sweetish-farinaceous. Taste strongly farinaceous-rancid.

Spores 7.0-10.0 × 5.0-5.5 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.4, ellipsoid in outline, distinctly undulate-pustulate, thin-walled. Basidia 20-42 × 6-10 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 3-7 µm wide, cylindrical hyphae. Pigment yellowish, membranal or minutely incrusting in upper layer of pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – On litter, humus, etc. in mixed and coniferous forest, preferably on sandy soil in the coastal region. Subgregarious. Rare. Wide-spread in Europe and North America from the lowlands up into the subalpine zone. July-Nov.

Rhodocybe nitellina is easily distinguished because of the vivid reddish colour and the relatively large spores.

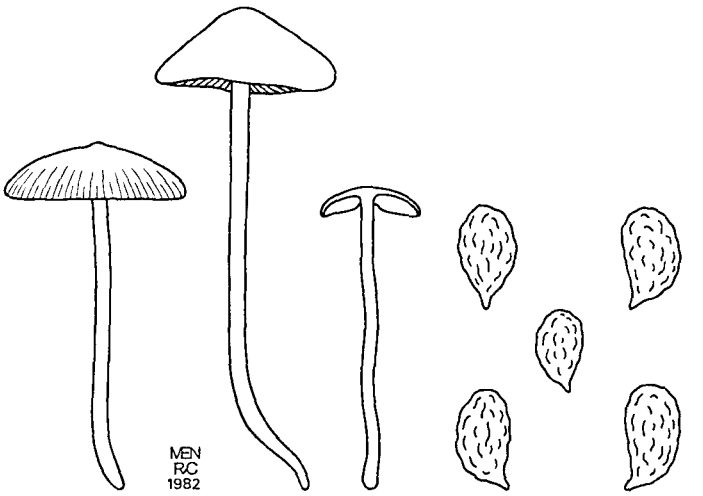

Fig. 38. *Rhodocybe nitellina.*

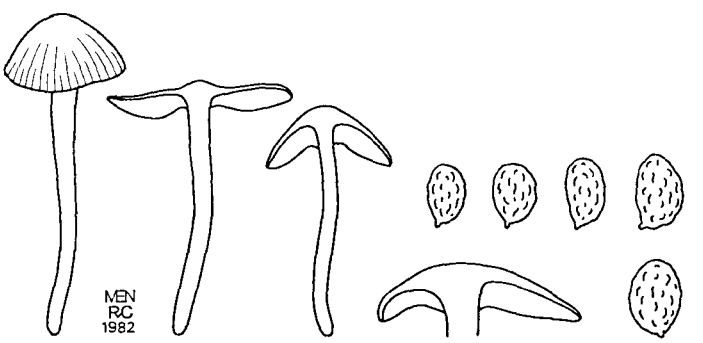

Fig. 39. *Rhodocybe melleopallens.*

3. Rhodocybe melleopallens P.D.Orton in Trans. Br. mycol. Soc. 43: 380. 1960. – Fig. 39.

Collybia nitellina f. *minor* Døssing in Friesia 6: 340. 1961 (invalid).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 40-41, fig. 14-16. 1983; P.D.Orton in Trans. Br. mycol. Soc. 43: 380. 1960.

Pileus 10-30 mm, conico-convex, then expanding, finally almost applanate, with or without small papilla, with straight margin, strongly hygrophanous, when moist vividly yellow-orange ochraceous or orange-brown (centre Mu. 7.5 YR 4-5/6, 6/8, margin 7.5 YR 5-7/6-8, 10 YR 6/6-8), translucently striate up to 2/3 of radius, pallescent on drying to pale yellow-brown (10 YR 7-8/6-8), smooth, sometimes slightly radially fibrillose. Lamellae, L = 20-30, l = 1-5, moderately distant, (broadly) adnate, sometimes with decurrent tooth, segmentiform to subventricose, up to 5 mm broad, brownish yellow (10 YR 7/4-8, 6/4, 7.5 YR 6-7/8) with entire, concolorous edge. Stipe 20-40 × 1.5-3 mm, cylindrical often tapering towards base, straight or flexuose, solid or fistulose, concolorous with pileus or slightly darker in upper part, occasionally paler than pileus in lower part, smooth, shining, polished. Context concolorous with surface. Smell farinaceous, especially when cut. Taste strong, oily-rancid.

Spores (4.0-) 4.5-7.0 × 3.0-4.0 (-4.5) µm, Q = 1.1-1.8, $\bar{Q}$ = 1.3-1.4, ellipsoid to broadly ellipsoid in outline, weakly nodulose-angular. Basidia 20-30 × 7-9.5 µm, (2-) 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 4.5-9 µm wide, cylindrical hyphae. Pigment membranal-incrusting in pileipellis and pileitrama. Clamp-connections present in whole basidiocarp.

HABITAT & DISTR. – In deciduous and mixed forest, preferably on more or less calcareous, sandy soil. Very rare (Zeeuws Vlaanderen; Voorne; Voorschoten) in the coastal area. Also known to occur in Denmark, Great Britain, German Federal Republic, and France. Sept.-Nov.

Sect. **Decurrentes** (Konr. & M.) Sing.

Pileus white, grey or grey-brown; lamellae (sub-)decurrent; clamp-connections absent; hymenial pseudocystidia absent.

4. Rhodocybe popinalis (Fr.: Fr.) Sing. in Lilloa 22: 609. 1951. – Fig. 40.

Agaricus popinalis Fr.: Fr., Syst. mycol. 1: 194. 1821; *Clitopilus popinalis* (Fr.: Fr.) Kumm., Führ. Pilzk.: 97. 1871; *Paxillus popinalis* (Fr.: Fr.) Rick., Blätterpilze: 94. 1911; *Clitocybe popinalis* (Fr.: Fr.) Bres., Iconogr. mycol. 4: 160. 1928; *Paxillopsis popinalis* (Fr.: Fr.) J.Lange, Fl. agar. dan. 5: VI. 1940; *Rhodopaxillus popinalis* (Fr.: Fr.) Konr. & M., Rév. Hyménomyc. France: 327. 1937; *Clitopilopsis popinalis* (Fr.: Fr.) Konr. & M., Agaricales 1: 379. 1948. – *Agaricus mundulus* Lasch in Linnaea 4: 527. 1829; *Clitopilus mundulus* (Lasch) Kumm., Führ. Pilzk.: 97. 1871; *Rhodopaxillus mundulus* (Lasch) Konr. & M., Ic. sel. Fung. 4: pl. 278. 1934; *Paxillopsis mundulus* (Lasch)

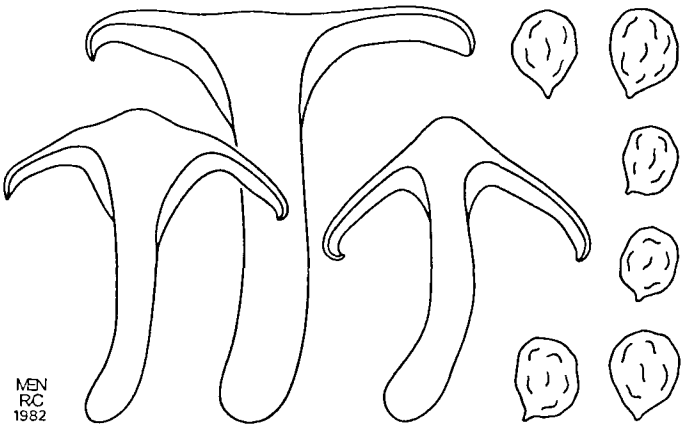

Fig. 40. *Rhodocybe popinalis*.

J.Lange, Fl. agar. dan. 5: VI. 1940; *Clitopilopsis mundulus* (Lasch) Konr. & M., Agaricales 1: 379. 1948; *Rhodocybe mundula* (Lasch) Sing. in Lilloa 22: 609. 1951. – *Hygrophorus meyendelii* Boetje-v. Ruyven in Levende Natuur 39: 324. 1935 (invalid).

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 97-102, figs. 82, 83, 86-99, 119, 128. 1981; Noordel. in Persoonia 12: 43-44. 1983.

Pileus 25-60(-90) mm, hemispherical, then conico-convex, finally almost applanate, usually with broad, low umbo, occasionally slightly depressed at centre, with strongly involute, deflexed or straight margin, with marginal zone usually strongly undulating with age, not distinctly hygrophanous, very variable in colour from almost white through cream-colour, greyish or brown to grey-brown, sometimes with violaceous lilac tinge, not translucently striate, more or less glabrous, sometimes minutely pruinose or tomentose, frequently with concentrical zones of irregular, smooth spots ('wasserfleckig'), often radially rimose with age, sometimes blackening when exposed or bruised, distinctly changing colour and darkening when water-soaked, slightly pallescent on drying. Lamellae, L = 40-80, l = 3-7, fairly crowded, adnate-subdecurrent when young, then strongly decurrent, arcuate to segmentiform, narrow, 3-5 mm broad, greyish white, then yellowish brown or ochraceous grey, sometimes staining black when bruised, with pink tinge when old, with concolorous, entire edge. Stipe 15-60 × 4-17 mm, cylindrical, tapering downwards, sometimes broadened at base, sordid white, then browish grey, sometimes tomentose in lower half, sometimes blackening when bruised. Smell strongly farinaceous. Taste bitter.

Spores (4.5-) 5.0-7.0 (-8.0) × (3.5-) 4.0-5.5 (-6.0) µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25, subglobose to broadly ellipsoid, with up to 12 facets in side-view. Basidia 20-40 × 6-9 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis made up of 3-8 µm wide, cylindrical hyphae with membranal and incrusting pigment. Clamp-connections absent.

HABITAT & DISTR. – In deciduous and coniferous forest, also in grassland, in coastal dunes, sometimes associated with *Salix repens*. Not uncommon. Wide-spread in Europe and North America. June-Nov.

Rhodocybe popinalis is taken here in a rather wide concept, including *R. mundula*, as it has been shown that the characters used to separate these species are not constant, but on the contrary intergrading and reversible (Noordel. in Persoonia 12: 44. 1983). *Rhodocybe parilis* differs in having slightly smaller spores and smaller basidiocarps.

5. Rhodocybe parilis (Fr.: Fr.) Sing., Agaricales mod. Taxon, Ed. 2: 678. 1962. – Fig. 41.

Agaricus parilis Fr.: Fr., Syst. mycol. 1: 168. 1821; *Clitocybe parilis* (Fr.: Fr.) Gillet, Hyménomycètes: 144. 1874; *Clitopilus parilis* (Fr.: Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953 (not valid, basionym not mentioned).

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 452. ('1982') 1983.

Pileus 12-25 mm, convex then expanded, usually with depressed centre, with involute margin, not hygrophanous, not translucently striate, grey with ochraceous tinge at centre, dull. Lamellae, very crowded, adnate or shortly decurrent, pink with grey tinge with concolorous, entire edge. Stipe 15-20 × 2-4 mm, cylindrical or tapering towards base, brown-grey, covered in adpressed white fibrils; apex hirsute. Context thin. Smell weak, not distinct. Taste weak, raphanoid.

Spores 5.0-6.5 (-7.0) × 3.5-4.5 µm, Q = 1.1-1.3, $\bar{Q}$ = 1.2, broadly ellipsoid in outline, weakly pustulate. Basidia 20-24 × 6-8 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2-8 µm wide, cylindrical hyphae with minutely incrusted walls. Clamp-connections absent.

HABITAT & DISTR. – In grassy vegetation on very dry, weakly acid sandy soil (*Festuco-Thymetum*). Very rare (Anloo). Distribution unknown.

The taxonomical status of *R. parilis* remains a bit uncertain, since only very limited material was available for study. It is extremely close to *R. popinalis*, and may represent a dwarfish form of it.

6. Rhodocybe fallax (Quél.) Sing. in Farlowia 2: 549. 1946. – Fig. 42.

Omphalia fallax Quél. in C.R. Ass. franç. Av. Sci. 24: 617. 1896 (Champ. Jura Vosges 20); *Clitocybe fallax* (Quél.) Sacc. & Trott., Syll. Fung. 21: 42. 1912; *Rhodopaxillus fallax* (Quél.) Maire in Bull. mens. Soc. linn. Lyon 6: 19. 1927; *Paxillopsis fallax* (Quél.) J.Lange, Fl. agar. dan. 5: VI. 1940, *Clitopilopsis fallax* (Quél.) Kühn. ex Konr. & M, Agaricales 1: 380. 1948; *Clitopilus fallax* (Quél.) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953 (not valid, basionym not mentioned).

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 102-104. 1981; Noordel. in Persoonia 12: 41-42, figs. 17-18. 1983.

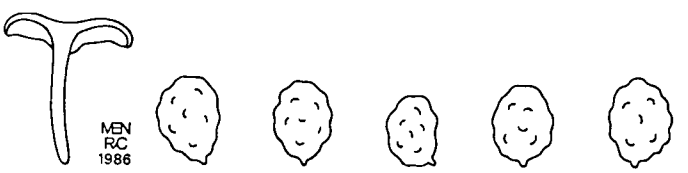

Fig. 41. *Rhodocybe parilis*.

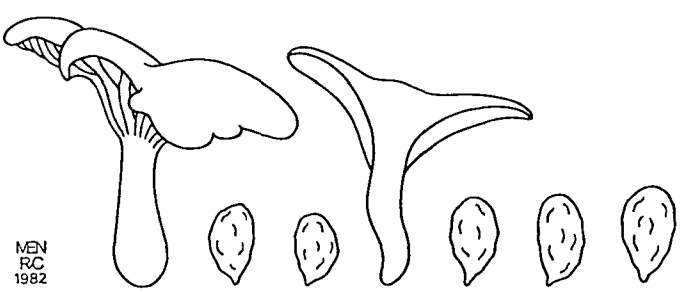

Fig. 42. *Rhodocybe fallax*.

Pileus 10-40 mm, convex, then applanate, usually depressed at centre, with or without weak umbo, with involute margin when young, then straight or reflexed, with strongly wavy-undulating margin when old, not hygrophanous, not translucently striate, white, sometimes with slight cream tinge at centre when old, smooth, glabrous. Lamellae, L = 50-70, l = 1-3, crowded, arcuate-decurrent, up to 5 mm broad, pale, then yellowish, finally with pink tinge, with entire, concolorous edge. Stipe 10-50 × 2-7 mm, cylindrical, often tapering towards base, white, subtomentose or pruinose to flocculose at apex and fibrillose below, solid. Context solid, white. Smell not distinctive. Taste bitter.

Spores 5.0-8.5 × 3.5-5.0 µm, Q = 1.4-2.0, $\bar{Q}$ = 1.7, oblong to amygdaliform in side-view, weakly nodulose-angular, very thin-walled. Basidia 18-30 × 7-11 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow, 2.5-6.5 (-9) µm wide, cylindrical hyphae. Pigment absent or minutely incrusting some hyphae of pileipellis. Clamp-connections absent.

HABITAT & DISTR. – In deciduous and mixed forest, preferably on sandy, slightly calcareous soil, also in grassland (*Corynephoretum*) on fairly dry, sandy soil. Rare. Wide-spread in Europe but everywhere rare. June-Nov.

7. Rhodocybe hirneola (Fr.: Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 181. 1960.

Agaricus hirneolus Fr.: Fr., Syst. mycol. 1: 269. 1821; *Clitocybe hirneola* (Fr.: Fr.) Kumm., Führ. Pilzk.: 120. 1871; *Rhodophyllus hirneolus* (Fr.: Fr.) Sing. in Lloydia 5: 101. 1942; *Clitopilopsis hirneolus* (Fr.: Fr.) Kühner ex Konr. & M., Agaricales 1: 379. 1948; *Clitopilus hirneolus* (Fr.: Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953 (not valid, basionym not mentioned).

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 110-112, figs. 42, 43, 79, 80, 112, 118, 120. 1981.

CHARACTERISTICS. – Basidiocarps small, omphalioid; pileus 7-20 mm broad, grey, dry; lamellae decurrent, grey; stipe grey, pruinose above, fibrillose below; smell none or faintly farinaceous; taste slightly farinaceous; spores 6.0-9.0 × 4.0-6.0 µm, ellipsoid in outline, hardly angular or pustulate; cheilocystidia present, 30-50 × 4-9 µm, septate; clamp-connections absent.

HABITAT & DISTR. – Usually in coniferous forest on litter or on the ground, also known from *Sphagnum*-bogs. Rare but wide-spread in Europe and North America. Not known from the Netherlands with certainty.

Sect. **Rufrobrunnea** T.Baroni

Pileus pink, ochraceous or red-brown; lamellae adnate or decurrent; stipe central; pseudocystidia and hymenial cystidia absent; clamp-connections absent.

8. Rhodocybe gemina (Fr.) Kuyp. & Noordel. in Persoonia 13: 379. 1987. – Fig. 43.

Agaricus geminus Fr., Epicr.: 38. 1838. – *Rhodopaxillus truncatus* var. *typicus* Maire in Bull. trimest. Soc. mycol. Fr. 40: 298. 1926 (inadmissable epithet). – *Rhodopaxillus truncatus* var. *mauretanicus* Maire in Bull. trimest. Soc. mycol. Fr. 40: 298. 1926; *Rhodocybe truncata* subsp. *mauretanica* (Maire) Sing., Agaricales mod. Taxon.: 609. 1951; *Clitopilus truncatus* var. *mauretanicus* (Maire) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953. – *Clitopilus truncatus* var. *leucopus* Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953 (not valid). – *Rhodopaxillus truncatus* var. *subvermicularis* Maire in Bull. trimest. Soc. mycol. Fr. 40: 298. 1926; *Rhodocybe truncata* subsp. *subvermicularis* (Maire) Sing. in Farlowia 2: 286. 1946; *Clitopilus truncatus* var. *subvermicularis* (Maire) Kühn. & Romagn., Fl. anal. Champ. sup.: 173. 1953.

MISAPPL. – *Rhodocybe truncata* sensu Sing., auct. eur., T.Baroni non Schaeff.

SEL. ICON. – Bres., Iconogr. mycol. 3: pl. 109. 1927; Konr. & M., Ic. sel. Fung. 3: pl. 274. 1932; J.Lange, Fl. agar. dan. 1: pl. 25A. 1935.

SEL. DESCR. & FIGS. – T.Baroni in Beih. Nova Hedwigia 67: 79-84, fig. 34, 52, 53, 110, 130, 146. 1981.

Pileus 15-130 mm, conico-convex, soon convex, truncate, with low, broad umbo, finally more or less plano-convex with weak umbo, with involute, then more or less inflexed margin, salmon-pink to pinkish brown or with pinkish-ochraceous tinges (Mu. 10 YR 7-8/6-8, 7.5 YR 7-8/6, 5 YR 7-8/6), not distinctly hygrophanous, not translucently striate, when young minutely tomentose or subsquamulose, glabrescent with age, sometimes concentrically kinked, when old sometimes vaguely radially rimose. Lamellae, L = up to 110, l = 1-5, crowded, broadly adnate-emarginate to dinstinctly decurrent, thin to thickish, segmentiform to ventricose, broadest part usually near stipe, up to 10 mm broad, whitish, then creamy-pinkish finally with brownish spots (10 YR to 7.5 YR 7-8/4) with entire or eroded, concolorous edge. Stipe 30-50(-65) × 10-30 mm, cylindrical or tapering downwards, sometimes broadened below, sometimes flexuose, whitish, yellowish or pinkish, subconcolorous with pileus, when old sometimes tinged brown, finely fibrillose to subsquamulose or minutely velutinous at first, especially in upper half, glabrescent from base upwards with age, solid. Context thick, watery greyish-white in cap with a hyalinous greyish line above the lamellae, more or less yellowish white in stipe with greyish-watery spots. Smell strong, somewhat perfumed or weak, almost lacking, sometimes farinaceous. Taste usually unpleasant, somewhat astringent-fungoid or farinaceous.

Spores 5.0-7.0 × 4.0-5.5 µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25-1.3, subglobose to broadly ellipsoid in outline, undulate-pustulate to almost angular. Basidia 22-30 × 6-9 µm, 4-spored, clampless. Lamella edge heterogeneous. Cheilocystidia usually sparse but rarely absent, cylindrical, flexuose or narrowly clavate, 20-55 (-70) × 2-8 µm. Pileipellis a cutis with transitions to a trichoderm, made up of loosely arranged, 5-20 µm

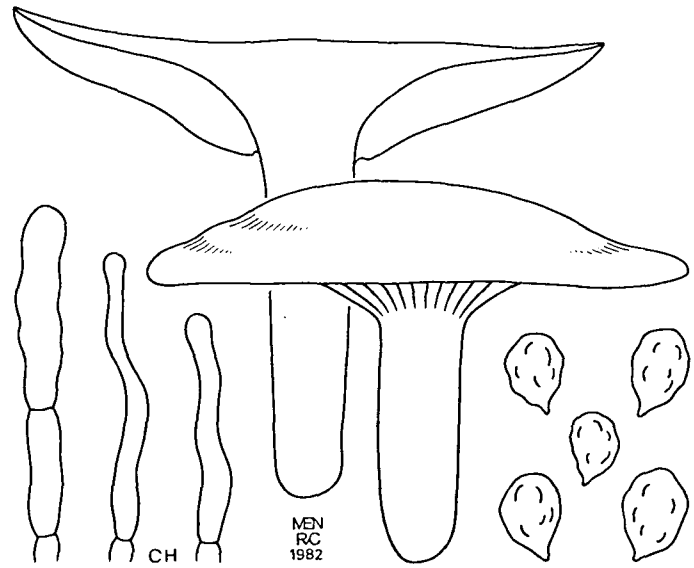

Fig. 43. *Rhodocybe gemina.*

wide, cylindrical to inflated hyphae. Pigment membranal or minutely incrusted in pileipellis. Clamp-connections absent.

HABITAT & DISTR. – Terrestrial, solitary or gregarious in humus in mixed deciduous or coniferous forest, preferably on slightly calcareous, sandy soils (e.g. in coastal dunes and IJsselmeerpolders). Rare. Widespread in Europe. June-Dec.

Rhodocybe gemina is taken here in a rather broad sense including subsp. *mauretanicus* Maire, subsp. *subvermicularis* Maire, and var. *leucopus* Kühn. & Romagn. These subspecies and varieties have been distinguished on account of differences in habit, colour of stipe, and/or smell and taste, but each of these characters seems to intergrade, so that not much taxonomic value can be placed upon them.

2. CLITOPILUS Kumm., Führ. Pilzk.: 96. 1871

Hexajuga Fay. in Ann. Sci. nat., Bot., sér. VII, 9: 389. 1889. – *Rhodosporus* Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 617. 1889. *Orcella* O.K. ex Earle in Bull. N.Y. bot. Gard. 5: 430. 1909. – *Pleuropus* Murrill, N.Amer. Fl. 10: 102. 1919. – *Paxillopsis* J.Lange, Fl. agar. dan. 5: VI. 1940.

MISAPPLIED – *Octojuga* sensu Fay. in Ann. Sci. Nat., Bot., sér. VII, 9: 390. 1889.

Basidiocarps omphalioid or pleurotoid; pileus more or less convex or flattened, often depressed at centre or distinctly umbilicate, white or brown; lamellae arcuate-decurrent, white then pink to pinkish brown; stipe well-developed or reduced, central, lateral or lacking; spores ellipsoid in outline with 3-12 longitudinal ribs, appearing angular in polar view; pileipellis a cutis or an ixocutis of cylindrical hyphae; cystidia usually absent; clamp-connections always absent. – Lectotype species: *Agaricus prunulus* Scop.: Fr.

HABITAT & DISTRIBUTION – In deciduous and coniferous forest, in grasslands, on wood, herbaceous plants, also on other fungi, saprophytic or forming mycorrhiza; widespread in the temperate and boreal regions of Europe.

KEY TO THE SPECIES

1. Stipe well-developed, central or (slightly) excentric, rarely lateral.
 2. Basidiocarps fleshy; pileus up to 80 mm, hemispherical to convex, usually umbonate; spores 10.5-12.5 × 5.0-6.5 µm with 6-8 distinct ribs. . . . . 1. **C. prunulus**
 2. Basidiocarps small and thin-fleshed; pileus up to 30 mm, convex to flattened with slightly depressed or distinctly umbilicate centre, rarely subpapillate; spores ranging from 6.0 to 10.0 µm in length. . . . . 2. **C. scyphoides**
1. Stipe lacking, or, if present, rather short, excentric or lateral.
 3. Basidiocarps growing on beds of cultivated *Agaricus* in dense headlike clusters; spores 4.5-6.0 × 3.0-3.5 (-4.0) µm. **5. C. fasciculatus**
 3. Basidiocarps growing singly or in small groups, never fasciculate in headlike clusters, terrestrial, on wood, herbaceous plants or on other fungi; spores > 6.0 µm long.
  4. Spores 3.5-4.0 µm broad. . . . . 2. **C. scyphoides f. reductus**
  4. Spores more than 5 µm broad.
   5. Spores (6.5-) 7.5-8.5 (-10.0) × 5.0-5.5 (-6.0) µm, on an average 7.5 × 5.0 µm; basidia 4-spored. . . . . 3. **C. hobsonii**
   5. Spores (7.0-) 8.0-11.5 (-12.5) × 5.0-7.0 µm, on an average 9.5 × 5.5 µm; basidia 4-spored or mixed 2- and 4-spored. **4. C. daamsii**

1. Clitopilus prunulus (Scop.: Fr.) Kumm., Führ. Pilzk.: 97. 1871. – Fig. 44.

Agaricus prunulus Scop., Fl. carn. 1: 437. 1772; *Agaricus prunulus* Scop.: Fr., Syst. mycol. 1: 193. 1821; *Paxillopsis prunulus* (Scop.: Fr.) J.Lange, Fl. agar. dan. 5: VI. 1940. – *Agaricus orcellus* Bull., Hist. Champ. France 2: 519. 1812; *Agaricus orcellus* Bull.: Fr., Syst. mycol. 1: 180. 1821; *Clitopilus orcellus* (Bull.: Fr.) Kumm., Führ. Pilzk.: 97. 1871.

SEL. ICON. – Cetto, Funghi Vero 1: 101. 1975; Romagn., Nouv. Atl. Champ. 1: pl. 79. 1956.

SEL. DESCR. – Mal. & Bert., Fl. Champ. sup. Maroc. 2: 38-39. 1975.

VERN. NAME. – Grote molenaar.

Pileus 25-80 mm broad, hemispherical, then convex, finally more or less applanate to shallowly depressed, usually broadly umbonate, relatively thick-fleshed with involute margin, marginal zone strongly undulating with age, not striate, white to pallid beige-grey or yellowish cream, often tinged pink or with flesh-colour, especially at centre, smooth or subtomentose-felted, sometimes slightly viscid when water-soaked. Lamellae, L = about 70, l = 1-9, crowded, decurrent, arcuate, thin, pale, then pale pinkish beige to flesh-coloured with entire, concolorous edge. Stipe 25-40 × 5-7 mm, often swollen at base (up to 10 mm broad), solid, pale, concolorous with pileus, slightly to distinctly fibrillose-striate lengthwise, smooth. Context white or tinged yellow-grey in cortex, compact, firm. Smell strongly farinaceous. Taste farinaceous.

Spores (9.0-)10.5-12.5(-14.0) × (4.5-)5.5-6.5(-8.0) µm, Q = 1.3-2, $\bar{Q}$ = 1.4-1.7, average 11-12 × 6-6.5 µm, ellipsoid to oblong or amygdaliform in outline with 6-8 distinct ribs. Basidia 25-47 × 7-12 µm, 4-spored. Pileipellis a cutis or an ixocutis of 3-7 µm wide, cylindrical hyphae. Pigment lacking or very pale, intracellular.

HABITAT & DISTR. – Solitary or in small groups, terrestrial in forest or under deciduous or coniferous trees, usually on rich soils. Not uncommon, July-Nov.

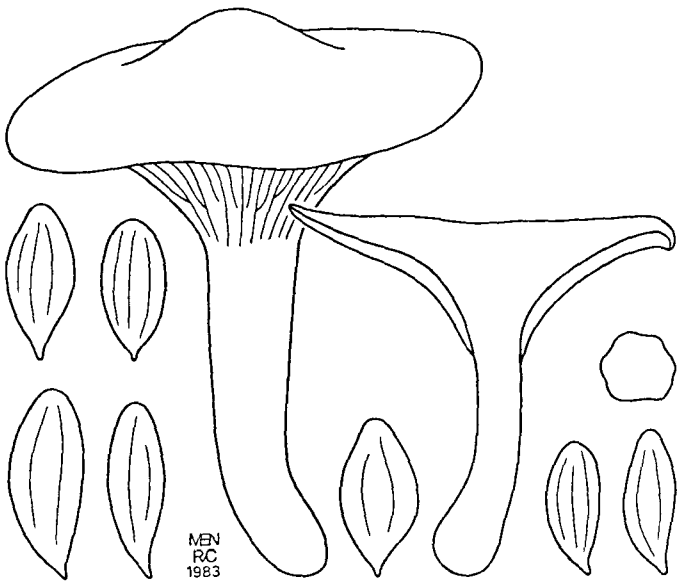

Fig. 44. *Clitopilus prunulus*.

2. Clitopilus scyphoides (Fr.: Fr.) Sing. in Farlowia 2: 554. 1946. – Fig. 45.

Agaricus scyphoides Fr.: Fr., Syst. mycol. 1: 163. 1821; *Omphalia scyphoides* (Fr.: Fr.) Kumm., Führ. Pilzk.: 106. 1871; *Omphalina scyphoides* (Fr.: Fr.) Quél., Enchir. Fung.: 42. 1886; *Clitocybe scyphoides* (Fr.: Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 174. 1960. – *Agaricus cretatus* B. & Br. in Annls Mag. nat. Hist., ser. III, 7: 373. 1861 (Notic. Brit. Fungi 903); *Clitopilus cretatus* (B. & Br.) Sacc., Syll. Fung. 5: 702. 1887. – *Clitopilus omphaliformis* Joss. in Bull. mens. Soc. linn. Lyon 10: 10. 1941; *Clitopilus giovanellae* var. *omphaliformis* (Joss.) Joss. in Bull. mens. Soc. linn. Lyon 13: 162. 1943; *Clitopilus scyphoides* f. *omphaliformis* (Joss.) Noordel. in Persoonia 12: 159. 1984. – *Clitopilus omphaliformis* f. *calathinoides* Locq. in Bull. mens. Soc. linn. Lyon 13: 107. 1943 (not valid); *Clitopilus scyphoides* f. *reductus* Noordel. in Persoonia 12: 159. 1984.

MISAPPL. – *Pleurotus mutilus* sensu Gillet, Hyménomycètes: 334. 1876; sensu J.Lange, Fl. agar. dan. 2: 71. 1937.

EXCL. – *Clitocybe scyphoides* sensu P.D.Orton in Trans. Br. mycol. Soc. 43: 174. 1960 (= *Clitocybe* spec.); *Omphalina scyphoides* sensu J.Lange, Fl. agar. dan. 2: 57. 1937 (= *Clitocybe* spec.).

VERN. NAME. – Kleine molenaar.

KEY TO THE FORMS AND VARIETIES

1. Smell sweetish, reminding of fruit or some of those sweet-smelling *Clitocybe*-species; spores 7.0-10.0 × 3.5-5.0 µm. var. **intermedius**
1. Smell weakly to distinctly farinaceous; spores 6.0-8.5 × 3.5-5.0 µm var. **scyphoides**
   2. Stipe central or excentric but well-developed.
      3. Spores 6.0-7.0 × 3.5-4.0 µm; basidiocarps small, omphalioid; pileus 3-9 mm; stipe central . . . . . f. **omphaliformis**
      3. Spores 6.5-8.5 × 3.5-5.0 µm; basidiocarps slightly to distinctly larger; pileus irregularly shaped, 5-25 mm, stipe usually slightly to distinctly excentric . . . . . f. **scyphoides**
   2. Basidiocarps spathulate; stipe strongly reduced and lateral; spores 3.5-4 µm broad . . . . . f. **reductus**

var. **scyphoides**

SEL. ICON. – Cetto, Funghi Vero 2: pl. 541. 1975. – J.Lange, Fl. agar. dan. 2: pl. 79C. 1937 (as *Pleurotus mutilis*).

SEL. DESCR. & FIGS. – Joss. in Bull. mens. Soc. linn. Lyon 10: 7-10. 1941 (as *Clitopilus cretatus*). – Noordel. in Persoonia 12: 156-160, figs. 1-3. 1984.

Pileus 5-25 mm (3-7 mm in f. *omphaliformis*), convex, then applanate with slightly to distinctly depressed centre (circular to flabelliform or reniform in f. *reductus*), not hygrophanous, white, dull, not translucently striate, slightly pruinose to velutinous (under lens). Lamellae, L = 20-35, l = 3-7, moderately distant, decurrent, arcuate, narrow to fairly broad (up to 4 mm), white, then (brown-)pink with entire, concolorous edge. Stipe 5-20 × 0.5-2 mm, (up to 1.5 × 1 or lacking in f. *reductus*), cylindrical sometimes with slightly swollen base, central (f. *omphaliformis*) or excentric (usually in f. *scyphoides*) to lateral or lacking (f. *reductus*), white, solid, finely pruinose under lens or glabrous, hyaline to pallid yellow. Context thin, white. Smell farinaceous. Taste farinaceous.

Spores 6.5-8.5 × 3.5-5.0 µm (f. *scyphoides*); 6.0-7.0 × 3.5-4.0 µm (f. *omphaliformis* or f. *reductus*), ellipsoid in outline with 6-9 (-11) rather distinct ribs. Basidia 15-30 × 5-10 µm, 4-spored. Pileipellis a cutis, sometimes with transitions to a trichoderm, made up of interwoven 2-5 µm wide, cylindrical hyphae. Pigment lacking.

HABITAT & DISTR. – Solitary or in small groups, on the ground or on debris of herbaceous plants and mosses in poorly manured grassland and also in deciduous, broad-leaved forest on humus-rich sandy or clayey soil. Not uncommon. Wide-spread in Europe. May-Nov.

var. **intermedius** (Romagn.) Noordel. in Persoonia 12: 158. 1984. – Fig. 46.

Clitopilus intermedius Romagn. in Bull. Soc. Nat. Oyonnax 8: 74. 1954 (Compl. Fl. anal. 3).

CHARACTERISTICS. – Differs from the typical variety in having slightly larger spores (7.0-10.0 × 3.5-5.0 µm) and a fruity smell.

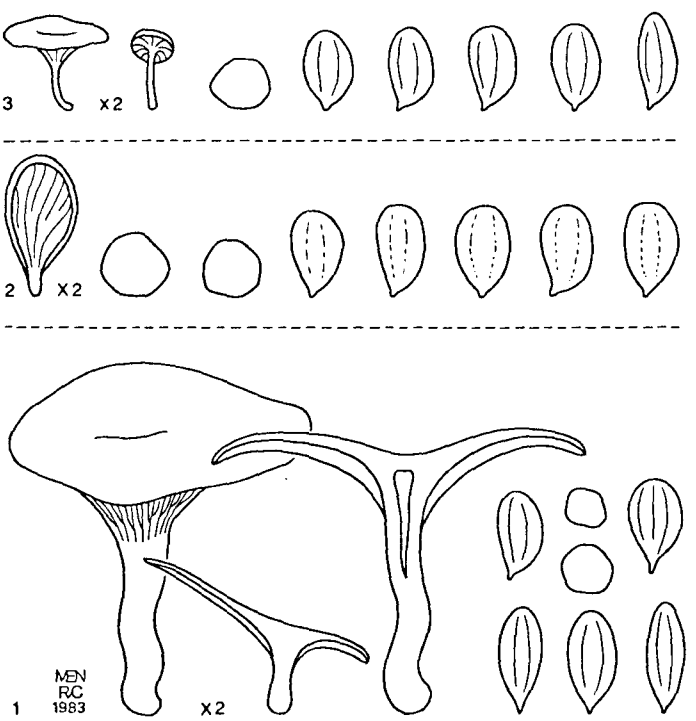

Fig. 45. *Clitopilus scyphoides*. 1. forma *scyphoides*; 2. forma *reductus*; 3. forma *omphaliformis*.

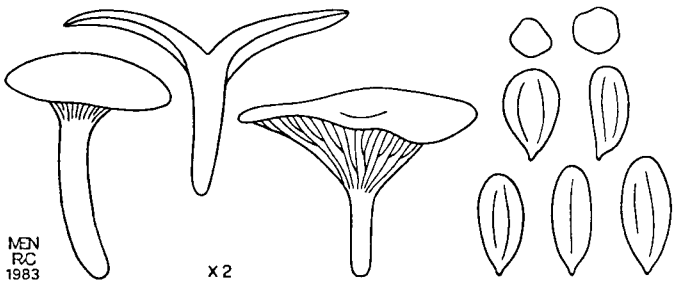

Fig. 46. *Clitopilus scyphoides* var. *intermedius*.

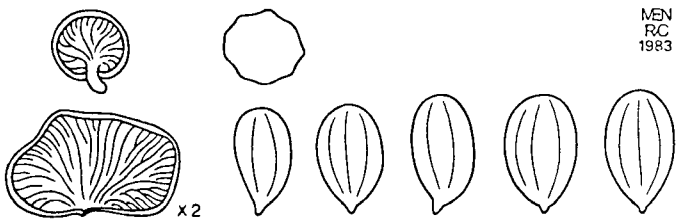

Fig. 47. *Clitopilus hobsonii*.

HABITAT & DISTR. – Terrestrial in (coniferous) forest on humus-rich, calcareous soil. Known from Belgium and France, not yet recorded from the Netherlands. Rare. Oct.

3. Clitopilus hobsonii (Berk.) P.D.Orton in Trans. Br. mycol. Soc. 43: 174. 1960. – Fig. 47.

Agaricus hobsonii Berk., Outl. Brit. Fungol.: 138. 1860; *Pleurotus hobsonii* (Berk.) Sacc., Syll. Fung. 5: 382. 1887. – *Octojuga pleurotelloides* Kühner in Botaniste 17: 158. 1926; *Clitopilus pleurotelloides* (Kühner) Joss. in Bull. mens. Soc. linn. Lyon. 10: 14. 1941. – *Octojuga fayodii* Konr. & M., Ic. sel. Fung. 6: 234. 1934.

MISAPPL. – *Claudopus variabilis* sensu Fay. in Ann. Sci. nat. Bot., sér. VII, 9: 390. 1889, – *Clitopilus pinsitus* sensu Joss. in Bull. trimest. Soc. mycol. Fr. 53: 210. 1937. – *Clitopilus septicoides* sensu Sing. in Lilloa 22: 606. 1951.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 162, fig. 7. 1984; P.D.Orton in Trans. Br. mycol. Soc. 43: 188. 1960.

Pileus 2-15(-30) mm broad, more or less circular, then reniform or lobed, more or less convex to applanate from aside, white, minutely tomentose (lens), sometimes glabrescent with age, with involute or inflexed margin. Lamellae L = 8-20, moderately distant, adnate, narrow, sometimes furcate or anastomosing, white, then slowly turning pink with concolorous, entire edge. Stipe absent or, if present, very short, strongly reduced, excentric or lateral, 1.5 × 0.2-0.5 mm, white, pruinose. Context very thin, white. Smell and taste none.

Spores (6.5-)7.5-8.5(-10.0) × 5.0-5.5(-6.0) µm, Q = 1.2-2, $\bar{Q}$ = 1.35-1.7, on average 7.5 × 5 µm, ellipsoid to oblong in outline, with 6-12 rather distinct ribs. Basidia 16-24 × 5-8.5 µm, 4-spored. Pileipellis a cutis with transitions to a trichoderm of narrow, 2-4.5 µm wide, cylindrical hyphae. Pigment absent.

HABITAT & DISTR. – Single or in small groups on wood or herbaceous plants, also on living and dead herbs, grasses, sedges, etc., common, wide-spread. May-Nov.

Clitopilus hobsonii can be recognised by its small, sessile basidiocarps and can be distinguished from *C. daamsii* and *C. scyphoides* f. *reductus* by the size and shape of the spores.

4. Clitopilus daamsii Noordel. in Persoonia 12: 161. 1984. – Fig. 48.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 161-162, fig. 6. 1984.

Pileus 2-8 mm, convex to irregularly applanate with (slightly) involute margin, white, densely tomentose under lens. Lamellae, L = (4-) 6-15, distant, sometimes furcate or anastomosing and slightly reduced, veinlike, white then pink with concolorous, entire or minutely fimbriate edge. Stipe absent or present, then strongly reduced, lateral, up to 1.5 × 1 mm, white, pruinose. Smell not known. Taste not known.

Spores (7.0-) 8.0-11.5 (-12.5) × 5.0-6.5 (-7.0) µm, Q = 1.4-2.0, $\bar{Q}$ = 1.6-1.7, on average 9.5 × 5.5 µm, ellipsoid to oblong in side-view with 6-9 rather distinct ribs. Basidia 15-25 × 6-9 µm, 4-spored or mixed 2- and 4-spored. Pileipellis a cutis with transitions to a trichoderm, made up of more or less interwoven, 2-7.5 µm wide, cylindrical hyphae. Pigment absent.

HABITAT & DISTR. – On wood or on other fungi (e.g. *Hymenochaete tabacina*). Rare. Known from the Netherlands and Denmark. Oct.-Dec.

Although very similar in habit to *C. hobsonii*, *C. daamsii* can readily be recognised by its large spores.

5. Clitopilus fasciculatus Noordel. in Persoonia 12: 160. 1984. – Fig. 49.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 160-161, fig. 5. 1984.

Pileus up to 25 mm long and 20 mm broad, more or less tubular, then flabelliform, with inflexed margin, pale brown, glabrous. Lamellae very crowded, very narrow, up to 1 mm broad, strongly undulating near margin of pileus, sometimes almost meruloid, very pale brownish pink (Mu. 2.5 Y 8/4 to 10 YR 8/3-7/4) with concolorous, entire edge. Stipe

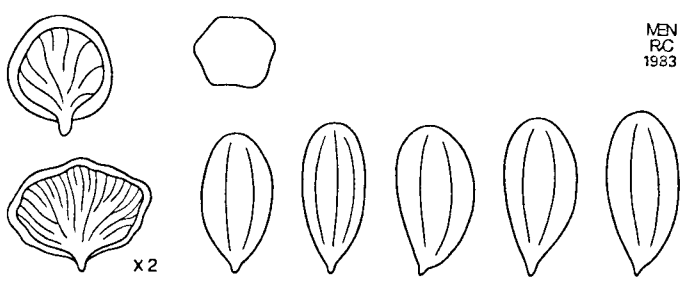

Fig. 48. *Clitopilus daamsii*.

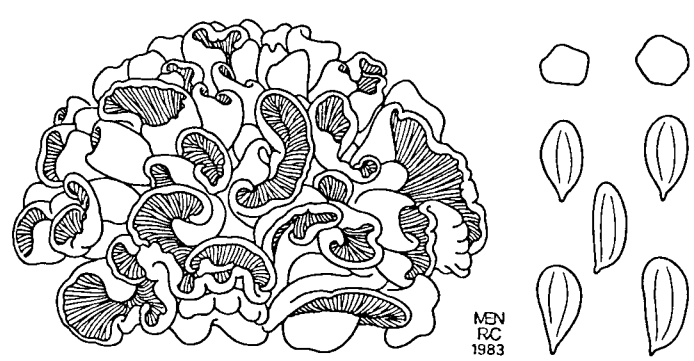

Fig. 49. *Clitopilus fasciculatus*.

absent. Context thin, hyaline. Smell acrid-fungoid, rather weak. Taste acrid-fungoid.

Spores 4.5-6.0 × 3.0-3.5 (-4.0) µm, Q = 1.2-1.85, $\bar{Q}$ = 1.5, ellipsoid to oblong in outline with 3-6, very indistinct ribs. Basidia 18-25 × 6-9 µm, 4-spored. Pileipellis a cutis with transitions to a trichoderm, made up of 2-4 µm wide, cylindrical hyphae. Pigment pale, intracellular in pileipellis.

HABITAT & DISTR. – In large, head-like clusters on beds of cultivated mushrooms. Known from the Netherlands and the German Federal Republic.

The head-like clustered basidiocarps and small spores are rather distinctive. *Clitopilus passeckerianus*, also known from mushroom-beds, differs in habit and larger spores.

3. ENTOLOMA (Fr.) Kumm., Führ. Pilzk.: 23. 1871

Nolanea (Fr.) Kumm., Führ. Pilzk.: 24. 1871. – *Leptonia* (Fr.) Kumm., Führ. Pilzk.: 24. 1871. – *Eccilia* (Fr.) Kumm., Führ. Pilzk.: 23. 1871. – *Claudopus* Gillet, Hyménomycètes: 426. 1876. – *Rhodophyllus* Quél., Enchir. Fung.: 56. 1886. – *Pouzaromyces* Pilát in Acta Mus. Nat. Prag. (B) 9: 60. 1953. – *Alboleptonia* Larg. & Benedict in Mycologia 62: 439. 1970. – *Pouzarella* Mazzer, Monogr. Stud. Gen. Pouzarella: 69. 1978.

SELECTED LITERATURE – Hesler in Beih. Nova Hedwigia 23. 1967; Horak in Beih. Nova Hedwigia 65. 1980; Noordel. in Persoonia 11: 121-151. 1981; Noordel. in Beih. Nova Hedwigia 91. 1987; Romagn. in Beih. Nova Hedwigia 59. 1979; Sing., Agaricales mod. Taxon., Ed. 4: 705-718. 1986.

Habit variable: pleurotoid, omphalioid, collybioid, mycenoid or tricholomatoid; lamellae variably inserted from free to decurrent with all possible intermediates; spores angular from all views, thin- or relatively thick-walled; spore print pink to pinkish brown; basidia 2- or 4-spored; lamella edge fertile, sterile or heterogeneous; cheilocystidia often present; pleurocystidia usually absent; pileipellis a cutis, trichoderm or hymeniderm with all possible intermediates; pigment membranal, incrusting or intracellular, frequently in combinations; pileitrama and hymenophoral trama regular; clamp-connections absent or present. – Lectotype species: *E. prunuloides* (Fr.: Fr.) Hesler.

HABITAT & DISTRIBUTION – Solitary or in groups, rarely caespitose, terrestrial or lignicolous in a great variety of biotopes, ranging from dry to wet, and from open grassland to dense forest. Most species are saprophytes, but some have recently been proved to form ectomycorrhiza.

KEYS TO THE SPECIES

1. Stipe reduced, excentrical or lateral, sometimes lacking (subgen. *Claudopus* p.p.). . . . . KEY ONE
1. Stipe well-developed, usually central, rarely (somewhat) excentric.
2. Pileus and/or stipe with blue or violaceous colour.
3. Pileus and stipe with blue or violaceous colour (subgen. *Leptonia* p.p., subgen. *Entoloma* p.p.). . . . . KEY TWO
3. Stipe only with blue or violaceous colour (subgen. *Leptonia* p.p., subgen. *Omphaliopsis*). . . . . KEY THREE
2. Pileus and stipe without blue or violaceous colour.
4. Pileus glabrous, rarely with more or less villose or rugulose centre; pileipellis a cutis or ixocutis of cylindrical, 2-10 µm wide hyphae, sometimes, particularly at centre, with some broader terminal elements.
5. Basidiocarps relatively fleshy, tricholomatoid, rarely collybioid, mycenoid or omphalioid; pileitrama and hymenophoral trama made up of relatively short, inflated elements, 40-150 µm long (subgen. *Entoloma* p.p.). . . . . KEY FOUR
5. Basidiocarps relatively thin-fleshed, mycenoid, more rarely collybioid or omphalioid; pileitrama and hymenophoral trama made up of relatively long, fusiform elements, 100-450 µm long (subgen. *Nolanea*) (compare also KEY SIX). . . . KEY FIVE
4. Pileus radially fibrillose, tomentose or squamulose, rarely glabrous; pileipellis a cutis, trichoderm, or hymeniderm, made up of inflated, 10-25 µm wide hyphae, often with still broader terminal elements.
6. Habit omphalioid; pigment incrusting in pileipellis and pileitrama (subgen. *Claudopus* p.p.). . . . . KEY SIX
6. Habit mycenoid, tricholomatoid, or collybioid, if omphalioid, then with intracellular pigment or pigment absent.
7. Habit mycenoid or tricholomatoid; pigment incrusting; clamp-connections absent (subgen. *Pouzarella*). . . . KEY SEVEN
7. Habit tricholomatoid, mycenoid, collybioid or omphalioid; pigment intracellular or absent, rarely in addition incrusting, but then clamp-connections always present.
8. Habit tricholomatoid; cheilocystidia very obvious and strongly protruding from hymenium (subgen. *Trichopilus* and *Allocybe*). . . . . KEY EIGHT
8. Habit mycenoid, collybioid or omphalioid, rarely tricholomatoid, but then without large cheilocystidia.
9. Pileus conical to convex with distinct papilla; clamp-connections present (subgen. *Inocephalus*). . . . . KEY NINE
9. Pileus conical to convex with slightly depressed to distinctly umbilicate centre, rarely with small papilla, but then clamp-connections absent (subgen. *Leptonia* p.p., *Alboleptonia*, and *Paraleptonia*). . . . . KEY TEN

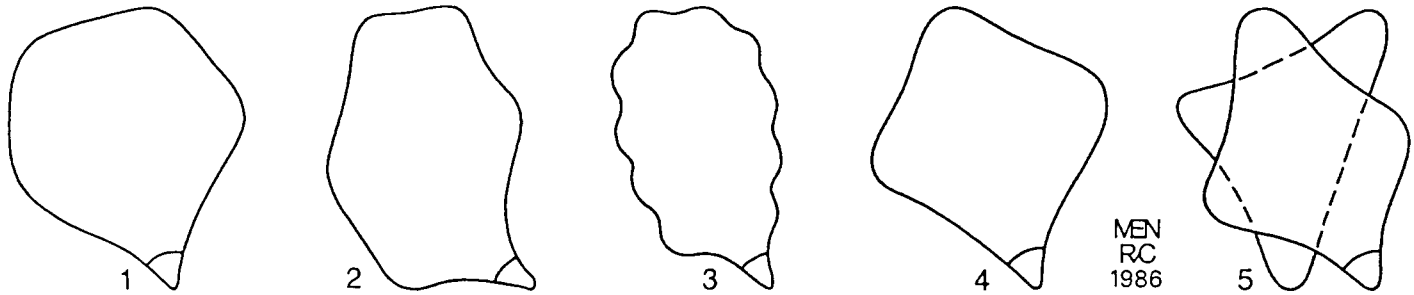

Fig. 50. Types of spores: 1. isodiametrical; 2. heterodiametrical; 3. nodulose; 4. cuboid; 5. cruciform.

KEY ONE

Basidiocarps with reduced, excentric or lateral stipe or stipe lacking (subgen. *Claudopus* p.p.).

1. Spores large, average length > 10 µm, subisodiametrical (Fig. 50), Q = 1.1-1.2, basidiocarps white or pale grey. 135. **E. parasiticum**
1. Spores small, average length < 9 µm, heterodiametrical (Fig. 50), Q = 1.3-1.7; basidiocarps white to brown.
 2. Cheilocystidia absent; pileus more or less glabrous. . . . . 134. **E. byssisedum**
 2. Cheilocystidia present, cylindrical often flexuose; pileus with silvery-white hairs. . . . . 136. **E. depluens**

KEY TWO

Pileus and stipe with blue or violaceous colour.

1. Lamella edge blue-black, fimbriate. . . . . 110. **E. serrulatum**
1. Lamella edge concolorous with sides or brown.
 2. Pileus glabrous or slightly rugulose or villose at centre only; pileipellis an (ixo)cutis of narrow, cylindrical hyphae; spores isodiametrical.
  3. Habit tricholomatoid; length of stipe not exceeding diameter of pileus; pileus often discolouring to brown with age; in poorly manured grassland. . . . . 5. **E. bloxamii**
  3. Habit mycenoid; stipe much longer than diameter of pileus; pileus usually retaining the blue colour during the development; in forest. . . . . 6. **E. nitidum**
 2. Pileus radially fibrillose, tomentose or squamulose, rarely more or less glabrous; pileipellis a cutis with transitions to a trichoderm, or a trichoderm, more rarely a hymeniderm, with (strongly) inflated 10-45 µm wide, terminal elements.
  4. Clamp-connections present in hymenium and pileipellis; pileipellis a trichoderm of septate hyphae with cylindrical or attenuated, rarely clavate terminal elements.
   5. Pileus and stipe with about the same blue or violaceous colour.
    6. Pileus and stipe violaceous; lamellae violaceous with brown edge; cheilocystidia present with intracellular pigment; on wood of deciduous trees; smell remarkable, sweetish or perfume-like. . . . . 100. **E. euchroum**
    6. Pileus and stipe dark blue; lamellae white or with slight blue tinge; cheilocystidia usually absent; terrestrial; smell not distinct. 105. **E. lepidissimum**
   5. Pileus not concolorous with stipe.
    7. Pileus grey-brown, only occasionally tinged blue at margin or with blue spots; spores thin-walled and obtusely angled. 103. **E. tjallingiorum**
    7. Pileus lilac or violaceous sometimes mixed with brown, spores relatively thick-walled and pronouncedly angled.
     8. Stipe deep blue or steel blue, innately fibrillose or glabrous; pigment intracellular. . . . . 101. **E. dichroum**
     8. Stipe pale to dark violaceous with darker, violaceous red fibrillose-flocculose covering, especially in upper part; pigment intracellular and incrusting the inner walls of the hyphae of the pileipellis. . . . . 102. **E. allochroum**
  4. Clamp-connections absent; pileipellis with cylindrical to clavate terminal elements.
   9. Pileus translucently striate at least up to half the radius, usually squamulose at centre only.
    10. Lamellae blue when young. . . . . 121. **E. chalybaeum** var. **lazulinum**
    10. Lamellae white when young. . . . . 120. **E. pseudocoelestinum**
   9. Pileus not translucently striate, usually entirely radially fibrillose, tomentose, or squamulose.
    11. Pileus and stipe with about the same grey violaceous colour. . . . . 122. **E. mougeotii**

11. Pileus and stipe dark blue or ultramarine, or blackish-violaceous.
12. Lamellae white when young. . . . . 123. **E. corvinum**
12. Lamellae blue when young. . . . . 121. **E. chalybaeum** var. **chalybaeum**

KEY THREE

Stipe blue, steel-blue or violaceous; pileus pink or some shade of brown, absolutely without blue or violaeous tinges.

1. Pileus glabrous; pileipellis an ixocutis of narrow, cylindrical hyphae; clamp-connections abundant in all tissues; spores 6.0-8.0 × 5.0-7.0 µm, very thin-walled and very obtusely angled. . . . . 27. **E. vinaceum** var. **violeipes**
1. Pileus radially fibrillose, tomentose or squamulose, rarely glabrous; pileipellis a cutis or a trichoderm, more rarely a hymeniderm of relatively broad, inflated hyphae; clamp-connections usually absent; spores distinctly larger and relatively thick-walled.
2. Clamp-connections present, at least at base of the basidia.
3. Spores 9.0-11.0 (-11.5) × 6.0-7.5 µm, $\overline{Q} > 1.35$, heterodiametrical (Fig. 50); stipe deep blue, fibrillose-flocculose; pileus 20-50 mm broad; on and round *Quercus* stumps and branches in deciduous forest. . . . . 103. **E. tjallingiorum**
3. Spores 8.0-10.0 (-11.0) × 6.0-8.0 µm, $\overline{Q} < 1.25$, (sub)isodiametrical (Fig. 50); stipe grey-blue often fading to brown with age, polished or weakly fibrillose; pileus 5-20 mm broad; in grassland often found near *Juniperus* shrub. . . 104. **E. juniperinum**
2. Clamp-connections absent.
4. Lamella edge sterile or heterogeneous; cheilocystidia present.
5. Lamella edge blackish-blue, fimbriate. . . . . 111. **E. caesiocinctum**
5. Lamella edge concolorous with sides or brown, entire or fimbriate.
6. Spores in average less than 10 µm long. . . . . 113. **E. poliopus** var. **parvisporigerum**
6. Spores in average longer than 10 µm.
7. Stipe with conspicuous blue fibrillose-flocculose covering. . . . . 114. **E. caeruleoflocculosum**
7. Stipe more or less glabrous, polished.
8. Pileus moderately dark brown, usually deeply translucently striate; cheilocystidia broadly clavate about 12-30 µm broad, not pigmented; lamella edge concolorous with sides. . . . . 112. **E. sodale**
8. Pileus dark brown to blackish, translucently striate at margin or not striate; cheilocystidia clavate, sometimes cylindrical 5-20 µm broad, often with brown, intracellular pigment; lamella edge concolorous with sides or brown. 113. **E. poliopus**
4. Lamella edge fertile; cheilocystidia absent.
9. Stipe glabrous, polished or with a few, scattered fibrils; pileus usually deeply translucently striate.
10. Spores in average more than 10 µm long; stipe grey with violaceous tinge; pileus sepia or grey-brown. 116. **E. huijsmanii**
10. Spores in average shorter than 10 µm; stipe blue or steel-grey; pileus yellow-brown or pinkish brown.
11. Pileus pinkish brown; pileitrama with minutely incrusted hyphae; in deciduous forest on humus-rich places, also in gardens, etc. . . . . 141. **E. incarnatofuscescens**
11. Pileus yellowish brown, rather pale; pigment exclusively intracellular; in poorly manured grassland. 115. **E. lividocyanulum**
9. Stipe fibrillose to flocculose all over; pileus not translucently striate or at margin only.
12. Pileus fairly pale to moderately dark brown; pileipellis a trichoderm at margin to a hymeniderm at centre, made up of rather strongly inflated, up to 45 µm wide terminal elements; stipe pale blue or violaceous with dense, silvery white fibrillose covering. . . . . 118. **E. griseocyaneum**
12. Pileus dark brown to almost black; pileipellis a trichoderm of slightly less inflated, up to 30 µm wide terminal elements; stipe dark blue or violaceous, never white fibrillose.
13. Pileus conico-convex subumbonate or with papilla less often umbilicate, not hygrophanous, not translucently striate; stipe blue at least when young; smell none; in grassland. . . . . 117. **E. anatinum**
13. Pileus convex to plano-convex, umbilicate, distinctly hygrophanous, translucently striate at margin; stipe violaceous-lilac; smell aromatical; in damp forest (*Alnetum*). . . . . 119. **E. scabrosum**

KEY FOUR

Pileus glabrous; pileipellis cutis or ixocutis; trama of pileus and lamellae made up of short elements; clamp-connections present in all tissues, only very rarely absent (subgen. *Entoloma* p.p.).

1. Pileus not hygrophanous, not translucently striate.

2. Pileus moderately dark yellow-brown; in grassland. . . . . 1. **E. prunuloides**
2. Pileus white, pale grey, grey-brown or yellow-brown; in forest.
3. Vernal species, associated with *Ulmus* or *Rosaceae*.
4. Pileus brilliantly white. . . . . 9. **E. niphoides**
4. Pileus slightly to distinctly pigmented.
5. Pileus when (very) young with fibrillose veil, in later stages grey or greyish white, sometimes with ochraceous tinges, with an irregularly spotted surface of micaceous patches alternating with glabrous ones; usually expanding under the surface of the ground and therefore often dotted with earth particles; spores large: 10.5 × 12.5 (–14.0) × 10.0 –12.0 µm, subglobose in outline; under *Ulmus*. . . . . 11. **E. saundersii**
5. Pileus without fibrillose veil; when mature usually yellow-brown to cream-colour, sometimes with ochraceous or orange tinges, with a fairly regular, silky surface; spores smaller, (7.5-) 8.0-10.5 (–11.0) × (6.5-) 8.0-10.0 (-11.0) µm, ellipsoid in outline; under *Rosaceae* (*Prunus spinosa*, *Crataegus*, *Prunus* spp.). . . . . 10. **E. saepium**
3. Species appearing in summer and autumn, not distinctly associated with *Rosaceae* or *Ulmus*, but growing in deciduous forest (*Quercus*, *Fagus*, *Fraxinus*) on humus-rich river-clay or calcareous loam.
6. Pileus pale, sometimes almost white or with ochraceous tinges; all parts of basidiocarps turn bright yellow when bruised; lamellae distant, thickish; cheilocystidia present, 22-60 × 4-8 µm, cylindrical, often flexuose. . . . . 4. **E. moserianum**
6. Pileus pale grey-brown or ochraceous, never turning bright yellow when bruised; lamellae (normally) crowded, normally thick; cheilocystidia absent.
7. Lamellae white when young; pileus pale ochraceous or grey. . . . . 3. **E. sinuatum**
7. Lamellae yellow when young; pileus pale grey-brown. . . . . 2. **E. eulividum**

1. Pileus distinctly hygrophanous, translucently striate or not.
8. Pigment incrusting.
9. Pileus dark grey-brown, red-brown, sepia or blackish brown, more or less uniformly coloured, not or only slightly paler at margin; usually not or only slightly translucently striate; pigment coarsely incrusting.
10. Basidiocarps small, relatively thin-fleshed; pileus 10-35 mm, often depressed at centre; stipe 13-45 × 2-5 (-10 at base) mm. 21. **E. gerriae**
10. Basidiocarps larger; pileus 25-75 mm; stipe 40-120 × 5-15 mm. . . . . 22. **E. myrmecophilum**
9. Pileus paler, grey-brown or yellow-brown, or with red tinges, but sometimes with contrasting, blackish brown umbo.
11. Pileus yellow-brown with strongly contrasting blackish brown umbo; pigment coarsely incrusting. 22. **E. myrmecophilum**
11. Pileus more or less uniformly coloured; pigment minutely incrusting.
12. Pileus yellow to yellow-brown without a trace of grey; smell absent. . . . . 19. **E. majaloides**
12. Pileus grey-brown or yellowish grey, sometimes tinged red, smell usually distinct, nitrous or farinaceous.
13. Pileus 10-45 (-55) mm broad, sordid grey-brown or reddish brown; stipe sordid grey to almost white, faintly striate to almost polished; lamellae grey-brown; smell farinaceous rancid. . . . . 18. **E. sordidulum**
13. Pileus 30-110 mm broad, yellow-brown or reddish brown; stipe brilliantly white, silvery striate lengthwise; lamellae pale then pink; smell faintly nitrous at first, then often farinaceous. . . . . 20. **E. sericatum**
8. Pigment intracellular.
14. Spores faintly angled with many, rather obtuse angles in side-view, thin-walled, small, 6.0-8.0 (-9.0) × 5.0-7.0 (-8.0) µm.
15. Basidiocarps small, collybioid or almost mycenoid; pileus 5-30 mm, convex with depressed centre, rarely with weak papilla; lamellae broadly adnate, often with decurrent tooth, rarely emarginate; stipe 1.5-3 mm broad. . . . . 27. **E. vinaceum**
15. Basidiocarps small to medium-sized, tricholomatoid; pileus 15-60 (-80) mm, convex, usually umbonate; lamellae emarginate to almost free; stipe 3-8 (-13) mm broad. . . . . 26. **E. turbidum**
14. Spores distinctly angled and usually slightly to distinctly thick-walled, larger, 7.0-11.0 or more µm long.
16. Vernal species, associated with *Rosaceae* or *Ulmus*; pileipellis a thin to thick ixocutis.
17. Pileus moderately dark to dark sepia or grey-brown.
18. Stipe solid and remaining so with age; context of stipe guaiac-negative; pileus usually slightly to distinctly rugulose, especially at centre or with small pits, not translucently striate; under *Rosaceae*. . . . . 7. **E. clypeatum**
18. Stipe fistulose already when young; context of stipe guaiac-positive; pileus smooth and glabrous, translucently striate; under *Ulmus*. . . . . 8. **E. aprile**
17. Pileus pale, when young almost white then pale brown, grey or ochraceous.
19. Context of stipe reacting positively to Guaiac, and also turning pale to intensely orange when bruised. . 10. **E. saepium**
19. Context of stipe not reacting with Guaiac, and not turning orange when bruised.
20. Lamellae distant, thickish, yellow when young; stipe white soon tinged yellow. . . 7. **E. clypeatum** f. **xanthophyllum**
20. Lamellae moderately crowded, normally thick, white or pale grey when young; stipe white or grey. 7. **E. clypeatum** f. **pallidogriseum**

16. Species from summer and autumn, not associated with *Rosaceae* or *Ulmus*.
21. Habit collybioid with slightly to distinctly depressed pileus; stipe glabrous, often polished, rarely with some adpressed fibrils lengthwise.
22. Basidia 2-spored. . . . . 25. **E. bisporigerum**
22. Basidia 4-spored.
23. Spores isodiametrical to subisodiametrical, Q = 1.0-1.3, $\bar{Q}$ = 1.15; smell none or nitrous. . . . . 23. **E. politum**
23. Spores heterodiametrical, Q = 1.1-1.5, $\bar{Q}$ = 1.25-1.3; smell farinaceous. . . . . 24. **E. caccabus**
21. Habit tricholomatoid, pileus usually broadly umbonate; stipe usually distinctly striate with adpressed to loose fibrils.
24. Pileus brilliantly white or very pale greyish yellow and smell never nitrous.
25. Cheilocystidia absent. . . . . 14. **E. speculum**
25. Cheilocystidia present. . . . . 15. **E. leucocarpum**
24. Pileus distinctly coloured, if very pale then with nitrous smell.
26. Lamellae dark reddish brown; spores elongate-angular in outline, 9.5-12.5 × 6.5-9.0 µm, $\bar{Q}$ = 1.3-1.4. 17. **E. sphagneti**
26. Lamellae never dark reddish brown; spores subisodiametrical, $\bar{Q}$ = 1.15-1.25.
27. Habit robust; context firm; pileus thick-fleshed, moderately dark sepia or horn brown; lamellae white then pink; stipe white or pale grey-yellow, shiny, fibrillose-striate; smell farinaceous. . . . . 13. **E. lividoalbum**
27. Habit small to fairly large, but then with brittle context, hollow stipe, and nitrous smell.
28. Pileus 20-75 mm, pale yellow-brown; stipe 25-95 (-125) × 5-15 mm, striate; smell nitrous. . . . . 12. **E. nidorosum**
28. Pileus 15-35 (-50) mm, moderately dark brown often with reddish tinge; stipe 25-50 × 1.5-4 mm, only faintly striate; smell farinaceous. . . . . 16. **E. subradiatum**

KEY FIVE

Basidiocarps mycenoid, rarely collybioid or omphalioid; hymenophoral trama made up of long, inflated elements (subgen. *Nolanea* and *Entoloma* p.p.).

1. Spores cruciform-stellate or cuboid (Fig. 50).
2. Spores cruciform-stellate; cheilocystidia absent. . . . . 40. **E. conferendum**
2. Spores cuboid; cheilocystidia present, lageniform. . . . . 41. **E. rhombisporum**
1. Spores 5- or more angled in side-view, never cruciform-stellate.
3. Cheilocystidia present.
4. Lamellae olivaceous green, especially when young. . . . . 85. **E. chlorophyllum**
4. Lamellae white, grey or brown when young.
5. Spores isodiameterical (Fig. 50); cheilocystidia subcylindrical to tibiiform. . . . . 53. **E. tibiicystidiatum**
5. Spores heterodiametrical (Fig. 50), Q > 1.2.
6. Cheilocystidia globose or sphaeropedunculate.
7. Clamp-connections present; pigment incrusting. . . . . 59. **E. sphaerocystis**
7. Clamp-connections absent; pigment intracellular. . . . . 83. **E. globuliferum**
6. Cheilocystidia cylindrical, clavate, lageniform or lecythiform.
8. Pigment intracellular only.
9. Cheilocystidia lecythiform to tibiiform; lamellae very dark brown when young. . . . . 82. **E. inutile.**
9. Cheilocystidia fusiform, narrowly lageniform or cylindrical; lamellae pale to moderately dark brown.
10. Spores more than 10 µm long; cheilocystidia cylindrical to fusiform or slenderly lageniform, much longer than 40 µm. 80. **E. velenovskyi**
10. Spores less than 10 µm long; cheilocystidia cylindrical often subcapitate, up to 40 µm long. 81. **E. cryptocystidiatum**
8. Pigment incrusting, sometimes in addition intracellular.
11. Pigment incrusting only; smell strong, aromatical, like caramel. . . . . 55. **E. sacchariolens**
11. Pigment incrusting and intracellular in subpellis; smell none or farinaceous.
12. Spores 6.0-7.5 (-8.0) µm wide; stipe slender, 1-3 (-5) mm thick. . . . . 39. **E. hebes**
12. Spores 8.0-9.5 µm wide; stipe 3-7 (-10) mm thick.
13. Pileus conical, only slightly expanding with involute margin; stipe much longer than diameter of pileus. 37. **E. hirtipes**
13. Pileus convex then plano-convex usually with small papilla and straight margin; stipe one or two times as long as diameter of pileus. . . . . 38. **E. kuehnerianum**
3. Cheilocystidia absent.
14. Basidia 2-spored.

15. Clamp-connections present; pigment minutely incrusting; stipe-apex with capitate hairs. . . . . 47. **E. cuspidiferum**
15. Clamp-connections absent; pigment membranal or intracellular; stipe without capitate hairs.
16. Basidiocarps mycenoid, usually with distinct papilla on pileus; stipe silvery striate; smell and taste none. 67. **E. cetratum**
16. Basidiocarps collybioid or omphalioid; pileus usually depressed; stipe glabrous, polished; smell and especially taste distinctly farinaceous. . . . . 68. **E. farinogustus**
14. Basidia 4-spored.
17. Pigment intracellular only.
18. Spores isodiametrical, $\overline{Q} = 1.05\text{-}1.15$.
19. Pileus usually convex to concave, depressed at centre, reddish brown; clamp-connections absent. . . . 28. **E. costatum**
19. Pileus usually convex with papilla, dark grey-brown; clamp-connections present in hymenium. 71. **E. occultopigmentatum**
18. Spores heterodiametrical, $\overline{Q} \geq 1.2$.
20. Pileus yellow olivaceous; smell usually strong, aromatic, like caramel or like that of *Hebeloma sacchariolens*. 84. **E. pleopodium**
20. Pileus without olivaceous tinges; smell none or farinaceous.
21. Spores 5-7 µm broad.
22. Pileus blackish brown; spores irregularly 6-9-angular in side-view. . . . . 79. **E. undulatosporum**
22. Pileus moderately dark brown, red-brown or yellow-brown; spores regularly 5-7-angled in side-view.
23. Stipe grey-brown to blackish brown; pileus moderately dark brown, often with ochraceous tinge; smell none. 75. **E. solstitiale**
23. Stipe moderately dark yellow or red-brown; pileus yellow-brown or reddish brown; smell strongly nitrous. 76. **E. chlorinosum**
21. Spores 7-10 µm wide.
24. Stipe polished.
25. Stipe yellow; pileus pinkish or red-brown. . . . . 77. **E. verecundum**
25. Stipe dark (horn) brown; pileus blackish brown. . . . . 78. **E. triste**
24. Stipe striate with silvery fibrils.
26. Spores 10-12 µm long, $Q = 1.25\text{-}1.5$, $\overline{Q} = 1.4$; in forest.
27. Pileus and stipe very pale brown, stipe entirely pruinose. . . . . 70. **E. lanuginosipes**
27. Pileus date brown with yellow papilla; stipe yellow-brown, usually pruinose at apex only. . . . . 69. **E. cuneatum**
26. Spores 8.5-10.0 µm long, $Q = 1.1\text{-}1.4$, $\overline{Q} = 1.25$; in grassland.
28. Pileus pale orange-brown with grey-brown striation up to centre; lamellae pale pink without grey tinges, (sub)ventricose, normally thick. . . . . 72. **E. calthionis**
28. Pileus pale grey-brown with slight ochraceous tinge, with darker brown striation up to centre; lamellae grey then brown-pink, broadly ventricose, thickish. . . . . 73. **E. ventricosum**
17. Pigment incrusting (especially on narrowest hyphae of pileipellis and upper pileitrama), sometimes also intracellular.
29. Clamp-connections absent.
30. Pigment minutely incrusting; pileus umbilicate; spores isodiametrical (Fig. 50), $Q = 1.0\text{-}1.2$. . . . . 58. **E. sericeoides**
30. Pigment coarsely incrusting, in addition also intracellular in form of agglutinated granules in pileipellis; pileus usually with papilla; spores heterodiametrical (Fig. 50), $Q > 1.2$.
31. Stipe distinctly silvery striate.
32. Pileus grey-brown with yellow or red tinge, pallescent on drying; lamellae white then pink; context very brittle in pileus; spores 8.0-10.5 (-11.0) × 6.0-7.0 (-7.5) µm. . . . . 62. **E. acidophilum**
32. Pileus grey-brown, only slightly pallescent on drying; lamellae pale brown-grey then sordid pink; context relatively firm in pileus; spores 7.5-9.5 (-10.5) × 6.0-7.0 (-7.5) µm. . . . . 63. **E. argenteostriatum**
31. Stipe glabrous, polished or slightly pruinose.
33. Stipe yellow. . . . . 66. **E. xanthocaulon**
33. Stipe grey-brown.
34. Spores weakly angular, rounded, 6.5-8.0 × 5.5-7.0 (-7.5) µm, $\overline{Q} = 1.2$. . . . . 65. **E. defibulatum**
34. Spores pronouncedly angled, $\overline{Q} \geq 1.25$.
35. Spores 9.0-12.5 µm long, $\overline{Q} = 1.45$. . . . . 64. **E. cuniculorum**
35. Spores shorter than 10.5 µm, $\overline{Q} = 1.3$.
36. Pileus weakly hygrophanous, translucently striate at margin only, fibrillose-subsquamulose. . . 60. **E. fernandae**
36. Pileus distinctly hygrophanous, deeply translucently striate, glabrous. . . . . 61. **E. psilopus**
29. Clamp-connections present, at least in hymenium.
37. Spores isodiametrical (Fig. 50), $\overline{Q} = 1.1$.

38. Pigment incrusting only or rarely some intracellular pigment present also; subpellis indistinct; habit collybioid, more rarely mycenoid; in grassland. . . . . 57. **E. sericeum**
38. Pigment minutely incrusting and in addition intracellular, especially in the subpellis that is usually well-developed.
39. Pileus fairly dark brown or grey-brown, glabrous; stipe glabrous or substriate with some loose fibrils; smell strong, farinaceous or rancid. . . . . 51. **E. juncinum**
39. Pileus moderately dark brown, often with ochraceous tinge, covered with loose fibrils, shiny; stipe strongly silvery striate; smell weak, somewhat earthy, never farinaceous. . . . . 52. **E. nitens**

37. Spores heterodiametrical (Fig. 50), $\bar{Q} \geq 1.25$.
40. Smell strong, aromatic, like caramel, reminiscent of that of *Hebeloma sacchariolens*. . . . . 54. **E. ameides**
40. Smell none or farinaceous.
41. Pileus and stipe pale beige or brown; basidiocarps tiny and brittle; smell absent.
42. Pileus usually slightly depressed at centre with conspicuous darker spot, rarely with small papilla; lamellae pale pink; stipe glabrous, polished; spores 8.0-10.5 (-11.5) × 6.5-8.0 (-8.5) µm. . . . . 50. **E. minutum**
42. Pileus with distinct papilla, never depressed; lamellae grey-pink.
43. Stipe with capitate hairs at apex; spores 9.5-12.0 (-14.) × 7.0-9.5 µm. . . . . 48. **E. favrei**
43. Stipe without capitate hairs, entirely glabrous; spores 7.5-9.5 (-10.5) × 6.0-8.0 (-8.5) µm. 49. **E. pygmaeopapillatum**

41. Pileus and stipe moderately dark to very dark brown, red-brown, sepia or yellow-brown.
44. Spores very obtusely angular, more or less rounded in outline, 7.5-8.5 (-9.5) × 5.5-7.5 (-8.5) µm, Q = 1.1-1.3, $\bar{Q}$ = 1.2; stipe strongly silvery striate. . . . . 46. **E. ortonii**
44. Spores pronouncedly angular; stipe polished or substriate.
45. Spores 8.5-10.5 × 6.5-8.0 (-9.0) µm, $\bar{Q}$ = 1.2-1.25. . . . . 44. **E. lucidum**
45. Spores slightly larger and $\bar{Q} > 1.3$.
46. Lamella very dark brown already when young, thickish; pileus and stipe very dark brown; stipe polished; smell none. 43. **E. clandestinum**
46. Lamellae white or pale never dark brown when young, normally thick; stipe moderately dark brown; smell farinaceous or none.
47. Average spore-length < 10 µm.
48. Pileus glabrous, yellow-brown or red-brown, strongly pallescent on drying; stipe polished; lamellae white then pink. . . . . 74. **E. infula**
48. Pileus reddish brown, with loose, radially fibrillose covering, shiny; stipe substriate; lamellae brown-pink. 45. **E. sericeonitens**

47. Spores with average length > 10 µm.
49. Pileus dark red-brown or sepia; stipe concolorous, polished or substriate without distinct hairs; in poorly manured grassland, in summer and autumn. . . . . 42. **E. papillatum**
49. Pileus dark brown or sepia, sometimes with very slight olivaceous tinge; stipe concolorous or paler, white pruinose at apex with cylindrical or clavate hairs; in coniferous forest in spring. . . . . 56. **E. vernum**

KEY SIX

Habit omphalioid, rarely collybioid; pigment often coarsely incrusting in pileipellis and pileitrama (subgen. *Claudopus* p.p.).

1. Spores distinctly heterodiametrical, $\bar{Q}$ = 1.35-1.4 (Fig. 50), pileus not hygrophanous, not translucently striate, entirely subtomentose or radially fibrillose, frequently more or less zonate. . . . . 137. **E. undatum**
1. Spores (sub-)isodiametrical, $\bar{Q}$ = 1.0-1.15 (Fig. 50), pileus weakly to distinctly hygrophanous, translucently striate when moist.
2. Pileus pale pinkish brown; cheilocystidia present, narrowly lageniform; clamp-connections present. . . . 138. **E. rhodocylix.**
2. Pileus moderately dark to very dark brown; cheilocystidia, if present, clavate to subglobose; clamp-connections absent.
3. Cheilocystidia absent; lamellae pale then pinkish brown; pileus moderately dark brown. . . . . 139. **E. rusticoides**
3. Cheilocystidia present, broadly clavate to subglobose; lamellae very dark grey or brown when young; pileus very dark brown to almost black. . . . . 140. **E. phaeocyathus**

KEY SEVEN

Habit mycenoid, pileipellis with incrusting pigment; clamp-connections absent (subgen. *Pouzarella*).

1. Cheilocystidia absent; pileipellis with incrusting and granular-intracellular pigment, and stipe without incrusted, septate hairs.

Compare KEY FIVE, couplet 30 (*fernandae*-group)

1. Cheilocystidia present, rarely absent and then pileipellis without granular-intracellular pigment, and stipe with septate, incrusted hairs.
 2. Cheilocystidia lageniform or fusiform; pigment incrusting and pale, diffusely intracellular in pileipellis.
  3. Pileus and stipe with distinct olivaceous green tinges. . . . . 34. **E. versatile**
  3. Pileus and stipe grey to grey-brown. . . . . 35. **E. araneosum**
 2. Cheilocystidia clavate to conical; pigment incrusting only.
  4. Spores on average longer than 15 µm.
   5. Pileus and stipe with long, reddish, non-incrusted, setiform hairs. . . . . 29. **E. strigosissimum**
   5. Pileus and stipe with septate, thin-walled, incrusted hairs. . . . . 30. **E. dysthales**
  4. Spores on average shorter than 15 µm.
   6. Spores 10.0-12.0 × 7.0-8.0 µm, weakly angled, thin-walled; pileus and stipe pale grey-brown; hairs of stipe 1-3 septate, with minutely incrusted walls. . . . . 33. **E. pulvereum**
   6. Spores 10.0-15.0 × 7.0-9.0 µm, slightly thick-walled, pronouncedly angular; pileus and stipe dark brown or grey.
    7. Spores 10.5-13.5 (-15.0) × 7.0-8.0 (-9.0) µm; pileus and stipe dark brown or grey-brown; hairs of stipe 1-5 septate, with incrusted walls. . . . . 31. **E. dysthaloides**
    7. Spores (10.0-) 11.0-15.0 (-15.5) × 7.0-8.0 (-10.0) µm; pileus and stipe grey; hairs of stipe 1-3 septate, with pale, non-incrusted walls. . . . . 32. **E. hirtum**

KEY EIGHT

Habit tricholomatoid; cheilocystidia present; pigment membranal or intracellular; pileipellis a cutis or trichoderm (subgen. *Trichopilus* and *Allocybe*).

1. Cheilocystidia fusiform to lageniform, 50-110 × 10-25 µm; pileus pale brown; pileipellis a cutis with membranal pigment. 36. **E. excentricum**
1. Cheilocystidia cylindrical, clavate, lecythiform to tibiiform, smaller, pileus usually intensely coloured; pileipellis a trichoderm with intracellular pigment.
 2. Clamp-connections absent; pileus coarsely radially fibrillose to subsquamulose, often showing the context between the fibrils; cheilocystidia often with mucronate capitulum. . . . . 90. **E. scabiosum**
 2. Clamp-connections present; pileus radially fibrillose to tomentose or squamulose, usually not showing context between the fibrils; cheilocystidia, if capitate, then usually not mucronate.
  3. Pileus rather strongly radially fibrillose, tomentose or squamulose, not hygrophanous; smell none.
   4. Pileus (dark) grey-brown or brown; lamellae dark grey-brown then red-brown; cheilocystidia mostly lecythiform with slender neck and distinct capitulum. . . . . 86. **E. jubatum**
   4. Pileus and often also stipe with porphyraceous-reddish tinges; lamellae pale, then pink; cheilocystidia often with moniliform, capitate neck. . . . . 87. **E. porphyrophaeum**
  3. Pileus weakly to distinctly hygrophanous, tomentose or radially fibrillose, often glabrescent; smell farinaceous.
   5. Lamella edge concolorous with sides. . . . . 88. **E. elodes**
   5. Lamella edge brown. . . . . 89. **E. fuscomarginatum**

KEY NINE

Pileus conical to convex with distinct papilla, radially fibrillose to squamulose; pileipellis trichodermal; clamp-connections present (subgen. *Inocephalus*).

1. Pileus radially venose like in some *Pluteus* species; cheilocystidia 35-135 × 4.5-9 µm, cylindrical, flexuose; pileipellis a trichoderm of fusiform elements with intracellular pigment, upper pileitrama with incrusted pigment. . . . . 91. **E. kitsii**
1. Pileus radially fibrillose to squamulose, often like in some species of *Inocybe*; pileipellis a trichoderm of cylindrical to inflated elements.
 2. Cheilocystidia slenderly to broadly clavate with pointed or mucronate apex. . . . . 98. **E. carbonicola**
 2. Cheilocystidia, if present, fusoid-cylindrical.
  3. Spores rather regularly 5-7-angled in side-view.
   4. Stipe fibrillose-striate, dark brown; spores 8.0-12.0 × 7.5-8.5 µm, $\bar{Q} = 1.25$. . . . . 93. **E. plebeioides**
   4. Stipe polished, pale brown; spores 8.0-11.0 × 6.0-8.0 µm, $\bar{Q} = 1.25$. . . . . 94. **E. resutum**
  3. Spores irregularly nodulose-angular (Fig. 50).

5. Spores (9.0-) 10.5-14.5 (-17.0) × 7.0-11.0 µm; pileus 10-40 mm broad, dark grey-brown, radially fibrillose to tomentose, relatively fleshy; stipe 25-75 × 2-6 mm, almost white; vernal, in forest. . . . . 92. **E. plebejum**
5. Spores 9.0-12.0 (-14.0) × 6.5-8.5 µm, pileus 5-20 mm broad, grey-brown, fibrillose-squamulose, relatively thin-fleshed; stipe 15-55 × 1-3 mm, yellow-brown or grey-brown, often tinged red at base, densely silky-striate; autumnal, in grassland. 99. **E. hispidulum**

KEY TEN

Pileus conical to convex usually slightly to distinctly depressed or umbilicate, rarely with papilla but then clamp-connections absent (subgen. *Leptonia* p.p., *Paraleptonia*, and *Alboleptonia*).

1. Basidiocarps white.
2. Clamp-connections absent; pileus and stipe with capitate hairs. . . . . 97. **E. cephalotrichum**
2. Clamp-connections present, pileus and stipe without capitate hairs.
3. Cheilocystidia present; pileus not translucently striate when moist, entirely tomentose or squamulose. . . . 95. **E. sericellum**
3. Cheilocystidia absent; pileus translucently striate when moist, fibrillous-subsquamulose in central part only. . 96. **E. olorinum**
1. Basidiocarps distinctly coloured.
4. Clamp-connections present.
5. Cheilocystidia absent.
6. Pileus translucently striate up to centre when moist, almost glabrous, slightly hygrophanous, fibrillose-subsquamulose at centre when dry. . . . . 109. **E. farinasprellum**
6. Pileus not translucently striate or at margin only, not hygrophanous, radially fibrillose to tomentose or squamulose, never glabrous.
7. Pileus brown; spores 9.0-13.5 (-18.0) × 6.0-9.0 µm, $\bar{Q}$ = 1.5, very irregular in outline. . . . . 144. **E. sarcitum**
7. Pileus pallid, cream-colour; spores broad, $\bar{Q}$ = 1.25-1.45.
8. Spores 9.0-12.5 × 6.0-9.0 (-10.0) µm, $\bar{Q}$ = 1.35-1.45, irregularly nodulose-angular (Fig. 50). . . . . 142. **E. neglectum**
8. Spores 9.5-11.0 × 7.0-8.0 µm, Q = 1.25, not nodulose, but acutely angled. . . . . 143. **E. pallens**
5. Cheilocystidia present.
9. Basidiocarps white with ochraceous tinge at centre of pileus, or pileus bright yellow ochraceous. . . . . 95. **E. sericellum**
9. Basidiocarps brown or greyish, if pale-coloured, then never with bright yellow or ochraceous tinges.
10. Pileus dark grey-brown; stipe concolorous or paler, fibrillose-striate. . . . . 106. **E. griseorubidum**
10. Pileus and stipe pale grey-brown; stipe polished.
11. Pileus not translucently striate, strongly radially fibrillose; cheilocystidia 27-60 × 15-30 µm, lageniform to conical or fusiform. . . . . 107. **E. calaminare**
11. Pileus translucently striate, rugulose or minutely squamulose at centre only; cheilocystidia 40-110 × 5-15 µm, cylindrical to narrowly lageniform. . . . . 108. **E. cocles**
4. Clamp-connections absent.
12. Pileus pink.
13. Stipe pink; lamella edge fertile or heterogeneous with clavate to broadly lageniform cheilocystidia. . . . . 132. **E. roseum**
13. Stipe white; lamella edge sterile with cylindrical cheilocystidia. . . . . 133. **E. queletii**
12. Pileus yellow-brown, brown, porphyraceous or grey, sometimes tinged green, without pink colour.
14. Stipe with glaucous or green tinges.
15. Pileus yellow-green, yellow or brown; stipe vividly yellow-green, turning blue-green when bruised; lamella edge fertile; cheilocystidia absent. . . . . 124. **E. incanum**
15. Pileus pale creamy brown or glaucous grey; stipe pale glaucous green; lamella edge sterile; cheilocystidia present. 125. **E. exile**
14. Stipe devoid of glaucous or green tinges.
16. Pileus porphyraceousgrey; stipe strongly fibrillose-flocculose. . . . . 130. **E. porphyrofibrillum**
16. Pileus yellow, yellow-brown, brown, or grey-brown.
17. Pileus vividly yellow, reddish yellow or yellow-brown.
18. Pileus yellow or yellow-brown with darker centre; lamella yellow ochraceous with brown, rarely concolorous, fimbriate edge; stipe yellow; spores on average 11.2-12.2 × 7.5-8.3 µm. . . . . 126. **E. xanthochroum**
18. Pileus yellow-brown to reddish yellow; lamellae white then pink with concolorous edge; stipe yellow to yellow-brown; spores on average 9.5-11.7 × 6.5-7.5 µm. . . . . 127. **E. formosum**
17. Pileus grey-brown or brown, without distinct yellow tinges.
19. Pileus moderately dark brown, slightly hygrophanous, translucently striate at least up to half the radius when moist,

squamulose at centre only. . . . . 131. **E. sarcitulum**

19. Pileus dark grey-brown, not hygrophanous, not translucently striate or at margin only, entirely fibrillose-squamulose or tomentose.

20. Spores 9.0-12.5 (-13.5) × 6.0-9.0 µm; base of stipe, and often also context, slowly turning pink or red when bruised. 128. **E. turci**

20. Spores 7.5-11.0 × 6.0-7.5 µm; no part of basidiocarp turning red or pink when bruised. . . . . 129. **E. pseudoturci**

Subgen. ENTOLOMA

SEL. LIT. – Noordel. in Persoonia 11: 153-250. 1981.

Basidiocarps usually tricholomatoid, more rarely collybioid, mycenoid or omphalioid; pileus usually convex with umbo, glabrous; pileipellis a (ixo-)cutis; hymenophoral trama and pileitrama made up of relatively short, cylindrical to inflated elements, on an average 40-150 µm long.

Sect. Entoloma

Basidiocarps robust, tricholomatoid; pileus not hygrophanous, not translucently striate; spores (sub-)isodiametrical; pileipellis a (ixo)-cutis of narrow cylindrical hyphae with intracellular pigment. Aestival-autumnal.

1. Entoloma prunuloides (Fr.: Fr.) Quél. in Mém. Soc. Emul., Montbéliard, sér. II, 5: 117. 1872 (Champ. Jura Vosges 11). – Fig. 51.

Agaricus prunuloides Fr.: Fr., Syst. mycol. 1: 198. 1821; *Rhodophyllus prunuloides* (Fr.: Fr.) Quél., Enchir. Fung.: 57. 1886. – *Entoloma autumnale* Velen., Novit. mycol. nov.: 133. 1949.

MISAPPL. – *Rhodophyllus repandus* sensu J.Lange, Fl. agar. dan. 2: 95, pl. 73A. 1937.

EXCL. – *Rhodophyllus prunuloides* sensu Konr. & M., Ic. sel. Fung. 2: pl. 187. 1930 (= *E. saepium*).

SEL. ICON – Einh. in Ber. bayer. bot. Ges. 41: pl. 11a. 1969; J.Lange, Fl. agar. dan. 2: pl. 73A (as *R. repandus*); pl. 73B. 1937; Michael, Hennig, Kreisel, Handb. Pilzfr. 3, 3. Aufl.: 203. 1979.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 107, figs 22-24. 1969; Kühner in Bull. trimest. Soc. mycol. Fr. 93: 457-459. 1977; Noordeloos in Persoonia 11: 231-232, Figs. 32a,b. 1981.

VERN. NAME. – Molenaarssatijnzwam.

Pileus 25-70 mm, conico-convex then convex, finally plano-convex usually with low, broad umbo, with slightly involute margin when young, not hygrophanous, not striate, yellowish brown to yellowish grey, relatively pale (Mu. 2.5 Y 8/3-10 YR 8/4) centre slightly darker (towards 10 YR 8/6-8/8, 7/6) slightly viscid when moist, satiny on drying, smooth. Lamellae, L = 45-50, l = 1-3, moderately distant, thickish, deeply emarginate, ventricose, white then pale pink with irregularly dentate, concolorous edge. Stipe 40-75 × 8-12 mm, cylindrical usually tapering downwards, white then tinged yellowish-greyish in middle part when old, coarsely fibrose-striate lengthwise, smooth, solid. Context firm, white but brown in cortex of pileus. Smell strongly farinaceous. Taste strongly farinaceous-rancid.

Spores 7.0-8.0 (-8.5) × 6.5-8.0 µm, Q = 1.0-1.1, $\bar{Q}$ = 1.05, isodiametrical, 5-7-angled in side-view. Basidia 27-45 × 7-13 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of 2.5-7.0 µm wide cylindrical hyphae. Pigment pale brown, intracellular in pileipellis. Clamp-connections numerous in all tissues.

HABITAT & DISTR. – Single or in small groups in grassland on calcareous loam. Very rare. Only known from the south of the province of Limburg (Bemelen: Bemelerberg; Wijlre). Aug.-Nov.

Entoloma prunuloides is a rare species in the lowlands of north-western Europe occurring in unmanured grasslands. It is probably more common in subalpine meadows in central Europe. *Entoloma prunuloides* differs from *E. eulividum* and *E. sinuatum* in smaller spores and habitat.

The description above is partly based on extralimital material.

2. Entoloma eulividum Noordel. in Persoonia 12: 457. 1985. – Fig. 52.

MISAPPL. – *Entoloma lividum* sensu Quél., auct. eur. p.p. – *Entoloma*

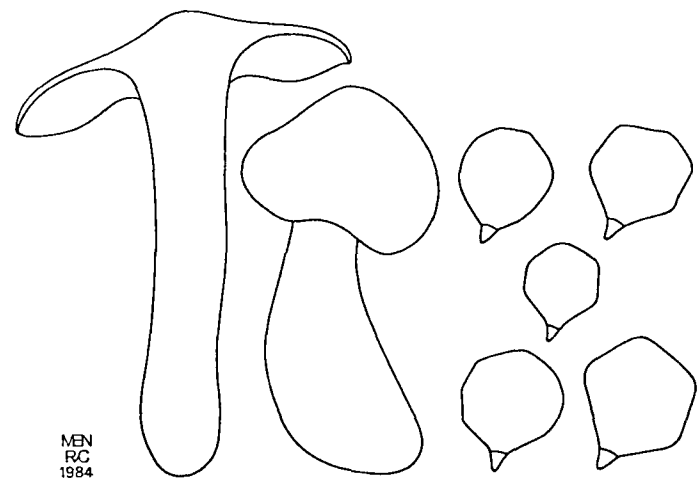

Fig. 51. *Entoloma prunuloides*.

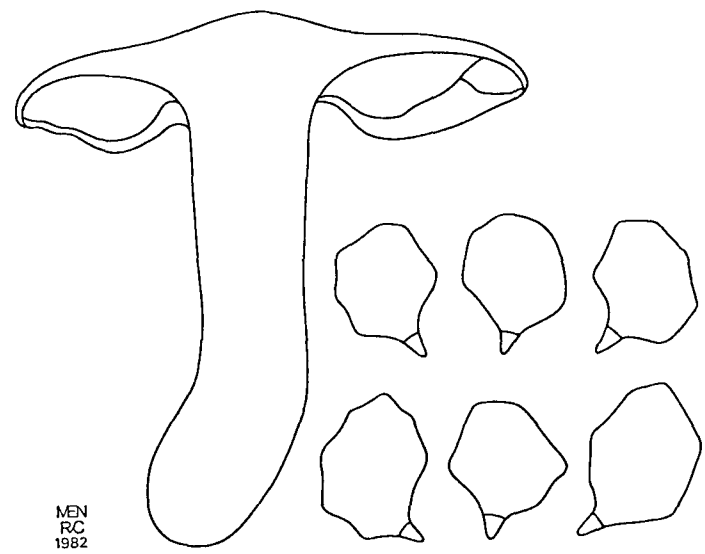

Fig. 52. *Entoloma eulividum*.

sinuatum sensu auct. eur. p.p. non sensu Noordel., Romagn.

SEL. ICON. – Dähncke & Dähncke, 700 Pilze: 256. 1975 (as *E. sinuatum*); J.Lange, Fl. agar. dan. 2; pl. 74C. 1937 (as *R. lividus*); R.Phillips, Mushr. other Fungi: 115. 1981 (as *E. sinuatum*); Ryman & Holmåsen, Svampar: 375. 1984 (as *E. sinuatum*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 159-160, fig. 1. 1981 (as *E. lividum*).

VERN. NAME. – Giftige satijnzwam.

Pileus 45-210 mm, conico-convex then convex, finally irregularly applanate, with broad umbo, with margin slightly involute when young, not hygrophanous, not striate, pale grey-brown, greyish-ochraceous or yellowish brown (Mu. 2.5 Y 7/4, 10 YR 8/4-6/2), glabrous, at centre with micaceous patches alternating with aeriferous, fluffy spots, when old often radially fibrillose-splitting. Lamellae, L = 70-100, l = 1-3, crowded, adnate or emarginate, segmentiform to ventricose, yellowish when young then salmon-pink to reddish brown, retaining the yellow tinge for a long time, especially near margin of pileus (2.5 Y 8/3, 10 YR 8/2, 7.5 YR 8/3, 8/6, 7/4) sometimes transvenose, with denticulate, concolorous edge. Stipe 40-140 × 7-32 mm, cylindrical, often tapering towards base, sometimes broadened at base, white in upper part, downwards paler than or concolorous with pileus, at apex pruinose, downwards smooth but fibrous, solid. Context firm, white. Smell strong, difficult to describe, somewhat nauseating-acidulous to subfarinaceous, or with raphanoid component, rarely with slightly aromatic smell like that of *Hebeloma sacchariolens*. Taste nasty, rancid-raphanoid.

Spores 8.0-10.5 (-11.5) × 7.0-9.5 µm, Q = 1.0-1.3, $\bar{Q}$ = 1.2, subisodiametrial to broadly ellipsoid in outline with about 6 angles in side-view. Basidia 35-58 × 10-16 µm, 4-spored. Lamella edge fertile. Cystidia absent. Pileipellis a narrow (ixo-)cutis of 2-5 µm wide, cylindrical hyphae. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant.

HABITAT & DISTR. – Solitary or in small groups in frondose forest, usually on heavy clayey soil, rare. Wide-spread all over Europe. Sept.-Dec.

Entoloma eulividum is one of the largest *Entoloma*-species and can be distinguished by the typical yellow tinge of the lamellae. *Entoloma sinuatum* comes close, but has different colours, lacks yellow tinges in the lamellae, and has a different smell. *Entoloma eulividum* is a notorious poisonous species able to cause a severe gastroenteritis, which however is rarely lethal.

3. Entoloma sinuatum (Bull. ex. Pers.: Fr.) Kumm., Führ. Pilzk.: 98. 1871. – Fig. 53.

Agaricus sinuatus Bull., Herb. France, pl. 579, fig. 1. 1793; *Agaricus sinuatus* Bull. ex Pers., Syn. meth. Fung.: 329. 1801; *Agaricus sinuatus* Bull. ex Pers.: Fr., Syst. mycol. 1: 197. 1821; *Rhodophyllus sinuatus* (Bull. ex Pers.: Fr.) Quél, Fl. mycol. France: 179. 1888.

EXCL. – *Entoloma sinuatum* sensu auct. eur. p.p. (= *E. eulividum*).

SEL. ICON. – Cooke, Ill. Brit. Fungi, pl. 316 (310). 1884.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 160-162, fig. 2. 1981; Romagn. in Bull. trimest. Soc. mycol. Fr. 94: 105-107, fig. 3. 1978.

Pileus up to 100 mm, irregularly conico-convex, then expanding with blunt umbo, with slightly involute margin, not hygrophanous, not striate, pallid ochraceous with pale grey spots, somewhat viscid when moist, minutely fibrillose or tomentose at margin when dry. Lamellae rather crowded, somewhat thickish, adnexed to adnate, segmentiform up to 15 mm broad, white, then flesh-colour with slight brown tinge, with entire to irregular subdentate, concolorous edge. Stipe up to 115 × 15 mm, cylindrical slightly tapering downwards, white in upper half, more brownish towards base, brownish creamy fibrillose-striate lengthwise with scattered, short, erect fibrils all over, solid. Context creamy white not really firm but fibrous in inner part. Smell somewhat alcaline-farinaceous. Taste not known.

Spores (8.0-) 8.5-10.5 × 7.5-8.0 (-10.0) µm, Q = 1.05-1.3, $\bar{Q}$ = 1.2, subisodiametrial to broadly ellipsoid, 5-6-angled in side-view. Basidia 28-43 × 8-15 µm, 4-spored. Lamella edge fertile. Cystidia none. Pileipellis a thin ixocutis of 2.5-5.0 µm wide, cylindrical hyphae. Pigment pale brownish, intracellular in upper pileitrama. Clamp-connections numerous.

HABITAT & DISTR. – Solitary or in small groups in frondose forest on clayey soil. Very rare (Hemmen). Very rare in western Europe (France), but probably confused with *E. eulividum*. Summer and early autumn.

Entoloma sinuatum comes close to *E. eulividum* from which it differs in colour and smell.

4. Entoloma moserianum Noordel. in Sydowia 36: 208. ('1983') 1984. – Fig. 54.

SEL. DESCR. & FIGS. – Noordel in Sydowia 36: 208-210, fig. 1. ('1983') 1984; Winterhoff in Z.Mykol. 51: 44. 1985.

Pileus (20-)30-95 mm, conico-convex to hemispherical, then expanding with or without umbo, with involute margin when young, not hygropha-

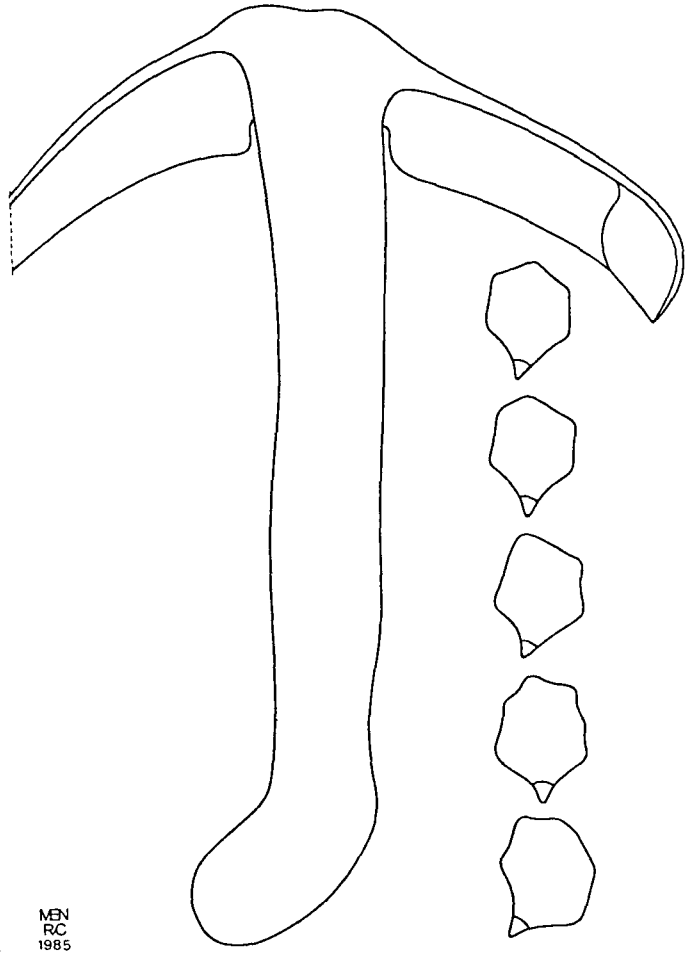

Fig. 53. *Entoloma sinuatum*.

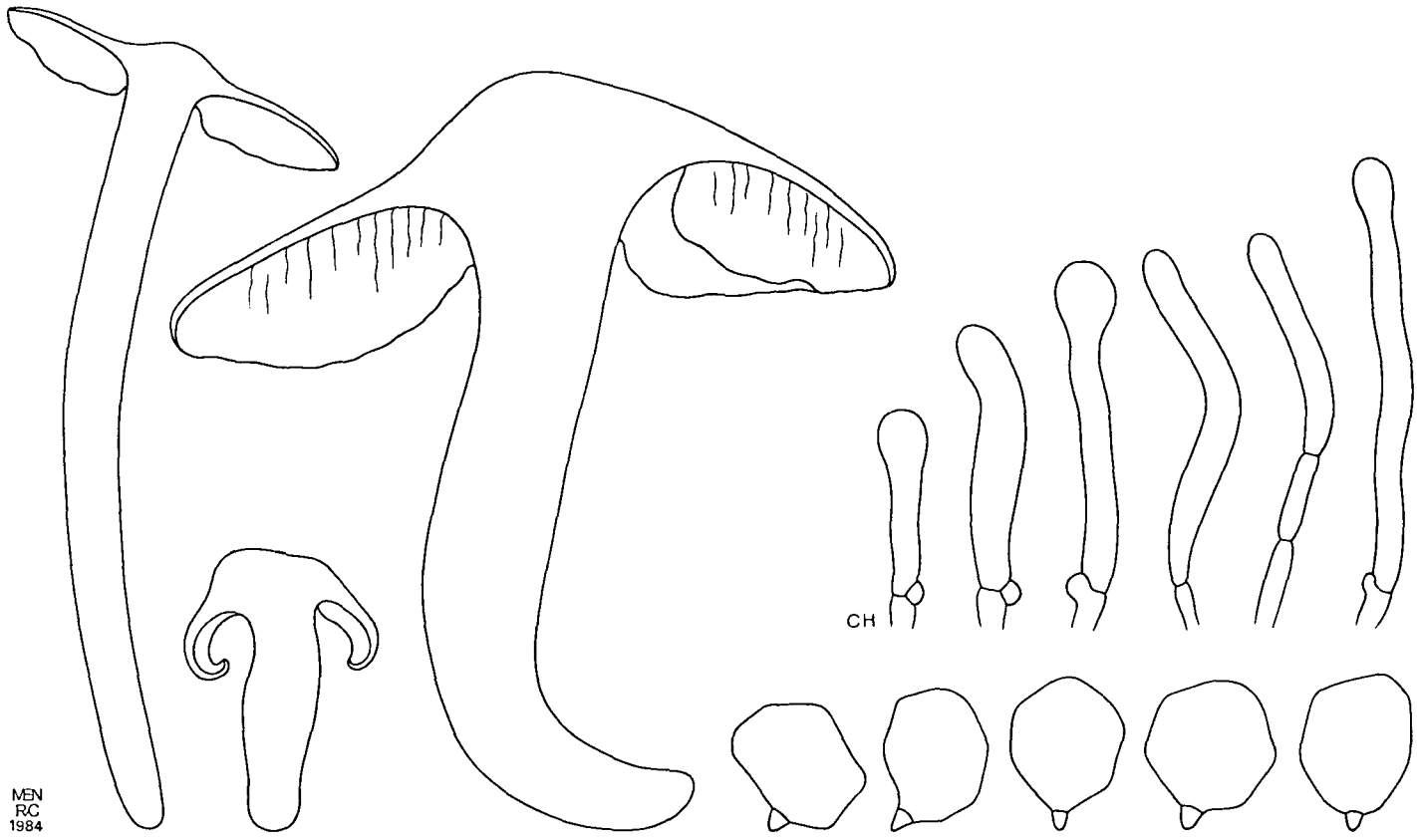

Fig. 54. *Entoloma moserianum.*

nous, not translucently striate, white to cream, often with slight ochraceous tinge at centre, turning bright yellow in places when bruised or with age (Mu. 2.5 YR 8/8-8/6), subviscid when moist, dull, appearing subtomentose when dry. Lamellae, L = 25-70, l = (1-)3-5, moderately distant, somewhat thickish, adnate-emarginate, broadly ventricose, white, then pallid pink with bright yellow spots when bruised or when old, with concolorous, dentate edge. Stipe 40-100 × 5-14 mm, tapering towards base, white or creamy with bright yellow spots when old or when bruised, with pruinose to subsquamulose apex, strongly fibrillose-costate lengthwise, solid. Context firm, white, occasionally turning orange when bruised. Smell spontaneously acidulous-soaplike, distinctly farinaceous when cut. Taste farinaceous-rancid.

Spores 9.5-11.5 × 8.0-9.5 µm, Q = 1.0-1.3, $\overline{Q}$ = 1.15, 5-6-angled in side-view. Basidia 27-48 × 8.5-13 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 22-60 × 4-8 µm, cylindrico-clavate, in clusters among basidia. Pileipellis an ixocutis of radially arranged, slightly gelatinized, 2-5 µm wide, cylindrical hyphae. Pigment pale, intracellular in pileipellis. Clamp-connections numerous in all tissues.

HABITAT & DISTR. – In large groups, terrestrial in deciduous forest on heavy river-clay. Very rare (Geldermalsen: Mariënwaard). Also known to occur in W.Germany and Austria. Aug.

Entoloma moserianum is very well-characterized by its pale basidiocarps with bright yellow tinges when bruised, its non-hygrophanous pileus, and its cylindrico-clavate cheilocystidia.

5. Entoloma bloxamii (B. & Br.) Sacc., Syll. Fung. 5: 684. 1887. – Fig. 55.

Agaricus bloxamii B. & Br. in Ann. Mag. nat. Hist., ser. II, 8: 399. 1854; *Entoloma madidum* var. *bloxamii* (B. & Br.) Larg. in Madroño 22: 368. 1974.

MISAPPL. – *Agaricus madidus* sensu Fr., Spicilegium: 6. 1836.

SEL. ICON. – Bres., Iconogr. mycol. 11: pl. 584, fig. 1. 1929 (as *E. madidum*); Cetto, Funghi Vero 1: pl. 96. 1975 (as *R. madidus*); Konr. & M., Ic. sel. Fung. 2: pl. 188. 1932 (as *E. madidum*).

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 106. 1969 (as *E. madidum*); Konr. in Bull. trimest. Soc. mycol. Fr. 39: 34-35. 1923; Larg. in Madroño 22: 366-368. 1974 (as *E. madidum*); Noordel. in Persoonia 11: 162-163. 1981 (as *E. madidum*).

Pileus 33-67 mm, convex with weak umbo, with slightly involute margin, not hygrophanous, not striate, deep (grey-)blue when young, then with violaceous blue tinges, becoming more brownish with age, especially at centre (K. & W. 22E3, 23E3, then 10E2, 9E3), dry, smooth, when young sometimes with white, pubescent surface, becoming (coarsely) radially fibrillose with age. Lamellae, L = about 140, l = 0-1 (-3), crowded, almost free, narrowly ventricose, pallid, then salmon pink to flesh-colour with entire, concolorous edge. Stipe 40-65 × 10-21 (apex) × 6-13 (middle) mm, tapering downwards, steel blue or greyish blue violaceous, whitish or yellow at base, fibrillose-striate lengthwise, solid. Context firm, greyish in cortex, white in inner part. Smell weakly to distinctly farinaceous. Taste weakly to distinctly farinaceous.

Spores (7.0-) 7.5-8.5 × 6.5-8.0 µm, Q = 1.0-1.2, $\overline{Q}$ = 1.1, subisodiametrical 5-7 (-8)-angled in side-view. Basidia 22-39 × 6.5-12.0 µm, 4-spored. Lamella edge fertile. Cystidia none. Pileipellis a thin ixocutis of 2.5-4.0 µm wide hyphae with well-developed subpellis of inflated elements, 25-60 × 12-25 µm. Pigment blue, intracellular in pileipellis, especially in subpellis, and in upper pileitrama. Clamp-connections numerous.

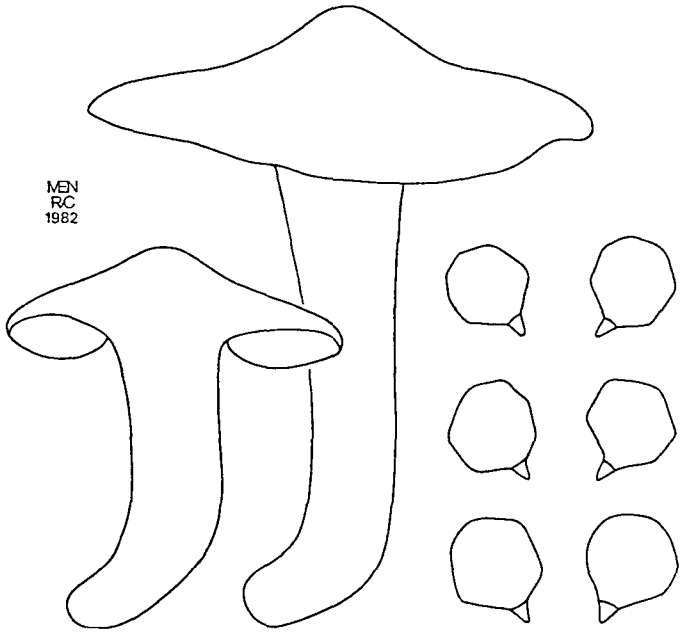

Fig. 55. *Entoloma bloxamii*.

HABITAT & DISTR. – In small groups in poorly manured grassland. Very rare. Rijssen-Markelo; Wageningen. Sept.-Nov.

Entoloma bloxamii is a rather remarkable species combining blue colours with a tricholomatoid habit. With age, the colour of the pileus varies considerably from blue to brown. *Entoloma nitidum* is rather similar but has a more slender habit and a different ecology.

6. Entoloma nitidum Quél., in C.R. Ass. franc. Av. Sci. (La Rochelle, 1882) 11: 391. 1883 (Champ. Jura Vosges 11). – Fig. 56.

Rhodophyllus nitidus (Quél.) Quél., Enchir. Fung.: 58. 1886.

MISAPPL. – *Agaricus ardosiacus* sensu Fr., Ic. sel. Hymenomyc. 1: pl. 94, fig. 4. 1867.

SEL. ICON. – Dähncke & Dähncke, 700 Pilze: 248. 1979; J.Lange, Fl. agar. dan. 2: pl. 74A. 1937; Romagn. & Favre in Rev. Mycol. 3: pl. 2, fig. 2, 3. 1938; Ryman & Holmåsen, Svampar: 376. 1984.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 164-166, fig. 4. 1981; Romagn. & Favre in Rev. Mycol. 3: 73-75. 1938.

VERN. NAME. – Blauwe satijnzwam.

Pileus 20-45 mm, conical then conico-convex, only slowly expanding to convex with conical umbo, with involute margin when young, later straight, dark blue almost black at centre only slightly fading with age (K. & W. 22F3-2 to 23F1), strongly shining, often fairly strongly radially fibrillose, smooth. Lamellae, L = 28-32, l = 1-3 (-7) moderately crowded, almost free to narrowly adnate, ventricose, pale then pink, with entire, concolorous edge. Stipe 30-85 × 2.5-5 mm, cylindrical, often flexuose, tapering downwards, sometimes almost rooting, concolorous with pileus or slightly paler, at base white or yellowish, innately fibrillose-striate lengthwise, sometimes twisted, shiny, solid or narrowly fistulose. Context blue in cortex, inner part whitish, brittle to firm in fleshy specimens. Smell weak, slightly farinaceous or more raphanoid. Taste almost none.

Spores (6.0-) 6.5-9.0 × (6.0-) 6.5-7.5 (-8.0) µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, subisodiametrical, 6-8-angled in side-view. Basidia 24-36 (-45) × 7.5-12.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin ixocutis of radially arranged, 2.5-6 µm wide, cylindrical hyphae; subpellis well-developed, made up of inflated elements, 25-60 (-80) × 20-25 µm. Pigment blue, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant.

HABITAT & DISTR. – Solitary or in small groups in humus of coniferous or mixed coniferous-deciduous forests, frequently on acidulous diluvial sandy soil. Rare in the Netherlands; wide-spread and locally common in north-western Europe. Sept.-Nov.

Entoloma nitidum is a beautiful species with its rather large, slender basidiocarps with deep blue colours.

Sect. **Nolanidea** (Fr.) Quél.

Basidiocarps tricholomatoid, usually distinctly hygrophanous, white, brown, or sepia, vernal, associated with *Ulmus* or *Rosaceae*.

7. Entoloma clypeatum (L.) Kumm., Führ. Pilzk.: 98. 1871. – Fig. 57.

Agaricus clypeatus L., Syst. Plant. 2: 1174. 1753; *Rhodophyllus clypeatus* (L.) Quél., Enchir. Fung.: 59. 1886; *Hyporrhodius clypeatus* (L.) Schroet. in Cohn., Krypt.-Fl. Schlesien 3(1): 616. 1889. – *Entoloma clypeatum* f. *pallidogriseum* Noordel. in Persoonia 11: 171. 1981. – *Entoloma clypeatum* f. *xanthophyllum* Noordel. in Persoonia 11: 172. 1981. – *Rhodophyllus aprilis* var. *hybridis* Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 201. 1947; *Entoloma clypeatum* f. *hybridum* (Romagn.) Noordel. in Persoonia 11: 173. 1981.

VERN. NAME. – Harde voorjaarssatijnzwam.

KEY TO THE FORMS AND VARIETIES

1. Clamps absent; stipe rather coarsely fibrillose, grey-brown. var. defibulatum
1. Clamps present; stipe generally smoother and paler to whitish. var. **clypeatum**
2. Lamellae yellow, especially when young. . . . f. **xanthophyllum**
2. Lamellae white or greyish then pink to pinkish-brown.

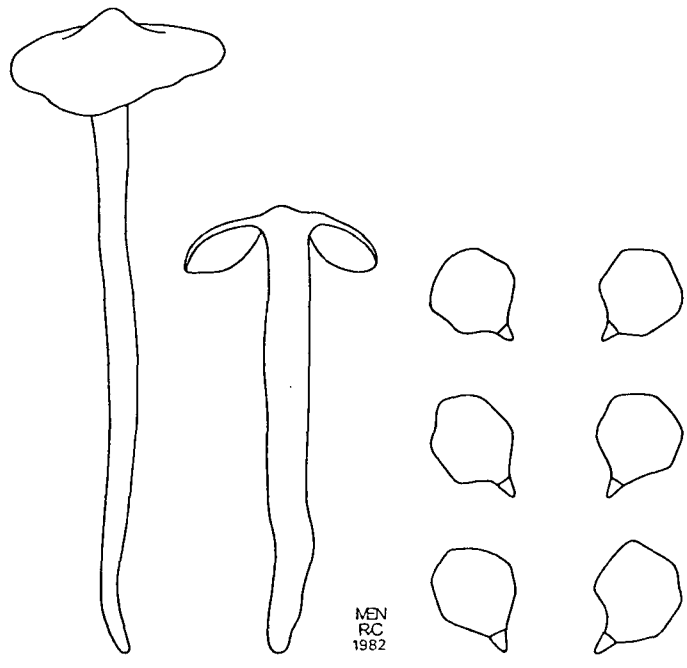

Fig. 56. *Entoloma nitidum*.

3. Basidiocarps rather pale. . . . . f. **pallidogriseum**
3. Pileus moderately dark to fairly dark coloured.
4. Stipe narrowly fistulose already when young and not very firm, easily compressible; pileus smooth, shining; Guaic on context giving blue-green colour within 10 minutes. . . . f. **hybridum**
4. Stipe initially solid and often remaining so with age, unless riddled by insects, firm; pileus slightly rugulose or marked with little pits, especially at centre; Guiac-reaction negative. f. **clypeatum**

var. **clypeatum**

SEL. ICON. – Marchand, Champ. Nord Midi 2: pl. 119. 1973; Romagn., Nouv. Atl. Champ. 1: pl. 77b. 1956.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 167-179, fig. 5. 1981 (incl. f. *pallidogriseum*, f. *xanthophyllum*, and f. *hybridum*).

Pileus (20-) 35-120 mm, conical to convex, usually irregularly planoconvex with age with large, broad umbo and slightly deflexed margin, sometimes with conical umbo and involute margin, with strongly undulating and splitting margin with age, hygrophanous, when moist rather dark sepia, grey-brown or reddish brown, sometimes with yellow or olivaceous tinges (f. *clypeatum*, f. *hybridum*, Mu. 10 YR 3-5/2-3), yellow-brown (f. *xanthophyllum*, 2.5 Y 6-8/4, 10 YR 5-6/4) or very pale grey or brown (f. *pallidogriseum*, 2.5 Y 5/4, 10 YR 5-6/3), slightly paler at margin, translucently striate at margin only or not translucently striate, slightly greasy to touch when moist never really viscid, pallescent on drying (almost white in f. *pallidogriseum*), innately radially fibrillose or smooth sometimes weakly rugulose or rimose or with minute pock-marks at centre (especially in f. *clypeatum*), frequently rimose with age sometimes with micaceous patches at centre (f. *clypeatum*). Lamellae, L = 40-80, l = 1-7, moderately crowded (rather distant in f. *xanthophyllum*), adnate usually emarginate, segmentiform to ventricose, up to 15 mm broad, white or pale grey then pink finally brown-pink or grey-pink (10 YR 7/2, 2.5 Y 7/2, 6/2, then 10 YR 6-7/2, 7.5 YR 5-6/4), yellow in f. *xanthophyllum* (2.5 Y 8/4-2), in large specimens often transvenose and/or hygrophanous, with irregular, often eroded and concolorous edge. Stipe 45-90 (-150) × 5-20 mm, equal often more or less flexuose, cylindrical or compressed, sometimes tapering towards base or irregularly broadened towards base, in fasciculate specimens often forming a large, bulbous common base, solid, white or tinged grey or brown especially in the middle, weakly to distinctly fibrillose to subcostate lengthwise with darker fibrils on paler background, smooth, except for the apex which is sometimes pruinose. Context firm, white in pileus and stipe. Smell farinaceous, taste farinaceous-rancid with nasty aftertaste.

Spores (8.5-) 9.0-11.5 × (7.5-) 8.0-9.0 (-10.0) µm, Q = 1.1-1.3, $\bar{Q}$ = 1.2, subisodiametrical to broadly ellipsoid in outline with 5-7 angles in side-view. Basidia (25-) 30-55 × 10-20 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of radially arranged, 2-7 µm wide cylindrical hyphae, sometimes with up to 12 µm wide, clavate, terminal elements. Pigment brownish, intracellular in upper pileitrama and less abundantly in pileipellis. Clamp-connections numerous in all tissues.

HABITAT & DISTR. – Gregarious, often in small bundles and in large fairy-rings under or near Rosaceous plants, especially *Prunus*, *Crataegus*, *Pyrus*, and *Malus* in parks, gardens, orchards, and forests. Very common and wide-spread all over Europe. (March-)April-June.

var. **defibulatum** Noordel. in Persoonia 11: 173. 1981.

SEL. DESCR. – Noordel. in Persoonia 11: 173-174. 1981.

CHARACTERISTICS. – Differs from var. *clypeatum* by the clampless hyphae and the rather pronouncedly coloured, strongly fibrillose almost costate stipe.

HABITAT & DISTR. – Solitary or gregarious under *Prunus* and *Crataegus monogyna*, preferably on sandy, calcareous soils. Rare (dunes, IJsselmeerpolders). Only known from the Netherlands. April-May.

8. Entoloma aprile (Britz.) Sacc., Syll. Fung. 5: 696. 1887. – Fig. 58.

Agaricus aprilis Britz. in Ber. naturhist. Ver. Augsburg 28: 149. 1885; *Rhodophyllus aprilis* (Britz.) Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 199. 1947.

MISAPPL. – *Rhodophyllus plebejus* sensu Romagn. in Rev. Mycol. 2: 36. 1937.

SEL. ICON. – Marchand, Champ. Nord Midi 2: pl. 118. 1973; Ro-

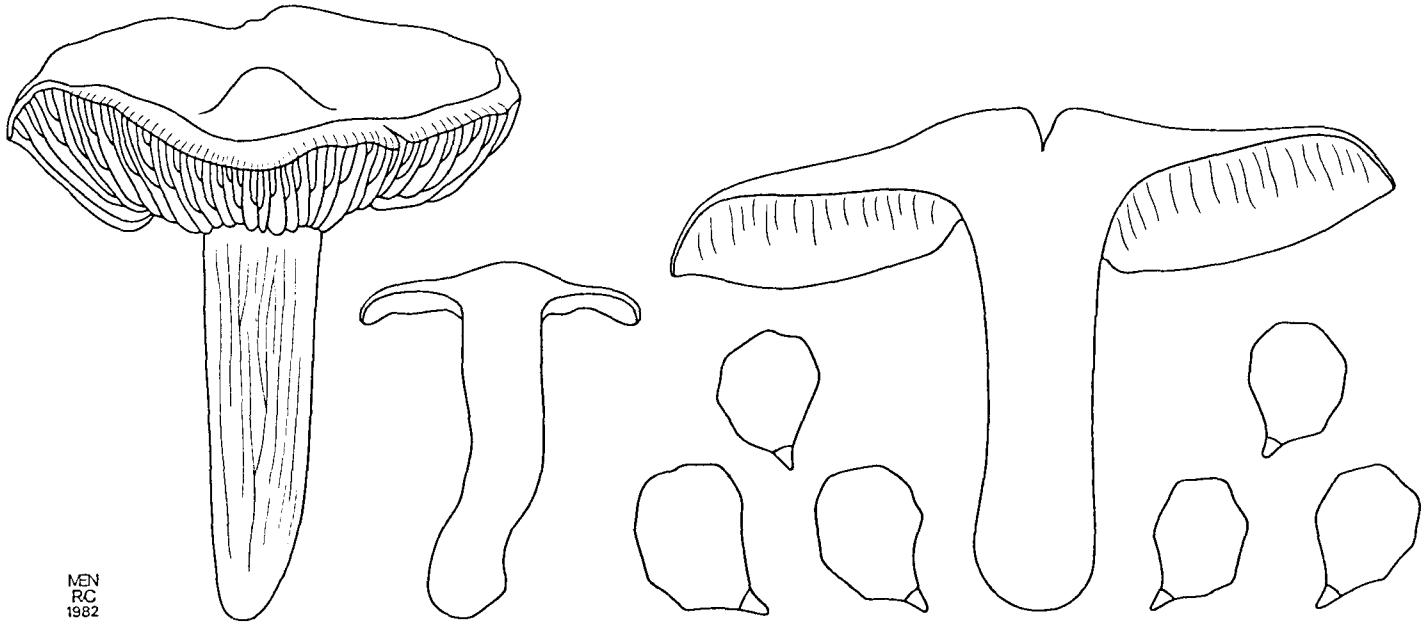

Fig. 57. *Entoloma clypeatum*.

magn. Nouv. Atl. Champ. 1: pl. 77a. 1956; Ryman & Holmåsen, Svampar: 378. 1984.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 174-176, fig. 6. 1981.

VERN. NAME. – Slanke voorjaarssatijnzwam.

Pileus 17-60 (-75) mm, acutely conical to conical, then expanding via campanulate to plano-convex with pronounced, often conical umbo, with slightly involute margin when young, becoming straight only in late stages, with marginal zone usually regular, but in expanded specimens sometimes irregularly undulating and splitting, strongly hygrophanous, when moist dark sepia, grey-brown or yellowish brown, not or only slightly paler towards margin (Mu. 10 YR 2-4/2-4, 5/4) translucently striate up to two-thirds of radius, strongly pallescent on drying to pale yellowish brown (10 YR 5-7/3-4 rarely 8/4) sometimes with slight olivaceous tinge, with subviscid surface when moist, smooth when dry. Lamellae, L = 30-60, l = 1-7, moderately crowded, narrowly adnate or deeply emarginate, often with decurrent tooth, segmentiform to narrowly ventricose, rarely transvenose, pale grey then pink with brown or grey tinge (10 YR 8/2, 7/2, 6/3 then 7.5 YR 5-7/2-4), with minutely crenulate to coarsely eroded concolorous edge. Stipe 30-85 × 4-12 mm, cylindrical, often slightly broadened at base, rarely bulbose, sometimes compressed, fistulose, brittle, easily splitting lengthwise, grey to grey-brown, rarely sordid white (10 YR 6/3, 5/3, 4/3, 4/4 rarely 7/4), strongly fibrillose-striate lengthwise, sometimes almost costate, at base usually glabrous, pruinose at apex. Context relatively thin, brittle, white when young soon with grey tinge, particularly in cortical layers. Smell strongly farinaceous-rancid. Taste strongly farinaceous-rancid.

Spores 9.0-11.5 × 7.0-9.5 (-11.0) µm, Q = 1.0-1.2 (-1.3), $\bar{Q}$ = 1.1, almost isodiametrical, many-angled in side-view. Basidia 40-68 × 13-17 µm, (2-)4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of radially arranged, cylindrical, 4-10 µm wide hyphae. Pigment brown, intracellular in pileipellis and underlaying pileitrama. Clamp-connections rare, except in hymenium.

HABITAT & DISTR. – In groups in humus of frondose forests, frequently on sandy soils, under or near *Ulmus*, rare. April-May(-June). Not uncommon in the lowlands of N. and W. Europe.

Entoloma aprile is closely related to *E. clypeatum* on account of the relatively dark coloured, hygrophanous pileus. It differs in more slender and brittle basidiocarps, relatively sparse clamp-connections in the tissues, and in the habitat, as it grows preferably near *Ulmus*, whereas *E. clypeatum* is associated with *Rosaceae*. On account of the *Nolanea*-like habit, *E. aprile* can be confused with real *Nolanea* species, such as *E. vernum*. That species, however, clearly differs in a number of characters, such as structure and pigmentation of pileipellis and structure of pileitrama and hymenophoral trama.

9. Entoloma niphoides Romagn. ex. Noordel. in Persoonia 12: 459. 1985. – Fig. 59.

Rhodophyllus niphoides Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 198. 1947 (not valid, no Latin diagn.).

MISAPPL. – *Entoloma speculum* sensu Cooke, Ill. Brit. Fungi 3: pl. 342 (308). 1884.

SEL. ICON. – Cooke, Ill. Brit. Fungi 3: pl. 342 (308). 1884 (as *E. speculum*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 176-178, fig. 7. 1981; Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 198. 1947.

VERN. NAME. – Witte voorjaarssatijnzwam.

Pileus 20-145 mm, conical when young, then expanding to convex or plano-convex with large, rounded or truncate umbo, with margin involute when young but straight later on, with marginal zone strongly undulating with age, weakly hygrophanous, when moist purely white or very pale beige, sometimes marbled with grey or pink when water-soaked, slightly translucently striate at margin or not, subviscid when moist, pallescent to brilliantly white on drying, sometimes with slight ivory tinge at centre, strongly silky-shining, smooth. Lamellae, L = 40-70, l = 1-9, moderately crowded, adnate to emarginate, segmentiform to ventricose, moderately broad, up to 15 mm, white then pink without real grey or brown tinge, occasionally transvenose with entire

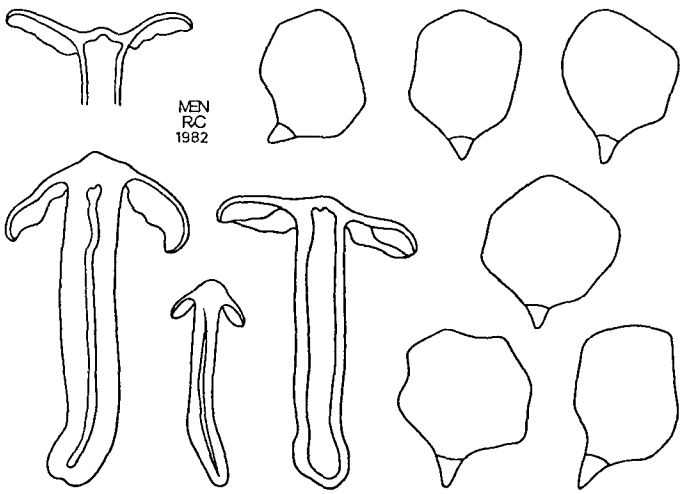

Fig. 58. *Entoloma aprile*.

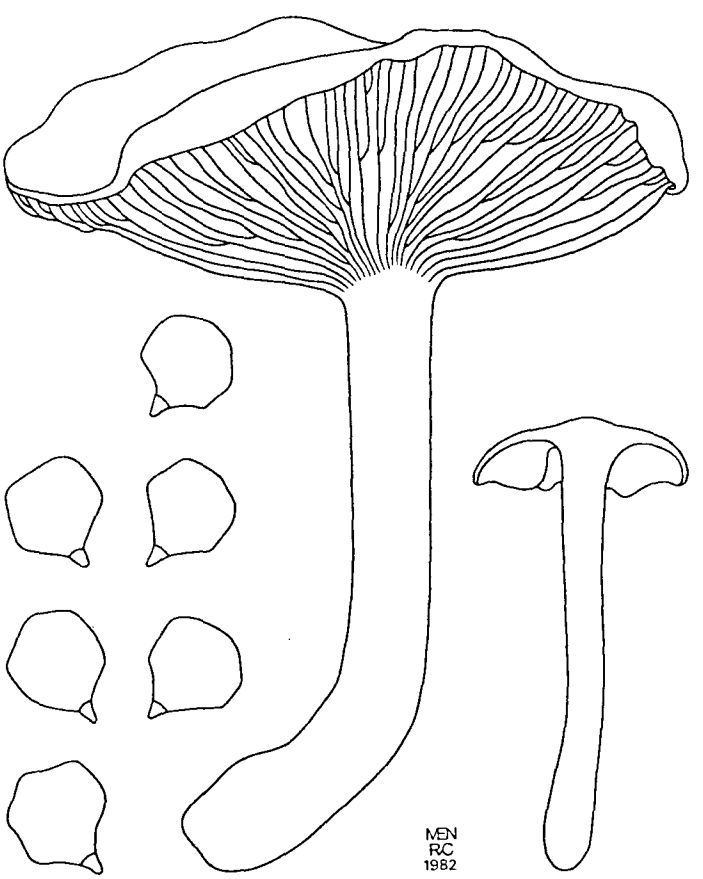

Fig. 59. *Entoloma niphoides*.

or subdenticulate, concolorous edge. Stipe 45-135 × (4-)6-25 mm, cylindrical or compressed, frequently with enlarged base, sometimes twisted, white, slightly to coarsely fibrillose-striate lengthwise, solid, firm. Context white, firm, not changing colour, or rarely turning yellow. Smell strongly farinaceous. Taste strongly farinaceous.

Spores 8.0-10.0 (-11.5) × 7.5-9.0 (-11.0) µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, many-angled, subisodiametrical in side view with rather blunt angles. Basidia 32-46 × 10-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of narrow, 4-6 µm wide cylindrical hyphae with strongly desintegrating walls, embedded in a gelatinous layer. Pigment hardly visible, intracellular. Clamp-connections present in all tissues.

HABITAT & DISTR. – In groups, often in fairy-rings, in hedges and dense thickets of *Prunus spinosa* and *Crataegus monogyna*, rare. Very rare in north-western Europe (Great Britain, Denmark, France). May-June.

Entoloma niphoides is easily distinguished by its brilliantly white basidiocarps. *Entoloma clypeatum* f. *pallidogriseum* is more distinctly hygrophanous, translucently striate and generally more pigmented.

10. Entoloma saepium (Noul. & Dass.) Richon & Roze, Atl. Champ. comest. vén.: 92. 1886. – Fig. 60.

Agaricus saepius Noul. & Dass., Champ. comest. susp. vén.: 155. 1838; *Entoloma clypeatum* var. *saepium* (Noul. & Dass.) Poirault & Roze in Bull. Soc. bot. Fr. 27: 257. 1880; *Rhodophyllus saepius* (Noul. & Dass.) Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 196. 1947. – *Agaricus prunarii* S.Schulz. in Verh. zool. bot. Ges. Wien 29: 496. 1878; *Agaricus clypeatus* var. *prunarii* (S.Schulz.) S.Schulz. in Verh. Mitt. Siebenburg. Ver. Naturw. 34: 30. 1884. – *Rhodophyllus clypeatus* var. *murinus* Quél. in C.R. Ass. franc. Av. Sci. (Saint Etienne 1897) 26: 448. 1898 (Champ. Jura Vosges 21).

MISAPPL. – *Rhodophyllus prunuloides* sensu Romagn. in Rev. Mycol. 2: 34. 1937; sensu Konr. & M., Ic. sel. Fung. 2: pl. 187. 1930 (pro parte). – *Entoloma saundersii* sensu R.Phillips, Mushr. other Fungi: 115. 1981.

SEL. ICON. – Dähncke & Dähncke, 700 Pilze: 254. 1979; Marchand, Champ. Nord Midi 1 (3me Éd.): pl. 27. 1974; R.Phillips, Mushr. other Fungi: 115. 1981 (as *E. saundersii*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 181-183, fig. 9. 1981.

VERN. NAME. – Sleedoornsatijnzwam.

Pileus 25-110 mm, conical to conico-convex then expanding to plano-convex or applanate with broad, low umbo, with involute margin when young, marginal zone usually regular, not hygrophanous, not translucently striate, greyish or yellowish cream to very pale brown, rarely with reddish ochraceous flush, particularly in exposed specimens, not or only slightly pallescent on drying, rather regularly radially, innately fibrillose, when exposed sometimes rugulose or tomentose at centre, and/or radially splitting, showing the reddish pileitrama between the fibrils. Lamellae, L = 50-60, l = 3-5-7, moderately crowded, deeply emarginate, segmentiform to ventricose, thin, creamy white then pink without any trace of brown or grey (Mu. 7.5 YR 7/4-6/4) with subentire to coarsely eroded, concolorous edge. Stipe 30-110 × (5-) 8-16 (-24) mm, cylindrical, sometimes flexuose, usually distinctly broadened towards base, very firm, solid, minutely to coarsely fibrillose-striate to costate, sometimes, especially near base and when bruised, with reddish ochraceous fibrils, elsewhere almost purely white. Context firm, white, when bruised discolouring reddish-ochraceous. Smell farinaceous. Taste strongly farinaceous.

Spores (7.0-) 8.0-11.0 × (6.5-) 8.0-10.0 (-11.0) µm, Q = 1.0-1.25, $\bar{Q}$ = 1.15, isodiametrical to broadly ellipsoid, 5-7-angled in side-view. Basidia 35-50 × 11-17 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of radially arranged, cylindrical, 1.5-7 µm wide hyphae. Pigment pale brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Solitary or caespitose, often in large fairy-rings under *Prunus spinosa* and cultivated *Prunus*-species (fruit trees), fairly common. Wide-spread all over W. and S.Europe. April-June.

Entoloma saepium can be distinguished from pale forms of *E. clypeatum* in the rather regular, non-hygrophanous, not striate pileus with its pale creamy colour, and also in the orange or reddish yellow discolouration of the context, particularly in the stipe (insect holes). *Entoloma saundersii* differs in having more grey tinges in the pileus with micaceous patches, and distinctly larger spores. *Entoloma niphoides* occurs in the same habitat as *E. saepium* but differs in having an almost purely white pileus, and in a context that does not discolour on bruising.

11. Entoloma saundersii (Fr.) Sacc., Syll. Fung. 5: 689. 1887. – Fig. 61.

Agaricus saundersii Fr., Hymenomyc. eur.: 192. 1874; *Rhodophyllus saundersii* (Fr.) Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 195. 1947.

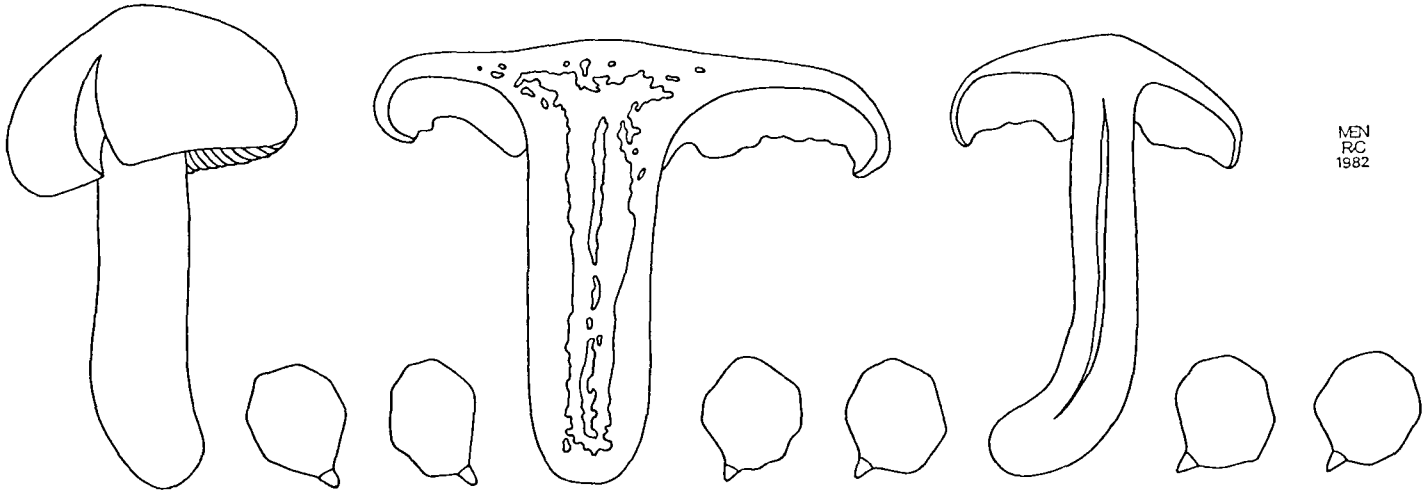

Fig. 60. *Entoloma saepium*.

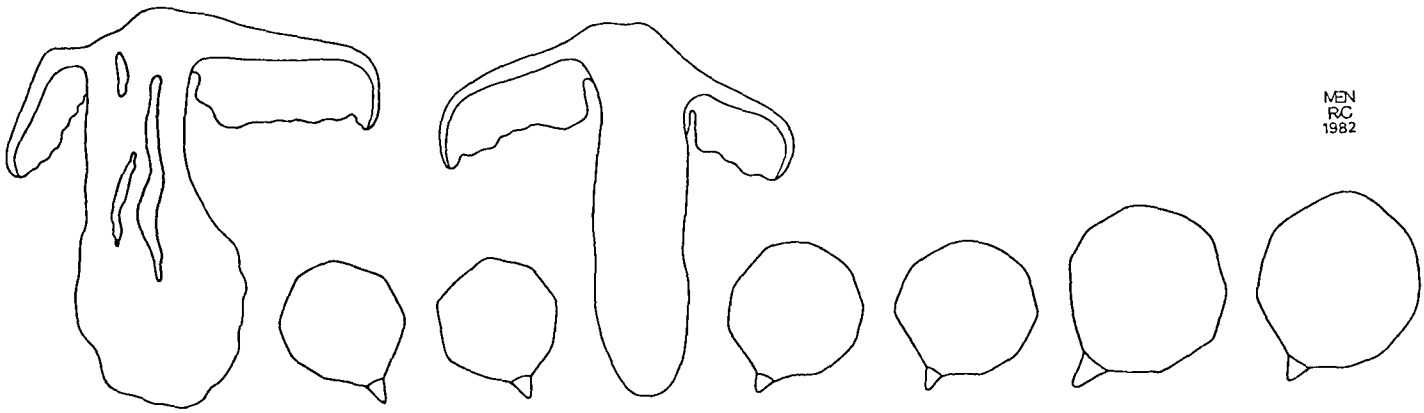

Fig. 61. *Entoloma saundersii*.

MISAPPL. – *Agaricus majalis* sensu Saunders, Smith & Bennett, Mycol. Ill.: pl. 46. 1872.

EXCL. – *Entoloma saundersii* sensu R.Phillips, Mushr. other Fungi: 115. 1981 (= *E. saepium*).

SEL. ICON. – Boud., Ic. mycol. 1: pl. 93. 1904; Romagn. in Bull. trimest. Soc. mycol. Fr. 67: pl. 97. 1951; Romagn., Nouv. Atl. Champ. 3: pl. 234. 1961.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 178-180, fig. 8. 1981; Romagn. in Bull. trimest. Soc. mycol. Fr. 67: 195. 1951.

VERN. NAME. – Zilverige satijnzwam.

Pileus 32-110 mm, conical or irregularly convex with large umbo, then expanding to plano-convex with pronounced umbo, finally very irregularly shaped with undulating marginal zone, with involute margin when young, straight in older stages, not hygrophanous, not translucently striate or at margin only in young specimens, when young sordid white, soon pale grey-brown (Mu. 10 YR 7/1, 7/2, rarely 7/3), sometimes with ochraceous tinges, with veil-like arachnoid patches at margin, in young specimens sometimes entirely covered with silvery-white arachnoid fibrils, in elder specimens with irregularly spotted surface of grey-brown, glabrous, sometimes shining patches alternating with silvery white micaceous patches; in exposed specimens pileipellis often strongly radially splitting and/or breaking up in coarse squamules. Lamellae, L = about 50, l = 1-3-5, subdistant, deeply emarginate, often with decurrent tooth, thickish, broadly ventricose, up to 21 mm broad, pale cream at first, then sordid pink, becoming grey-pink with age (7.5 YR 8/4-7/2), in large specimens often transvenose with irregularly dentate, concolorous edge. Stipe 35-100 × (5-)12-22 mm, rather irregular, usually more or less cylindrical but also frequently tapering downwards or with broadened to broadly bulbous base, sometimes compressed and/or flexuose, white when young, then with grey, grey-brown or yellow-brown tinges, particularly near base, strongly fibrillose-costate lengthwise, sometimes fissurate, at apex minutely pruinose, downwards glabrous, solid. Context white in stipe, pale grey-brown in cortex of pileus and just above hymenium, firm. Smell strongly farinaceous. Taste strongly farinaceous-rancid.

Spores 10.5-12.0 (-12.5) × (9.5-) 10.5-11.5(-12.0) µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, subisodiametrical, many-angled in outline with rather blunt angles. Basidia 45-60 × 12-18.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin ixocutis of radially arranged, cylindrical, 4.5-6 (-7) µm wide hyphae. Pigment pale, intracellular in pileipellis. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In large groups, often fasciculate on bare soil, preferably on heavy clay under *Ulmus*, but also known to occur under fruit-trees (*Prunus*) in orchards. Rare. Febr.-May. Distribution in Europe poorly known: recorded from Great Britain, France and Italy.

Entoloma saundersii is very well characterized by its pale, spotted pileus with alternating greyish smooth patches and whitish micaceous-fibrillose patches, and by its large spores.

Sect. **Rhodopolia** (Fr.) Noordel.

Basidiocarps tricholomatoid; pileus hygrophanous. Aestival-autumnal.

Subsect. **Rhodopolia** Noordel.

Pigment intracellular.

12. Entoloma nidorosum (Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 119. 1872 (Champ. Jura Vosges 1). – Fig. 62.

Agaricus nidorosus Fr., Epicr.: 148. 1838; *Rhodophyllus nidorosus* (Fr.) Quél., Enchir. Fung.: 59. 1886.

SEL. ICON. – Cetto, Funghi Vero 1: pl. 97. 1975; R.Phillips, Mushr. other Fungi: 115. 1981; Romagn., Nouv. Atl. Champ. 1: pl. 78a. 1956; Ryman & Holmåsen, Svampar: 379. 1984.

SEL. DESCR. & FIGS. – Kühn. & Romagn. in Rev. Mycol. 20: 14-18, figs. 2d-e, 3. 1954 (Compl. Fl. anal. 1); Noordel. in Persoonia 11: 184-186, fig. 10. 1981.

VERN. NAME. – Stinksatijnzwam.

Pileus (10-)20-75 mm, conico-convex when young, then expanding to plano-convex or plano-concave, usually with slight central depression, more rarely with umbo, with margin slightly involute when young, later on straight, marginal zone irregularly undulating with age, hygrophanous, when moist relatively pale yellowish brown, horn brown (Mu. 10 YR 6-8/3-4, 7/6, 2.5 Y 8.4), often darker at centre (10 YR 4-5/3-4) slightly paler at margin (10 YR 8/2-3), translucently striate at margin up to one-third of radius, strongly pallescent on drying to greyish yellow or sordid white, glabrous, sometimes, particularly when young and fresh, with aeriferous, silvery patches, especially towards margin. Lamellae, L = 35-50, l = 1-5, moderately distant, broadly adnate with decurrent tooth or (slightly) emarginate, segmentiform to ventricose, pale then pink, rarely with greyish shade with irregular, concolorous edge. Stipe (25-) 40-95 (-130) × 3-8 (-13) mm, cylindrical, often with broadened base, pale yellowish-whitish, strongly white fibrillose-striate lengthwise, at

apex sometimes flocculose, downwards glabrous, solid quickly fistulose. Context pallid, brittle in stipe, in pileus usually firm in young and fresh specimens. Smell nitrous, particularly when fresh. Taste slightly rancid, unpleasant.

Spores 7.0-9.5 × 6.0-8.0 µm, Q = 1.0-1.4, $\bar{Q}$ = 1.25, 5-6-7-angled in side-view. Basidia 32-50 × 7.5-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow cylindrical hyphae, 2.5-7(-9) µm wide; subpellis sometimes well-developed, made up of inflated elements, 25-75 × 12-30 µm. Pigment brown, intracellular in pileipellis. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In (large) groups at moist places in frondose forests, particularly in *Alnus*, *Salix*, *Betula*, *Fraxinus-Alnus* and *Quercus* forests, sometimes also in peat-bogs among *Sphagnum*. Very common all over Europe. Early summer to late autumn.

Entoloma nidorosum can be distinguished from *E. sericatum* in the more constant and persistent smell and in the lack of incrusting pigments. *Entoloma rhodopolium* has a more grey coloration of pileus and stipe, and lacks a nitrous smell.

13. Entoloma lividoalbum (Kühn. & Romagn.) Kubička in Ceská Mykol. 20: 28. 1975. – Fig. 63.

Rhodophyllus lividoalbus Kühn. & Romagn. in Rev. Mycol. 19: 6. 1954 (Compl. Fl. anal. 1).

SEL. DESCR. & FIGS. – Kühn. & Romagn. in Rev. Mycol. 20: 205-207, fig. 15. 1955 (Compl. Fl. anal. 1); Noordel. in Persoonia 11: 186-188, fig. 11. 1981.

Pileus 35-90 mm, conical, then convex finally irregularly applanate, usually with pronounced, broad umbo, margin involute when young, then straight, hygrophanous, when moist moderately dark yellowish brown, sepia, only slightly paler towards margin (Mu. 10 YR 4/4, 5/4 rarely 3/4, towards margin more like 10 YR 5/3, 5/4, 6/4, 7/4) translucently striate at margin only or not striate, pallescent on drying to greyish-ochraceous, pale sepia or ivory yellowish (2.5 Y 7/4, 6/4, 10 YR 8-6/3), subviscid when moist, minutely rugulose on drying. Lamellae, L = 40-65, l = 1-9, moderately crowded, broadly adnate or emarginate, segmentiform to ventricose, pallid then pink (2.5 Y 8/2, 7/2 then 7.5 YR 8/4, rarely 7/4) with irregularly dentate, concolorous edge. Stipe 30-70 × 8-20 mm, cylindrical or flattened, usually broadened towards base, rarely tapering, white to sordid yellow-cream with shining, aeriferous, fibrillose covering, sometimes flocculose at apex, downwards glabrous, solid. Context firm, white. Smell strongly farinaceous. Taste strongly farinaceous.

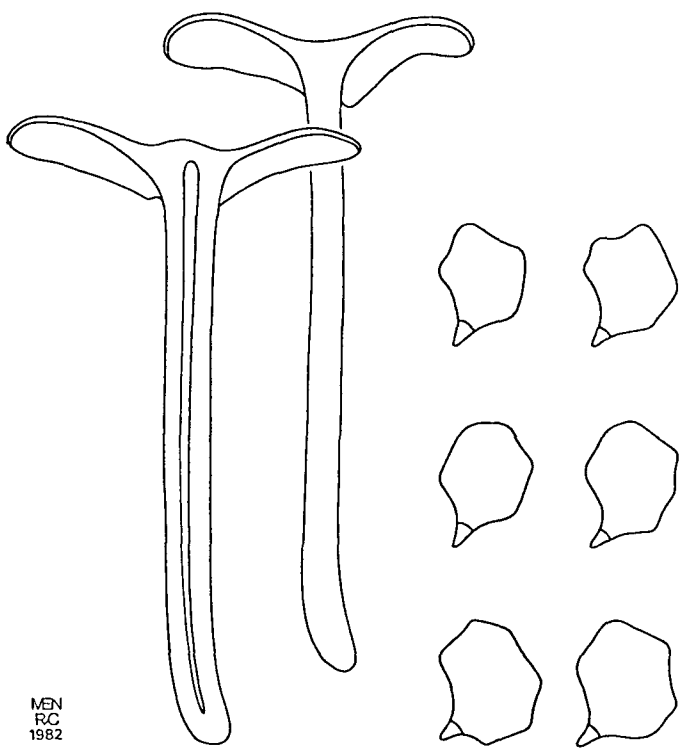

Fig. 62. *Entoloma nidorosum*.

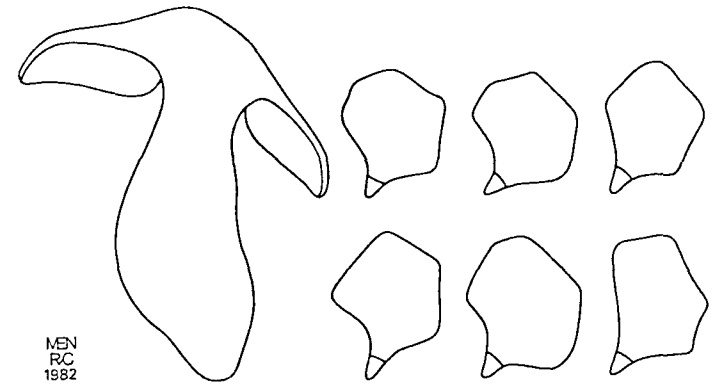

Fig. 63. *Entoloma lividoalbum*.

Spores 8.0-10.0 (-11.0) × 8.0-8.5 (-9.0) µm, Q = 1.05-1.3 (-1.4), $\bar{Q}$ = 1.2, 5-7-angled in side-view. Basidia 35-50 × 10-14 µm, 4-spored, clamped. Lamella edge fertile, Cystidia absent. Pileipellis a cutis of 2.5-12 µm wide, cylindrical hyphae, at centre sometimes with ascending, clavate terminal elements up to 25 µm wide. Pigment brown, intracellular in pileipellis. Clamp-connnections abundant in all tissues.

HABITAT & DISTR. – Terrestrial in humus-rich frondose forests in zone of inner coastal dunes, often in groups. Very rare (Bloemendaal: Vogelenzang; Domburg: Kasteelpark). Rare but wide-spread in temperate regions of Europe. Aug.-Oct.

The rather robust and firm basidiocarps of *E. lividoalbum* are reminiscent of the vernal *E. clypeatum*. That species, however, clearly differs in habitat, vernal appearance, size and shape of spores, and type of pileipellis.

14. Entoloma speculum (Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 119. 1872 (Champ. Jura Vosges 1). – Fig. 64.

Agaricus speculum Fr., Spicilegium: 4. 1836; *Rhodophyllus speculum* (Fr.) Quél., Enchir. Fung.: 59. 1886.

EXCL. – *Entoloma speculum* sensu Cooke, Ill. Brit. Fungi 3: pl. 342 (308). 1884 (= *E. niphoides*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 188-189, fig. 12. 1981.

Pileus 14-37 mm, convex, then expanding, with or without low umbo, with slightly involute margin when young, with marginal zone undulating with age, weakly hygrophanous, when moist brilliantly white, sometimes with pale greyish or pale yellowish spots, translucently striate at margin or not, pallescent on drying, glabrous or slightly villose at centre. Lamellae, L = 30-60, l = 1-5, moderately distant, adnate-emarginate, narrowly ventricose, sometimes veined, white then pink, sometimes with brown tinge (Mu. 7.5 YR 7/6, 7/4, 6/4, 10 YR 6/3), with entire or dentate, concolorous edge. Stipe 20-65 × 2-5 mm, cylindrical,

sometimes broadened at base, sometimes flexuose, brilliantly white or with grey or yellowish tinges, especially when handled, at apex sometimes pruinose-flocculose, downwards glabrous, silvery striate lengthwise, solid, then narrowly fistulose. Context thin, white, relatively firm. Smell weakly to distinctly farinaceous, especially when cut. Taste strongly farinaceous.

Spores 9.0-12.5 (-13.0) × (7.5-) 8.0-12.0 µm, Q = (1.0-) 1.05-1.25 (-1.3), $\bar{Q}$ = 1.2, irregularly 5-8-angled in side-view. Basidia 35-45 × 9-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to an ixocutis of narrow cylindrical hyphae, 2-7.5 µm wide with easily disintegrating and gelatinized walls. Pigment hardly visible, intracellular. Clamp-connections present.

HABITAT & DISTR. – Solitary or in small groups and terrestrial in or near humus-rich frondose forest. Very rare (Zwolle: Windesheim; Neerijnen: Kasteelbos; Dorst.). Aug.

The small basidiocarps and pale colour are distinctive for *E. speculum*. *Entoloma niphoides* is a larger species, appearing in spring in copses of *Prunus spinosa*, and has more weakly angled spores. *Entoloma leucocarpum* comes very close to *E. speculum*, but differs in having distinctly developed cheilocystidia.

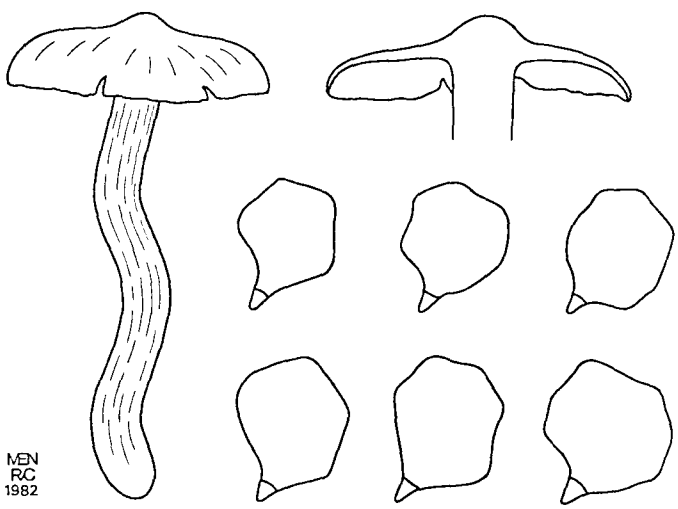

Fig. 64. *Entoloma speculum*.

15. Entoloma leucocarpum Noordel. in Persoonia 11: 189. 1981. – Fig. 65.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 189-190, fig. 13. 1981.

Pileus 18-32 mm, conico-convex then applanate with small, weak umbo, with straight margin, not hygrophanous, pallid, almost white, centre with slight grey-brown tinge, strongly radially fibrillose, satiny, appearing subtomentose under lens. Lamellae, L = 30-36, l = 3-5, crowded, narrowly adnate to emarginate, ventricose, extending below pileus, white then pink with entire, concolorous edge. Stipe 25-40 × 2.5-4 mm, cylindrical with abruptly bulbous base, solid then hollow, white then with pale yellowish grey tinge, fibrillose-striate lengthwise, pruinose at apex only. Context thin, white. Smell none. Taste rancid.

Spores (8.5-) 9.0-11.0 (-11.5) × (7.5-) 8.0-8.5 (-9.0) µm, Q = 1.1-1.25 (-1.3), $\bar{Q}$ = 1.2, 5-7-angled in side-view. Basidia 40-53 × 13-16 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 60-125 × 13.5-26 (-40) µm, irregularly cylindrical, often flexuose, with subcapitate or moniliform apex. Pileipellis a thin cutis of narrow,

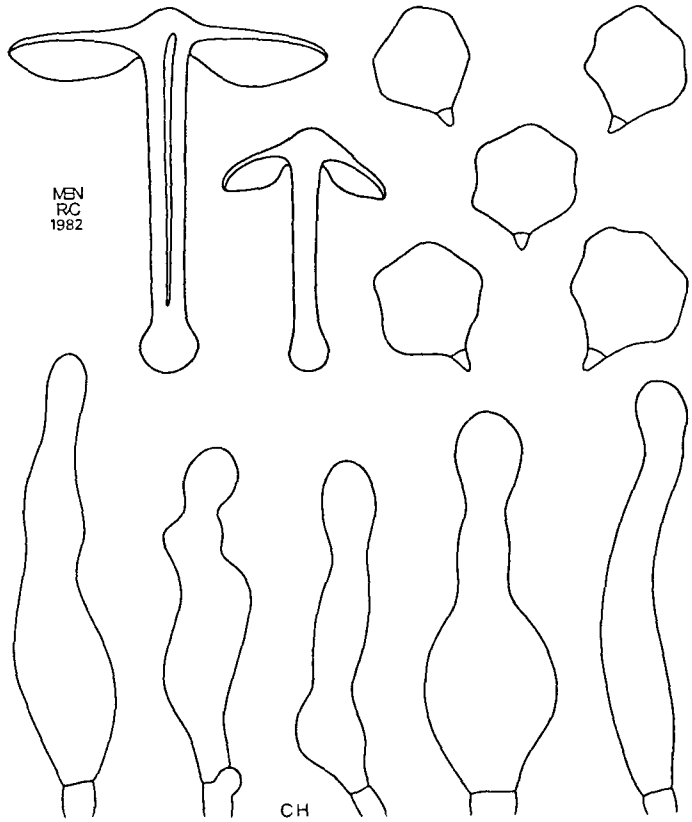

Fig. 65. *Entoloma leucocarpum*.

cylindrical hyphae, 3-6 (-7.5) µm wide. Pigment pallid, intracellular. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In small group, on moist soil in humus-rich frondose forest with *Quercus robur*, *Fraxinus excelsior*, and *Alnus glutinosa*. Only known from the type-locality (Oostvoorne: Mildenburg). Aug.

16. Entoloma subradiatum (Kühn. & Romagn.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 197. 1978. – Fig. 66.

Rhodophyllus subradiatus Kühn. & Romagn. in Rev. Mycol. 19: 10. 1954 (Compl. Fl. anal. 1).

SEL. DESCR. & FIGS. – Kühn. & Romagn. in Rev. Mycol. 19: 30-31, fig. 4, 6. 1954 and Rev. Mycol. 20: 212-214, fig. 18. 1955 (Compl. Fl. anal. 1); Noordel. in Persoonia 191-192, fig. 14. 1981.

Pileus 15-30 (-50) mm, conico-convex soon expanding to plano-convex or plano-concave, usually with applanate or slightly depressed centre, more rarely with small umbo, with margin slightly involute when young, straight later on, marginal zone usually lobed-undulating with

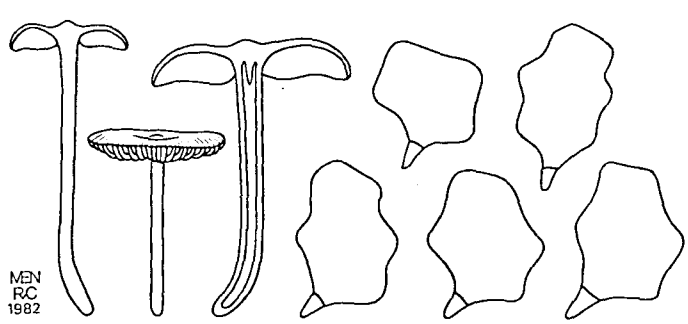

Fig. 66. *Entoloma subradiatum*.

age, strongly hygrophanous, when moist dark brown with reddish or greyish flush, centre usually distinctly darker to almost black, paler at margin (centre Mu. 10 YR 2/2, 3/2, 4/2, 4/3 to 7.5 YR 3/2, at margin 10 YR 7/4, 8/3) translucently striate up to quarter or half of radius, strongly pallescent on drying along radial streaks, smooth or slightly to distinctly rugulose, especially at centre. Lamellae, L = 20-40(-45), l = 3-5, crowded to moderately distant, broadly adnate to emarginate, often with slight decurrent tooth, segmentiform or ventricose, up to 4 mm broad, pale then pink sometimes with brown tinge (7.5 YR 8/4 to 10 YR 7/4) with concolorous, denticulate edge. Stipe 27-50 × 1.5-4 mm, cylindrical, often slightly broadened at base (-6 mm), pallid, white or pale grey-brown (2.5 Y 8/2, 7/2 to 10 YR 7/2, 7/3) innately fibrillose to weakly silvery striate, at apex pruinose or not, downwards glabrous, solid or fistulose. Context thin, relatively firm in pileus, pallid watery grey in cortex. Smell weakly to strongly farinaceous. Taste weakly to strongly farinaceous.

Spores (8.0-) 8.5-11.0 (-12.5) × 7.0-8.0 (-10.5) µm, Q = 1.1-1.3 (-1.35), $\bar{Q}$ = 1.2, 5-7-angled in side-view. Basidia 32-47 × 9-16 µm, 4- rarely also 2-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow, 2.5-7 µm wide hyphae, sometimes gradually desintegrating forming an ixocutis; subpellis well-developed, made up of inflated elements. Pigment brown, intracellular. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial, solitary or caespitose in humus-rich frondose forest. Not uncommon. July-Oct. Probably widespread in W.Europe but easily overlooked or confused with other small *Entoloma* species.

Entoloma subradiatum is one of the smallest members of sect. *Rhodopolia*. It comes close to *E. sordidulum*, from which it mainly differs in the type of pigmentation.

17. Entoloma sphagneti Naveau in Natuurw. Tijdschr. 5: 75. 1935. – Fig. 67.

Rhodophyllus sphagneti (Naveau) Kühn. & Romagn., Fl. anal. Champ. sup.: 194. 1953 (not valid, basionym not mentioned).

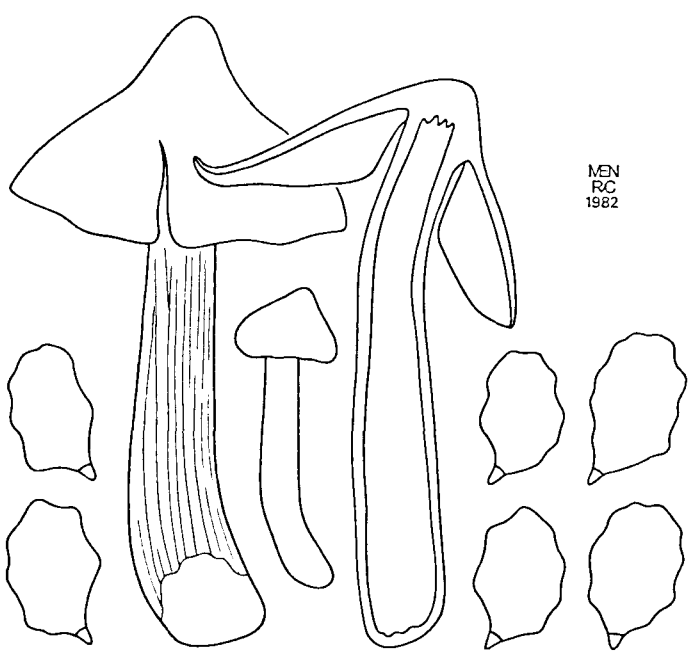

Fig. 67. *Entoloma sphagneti*.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 95a. 1981; Imler in Bull. Soc. Nat. Oyonnax 14-15: 148a. 1961.

SEL. DESCR. & FIGS. – Imler in Bull. Soc. nat. Oyonnax 16-18: 105-106. 1966; Noordel. in Persoonia 11: 192-194, fig. 15. 1981.

Pileus (15-) 20-80 (-120) mm, conical to conico-campanulate, slowly expanding, finally plano-convex with broad conical umbo, with margin involute when young, straight in old stages, strongly hygrophanous, when moist very dark chocolate brown to almost blackish brown (Mu. 5 YR 2/1, 2/2, 3/1, 7.5 YR 3/2, 4/2, 10 YR 2/2, 3/3), almost uniformly coloured, not much paler towards margin, obscurely translucently striate at margin only, pallescent on drying along radial streaks to greyish brown or yellowish brown with slight reddish tinge (7.5 YR 4/4 to 10 YR 5/4), subviscid when moist, dry and satiny on drying. Lamellae, L = 40-60, l = 3-5, crowded, free or deeply emarginate, triangular then broadly ventricose, up to 11 mm broad, pale cream when young soon flesh-colour to reddish brown (10 YR 5/3, 7.5 YR 6/4, 5/4, 4/4, 4/2, 5 YR 7/3, 6/4) with irregular, concolorous edge. Stipe 35-105 × 3-15 mm, cylindrical more rarely tapering at base to almost rooting, fragile, grey-brown to reddish brown, paler than pileus (10 YR 6/3, 5/4, 4/3, 7.5 YR 4/2, 3/2, 5 YR 3/2), strongly fibrous-striate lengthwise with paler fibrils alternating with darker background, white tomentose at base. Context almost concolorous with surface or slightly paler in inner parts, very fragile and brittle, especially in stipe. Smell indistinct. Taste indistinct.

Spores 9.5-12.5 × 6.5-9.0 µm, Q = (1.2-) 1.3-1.5 (-1.8), $\bar{Q}$ = 1.35-1.4, many-angled almost nodulose in side-view. Basidia 25-50 × 8-16 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow, cylindrical, 2.5-9 µm hyphae. Pigment abundant, brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In and on dead or living *Sphagnum* in pleistocene peat-bogs of north-western Europe, rarely outside bogs and then terrestrial in very moist deciduous forest, usually in large groups. Rare, July-Oct.

Entoloma sphagneti is very characteristic with its large, dark coloured basidiocarps, its elongate, almost nodulose spores, and its habitat. It cannot be confused with any other species of *Entoloma*.

Subsect. **Typodochroa** (Larg.) Noordel.

Pigment incrusting, sometimes in addition intracellular.

18. Entoloma sordidulum (Kühn. & Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 175. 1960. – Fig. 68.

Rhodophyllus sordidulus Kühn.& Romagn. in Rev. Mycol. 19: 10. 1954 (Compl. Fl. anal. 1).

SEL. DESCR. & FIGS. – Kühn. & Romagn. in Rev. Mycol. 19: 29-30, figs. 4, 6. 1954 and Rev. Mycol. 20: 208-210, fig. 16, pl. 3B. 1955 (Compl. Fl. anal. 1); Noordel. in Persoonia 11: 207-209, fig. 22. 1981.

VERN. NAME. – Groezelige satijnzwam.

Pileus (5.5-)10-40(-50) mm, conical to hemispherical at first, then expanding, finally applanate to concave, usually with small umbo, with slightly involute margin when young, with marginal zone undulating with age, hygrophanous, when moist pale to moderately dark grey-brown, rarely purely white, sometimes with reddish flush (Mu. 7.5 YR 4/2, 6/4; 10 YR 5-7/2-4; 2.5 Y 6-7/2-3), paler at margin (10 YR 7/3, 7/4), usually with conspicuously darker centre (7.5 YR 3/2, 4/2, 10 YR 2-5/2-3) not translucently striate or at very margin only, strongly palles-

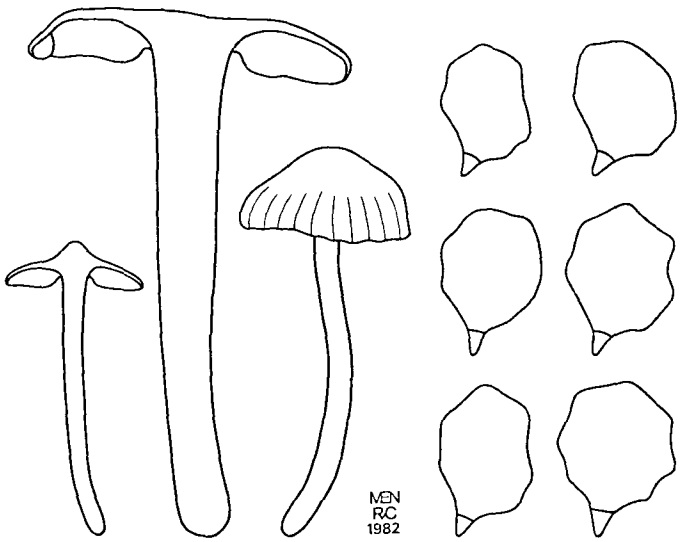

Fig. 68. *Entoloma sordidulum.*

cent on drying to grey-brown or yellowish grey (10 YR 7/3, 8/3, 8/6, 8/8), smooth or frequently slightly tomentose at centre, sometimes radially rugose towards margin. Lamellae, L = 20-40, l = 3-5, moderately distant, narrowly adnate to emarginate, more rarely broadly adnate with decurrent tooth, segmentiform to ventricose, rarely very broadly ventricose exceeding the pileus, grey, rarely white when young, then with pink tinge, finally brown-pink (10 YR 8-6/4, 7.5 YR 8-6/4) with entire or eroded concolorous edge. Stipe 20-50 (-60) × 2-4.5 (-6.0) mm, cylindrical, sometimes broadened at base, sordid white to pale grey-brown (10 YR 8/3, 7/4, 7/3, 7/2, 6/4), with innate silvery striation lengthwise, often almost polished, at apex pruinose, solid or fistulose. Context firm, sordid white. Smell farinaceous-rancid. Taste strongly farinaceous with nasty rancid aftertaste.

Spores 8.0-11.5 × 7.0-9.0 µm, Q = (1.0-) 1.1-1.3 (-1.4), $\bar{Q}$ = 1.2, 5-7-angled in side-view. Basidia 30-45 × 10.5-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of radially arranged, cylindrical, 2-7 µm wide hyphae, sometimes, particularly at centre, with cylindrical to subclavate terminal elements, up to 12 µm wide. Pigment minutely incrusting the hyphae of pileipellis and upper pileitrama, in addition pale brown intracellular in upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial in humus-rich frondose forest, often on clayey soil. Rather common, often in large groups. Probably widespread in W.Europe. July-Oct.

Entoloma sordidulum is one of the most common species of *Entoloma* in the rich forests on clay along the large rivers and in the humus-rich forest along the inner margin of the coastal dunes. It is extremely variable in colour on the pileus; even absolute white specimens have been found. *Entoloma subradiatum* comes close to *E. sordidulum*, but differs in having a distinctly translucently striate pileus and in lacking incrusting pigments.

19. Entoloma majaloides P.D.Orton in Trans. Br. mycol. Soc. 43: 230. 1960. – Fig. 69.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 205-207, fig. 21. 1981; P.D.Orton in Trans. Br. mycol. Soc. 43: 230. 1960.

Pileus 32-85 mm, conical or hemispherical, then expanding, finally applanate with umbo, with straight margin, with strongly undulating marginal zone when old, hygrophanous, when moist brown when young (Mu. 10 YR 3/3, 4/3) when mature yellow-brown (10 YR 5/4, 6/4, 7/4, 6/6, 7/6), translucently striate up to one-third to one-half of radius, strongly pallescent on drying, covered with minutely silvery hairs when young, later glabrescent, remaining slightly pruinose to velutinous at centre. Lamellae, L = 28-40, l = 3-9, moderately distant, broadly adnate to emarginate, segmentiform to ventricose, pale grey then sordid pink (2.5 Y 8/2, 10 YR 8/2 then between 10 YR 7/3 and 7.5 YR 8/4) with irregular, concolorous edge. Stipe 70-120 × 8-12 mm, cylindrical or slightly broadened towards base, sometimes more or less rooting, solid then fistulose, yellow, strongly white-fibrillose striate lengthwise, at apex sometimes conspicuously pruinose, white tomentose at base. Context pale grey in pileus and stipe, brittle. Smell none or weakly farinaceous. Taste none or rancid.

Spores 8.0-10.5 × 7.0-8.0 µm, Q = 1.0-1.15, $\bar{Q}$ = 1.05, rounded 5-6-angled in side-view. Basidia 27-40 × 8.5-13.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of narrow cylindrical hyphae, 2.5-6 µm wide. Pigment minutely incrusting the hyphae of pileipellis, in addition pale brown intracellular in upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial. In small groups in the humus of frondose forest of *Betula*, *Alnus*, *Populus*, *Salix*; in Great Britain and Norway also in coniferous forest. Very rare (Delden: Twickel; Oostvoorne). Sept.-Oct.

Entoloma majaloides comes very close to *E. sericatum*, from which it differs mainly in the predominant yellow colours of the basidiocarps, and the lack of a nitrous smell.

20. Entoloma sericatum (Britz.) Sacc., Syll. Fung. 11: 45. 1895.

Agaricus sericatus Britz. in Bot. Zbl. 15/17: 8. 1893 (Hymenomyc. Südbayern 9); *Rhodophyllus sericatus* (Britz.) J.Favre, Assoc. Fong. Hauts-Marais: 54. 1948.

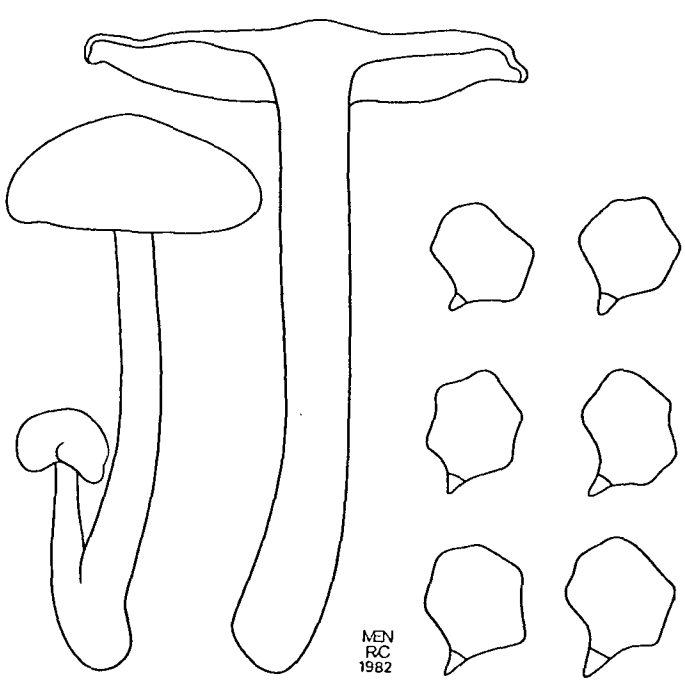

Fig. 69. *Entoloma majaloides.*

KEY TO THE VARIETIES

1. Stipe pale brown, covered with silvery fibrils; in swamp-forest of *Alnus* and *Salix*. . . . . var. **sericatum**
1. Stipe brilliantly white, strongly silvery striate; in coastal sand-dunes among *Salix repens*. . . . . var. **saliciphilum**

var. **sericatum** – Fig. 70.

SEL. DESCR. & FIGS. – J.Favre, Assoc. fong. Hauts-Marais: 54. 1948; Noordel. in Persoonia 11: 201-203, fig. 19. 1981.

Pileus 15-70 mm, conical or hemispherical then expanding to plano-convex or applanate, usually with low, broad umbo, with slightly involute margin when young, straight when old, strongly hygrophanous, when moist pale to moderately dark brown (Mu. 10 YR 5/4, 6/4 rarely 3/4) not very much paler towards margin, translucently striate up to half the radius, strongly pallescent on drying to pale brown (10 YR 7/4, 8/4), smooth, glabrous or with small arachnoid-fibrillose patches at margin when young and fresh. Lamellae, L = 25-45, l = 3-7, moderately crowded, broadly adnate with slight decurrent tooth or emarginate, arcuate, then segmentiform, rarely ventricose, white then pink (10 YR 8/3; 7/5 YR 8/2, 8/4) with entire or eroded, concolorous edge. Stipe 45-110 × 3-10 mm, cylindrical, slightly broadened towards base or somewhat rooting, often flexuose, very pale brown, densely silvery fibrillose-striate, at apex sometimes pruinose, white tomentose at base, fistulose. Context brittle, rarely firm in stipe. Smell spontaneously slightly nitrous, soon more or less farinaceous. Taste unpleasant, rancid-farinaceous.

Spores 8.0-10.0 × 6.5-8.0 µm, Q = 1.05-1.3, $\bar{Q}$ = 1.2, rounded 5-6-angled in side-view. Basidia 25-42 × 8.5-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of narrow, cylindrical, 2.5-8 µm wide hyphae. Pigment minutely incrusting in the hyphae of pileipellis, in addition very pale brown intracellular in upper layers of pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In groups, in swamp-forests of *Alnus* and *Fraxinus*, in pure *Alnus*-stands or in *Betula* forest, sometimes along *Sphagnum*. Wide-spread in N.W.Europe, not uncommon. July-Nov.

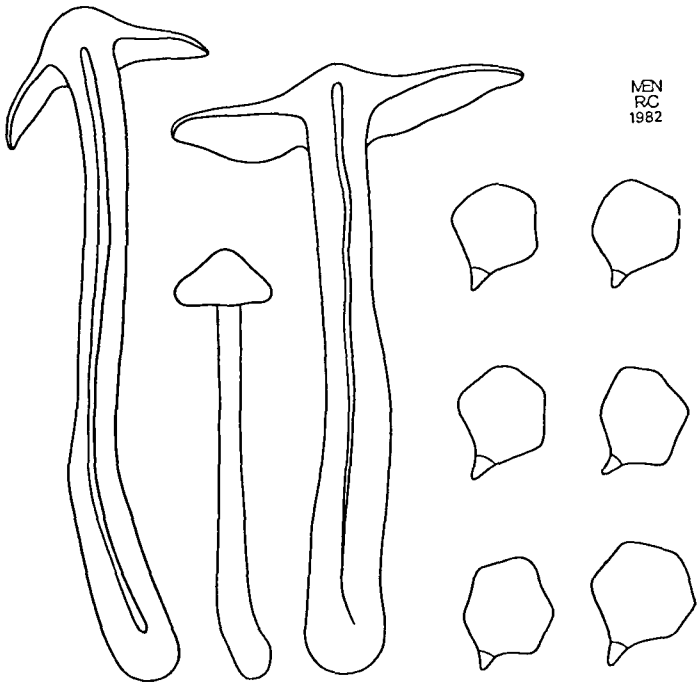

Fig. 70. *Entoloma sericatum* var. *sericatum*.

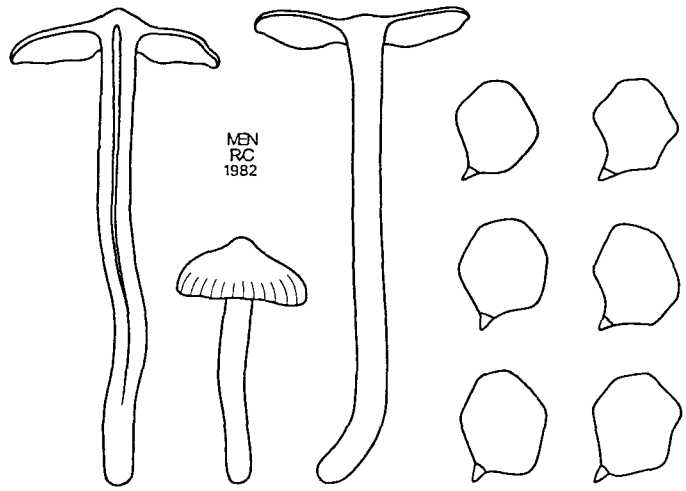

Fig. 71. *Entoloma sericatum* var. *saliciphilum*.

Entoloma sericatum resembles *E. nidorosum* in having a relatively pale brown pileus and pallid stipe, and a somewhat nitrous smell. It differs, however, in having minutely incrusted hyphae in pileipellis and upper pileitrama.

var. **saliciphilum** – Fig. 71.

Entoloma sericatum var. *saliciphilum* Noordel. in Persoonia 11: 203. 1981.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 203-205, fig. 20. 1981.

CHARACTERISTICS. – Basidiocarps medium-sized to small; pileus 20-60 (-70) mm broad, pale yellow-brown or greyish brown; lamellae pale then pink; stipe brilliantly white; smell subnitrous, then more or less farinaceous; in *Salix repens* thickets in the coastal sand dunes.

HABITAT & DISTR. – In large groups among *Salix repens* on slightly acid sand in moist valleys in the coastal sand dunes of the Netherlands and the German Federal Republic. Not uncommon. Aug.-Nov.

21. Entoloma gerriae Noordel. in Persoonia 11: 199. 1981. – Fig. 72.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 332, fig. 147. ('1982') 1983; Noordel. in Persoonia 11: 199-201, fig. 18. 1981.

Pileus 10-35 mm, convex, soon applanate to concave, with or without central depression, rarely faintly umbonate, with involute margin when young, weakly hygrophanous, when moist blackish brown, only slightly paler at margin (Mu. 10 YR 2/1, 2/2, 3/2, towards margin 10 YR 3/2, 3/3, 4/4, outermost margin 10 YR 5/4, 6/5), not translucently striate or at very margin only, slightly pallescent on drying to greyish brown (10 YR 4/3, 3/4), dull, subtomentose (under lens). Lamellae, L = 20-40, l = (1-) 3-5, distant, broadly adnate with short decurrent tooth or slightly emarginate, sometimes transvenose or intervenose, sometimes thickish, pale brown or yellowish then pink finally brown-pink (10 YR 7/3, 7.5 YR 7/6, 7/4, 6/6) with slightly eroded, concolorous edge. Stipe 13-50 × 2-10 mm, cylindrical and flexuose or strongly tapering downwards, solid, pale at very apex, downwards dull grey-brown (10 YR 6/4, 5/4, 5/3, 5/2, 4/3), silvery white fibrillose striate lengthwise, slightly pruinose at apex; base white tomentose. Context sordid, very firm. Smell strongly farinaceous. Taste strongly farinaceous.

Spores 8.5-11.0 (-12.5) × 7.0-9.0 µm, Q = 1.15-1.4, $\bar{Q}$ = 1.3, 6-angled in side-view. Basidia 25-50 × 9.5-14 µm, 2- and 4-spored,

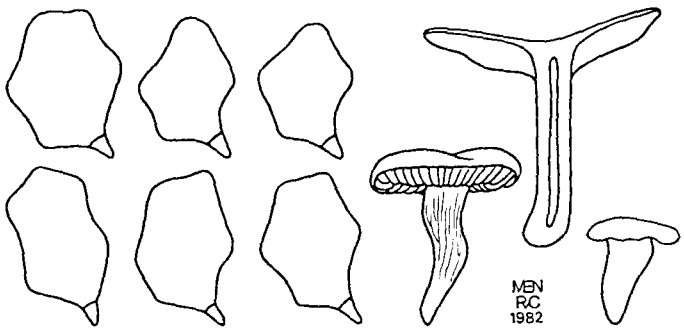

Fig. 72. *Entoloma gerriae*.

clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical, 3-12 µm wide hyphae with numerous ascending subclavate terminal elements, particularly at centre. Pigment brown, incrusting the hyphae of pileipellis and pileitrama, in addition intracellular in some hyphae of pileipellis. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial on clayey soil in beech-forest (*Fagus*) and in grass-heath on moist, acid sandy soil (Arnolds, loc. cit.). Very rare (Mantinge: Hullenzand; Ysbrechtum: Epema State; Wilp: 'de Poll'). Aug.-Oct.

Entoloma gerriae is distinctive because of its dark colours, the structure and pigmentation of its pileipellis, and its elongate spores.

22. Entoloma myrmecophilum (Romagn.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 197. 1978. – Fig. 73.

Rhodophyllus myrmecophilus Romagn. in Bull. mens. Soc. linn. Lyon 43 (no. spéc.): 386. 1974. – *Entoloma myrmecophilum* var. *atrogaleatum* Noordel. in Persoonia 11: 198. 1981; *Entoloma myrmecophilum* f. *atrogaleatum* (Noordel.) Noordel. in Persoonia 12: 461. 1985.

MISAPPL. – *Rhodophyllus platyphylloides* sensu Horak in Schweiz. Z. Pilzk. 49: 116. 1971. – *Rhodophyllus nigrocinnamomeus* sensu J.Favre, Assoc. fong. Hauts-Marais: 51-52. 1948.

SEL. ICON. – Einh. in Ber. Bayer. bot. Ges. 47: pl. 7B. 1976; Horak in Schweiz. Z. Pilzk. 49: 113a. 1971 (as *R. platyphylloides*).

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 47: 126-127. 1976; Horak in Schweiz. Z. Pilzk. 49: 116-117. 1971 (as *R. platyphylloides*); Noordel. in Persoonia 11: 196-199, figs. 16, 17. 1981; Romagn. in Bull. mens. Soc. linn. Lyon 43 (no. spéc.): 386. 1974.

KEY TO THE FORMAE

1. Pileus more or less uniformly coloured. . . . **f. myrmecophilum**
1. Pileus with dark brown central spot and much paler marginal zone. **f. atrogaleatum**

Pileus (15-) 20-65 mm, broadly conical or conico-campanulate, then expanding to convex, finally applanate with or without conical umbo, with slightly involute margin when young, then straight, with undulating marginal zone when old, hygrophanous, when moist rather dark (blackish) brown (Mu. 10 YR 3-4/2-3), uniformly coloured and not much paler towards margin (in f. *myrmecophilum*) or with dark blackish brown umbo and much paler margin (in f. *atrogaleatum*), pallescent on drying to brownish grey or yellowish brown (10 YR 5-6/4), when moist shiningly polished or with minute fibrillose patches, especially when young, on drying radially fibrillose or with minute micaceous patches, exposed specimens often rimose. Lamellae, L = about 40, l = 3-9, moderately crowded, broadly adnate with small decurrent tooth or deeply emarginate to almost free, arcuate then segmentiform rarely ventricose, white then with grey or brown tinge, finally brownish pink (Mu. 10 YR 7-5/3-4; 7.5 YR 7-6/4), with entire or subdenticulate, concolorous edge. Stipe 40-92 × 5-15 mm, cylindrical, often gradually broadening towards base, rarely subbulbous, sordid white or cream to grey-brown (2.5 Y 8/4, 10 YR 7/2, 7/3, 6/3) with dense pallid striation, glabrous or minutely downy-pruinose at apex, white tometose at base, solid. Context (dark) grey-brown when moist, pallescent on drying, relatively thick and firm in pileus or brittle. Smell farinaceous, often weakly so but usually distinct when cut. Taste rancid-farinaceous, nasty.

Spores 8.0-11.0 × (6.0-) 6.5-8.0 (-9.0) µm, Q = (1.0-) 1.1-1.3, $\bar{Q}$ = 1.15-1.2, 6-7-angled in side-view. Basidia 23-40 (-50) × 10-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin, compact cutis of radially arranged, cylindrical hyphae, 3-8 (-10) µm wide, at centre with ascending, often slightly thick-walled, clavate terminal elements up to 17 µm wide. Pigment incrusting the hyphae of pileipellis and upper pileitrama, in addition with intracellular pigment in upper pileitrama and, less abundant, also in pileipellis. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In groups in frondose forest on humus-rich soil, also in dune valleys dominated by *Salix repens*. Widespread and not uncommon. Aug.-Nov.

Entoloma myrmecophilum is one of the darkest species in section *Rhodopolia*, at least in the lowlands in north-western Europe. It resembles *E. venosum*, which has more slender spores. *Entoloma gerriae* is smaller and has rather differently shaped spores.

A forma with bicoloured pileus is distinguished as *E. myrmecophilum* f. *atrogaleatum* (Noordel.) Noordel. For a full description, see Persoonia 11: 198-199, fig. 17 (as var. *atrogaleatum*).

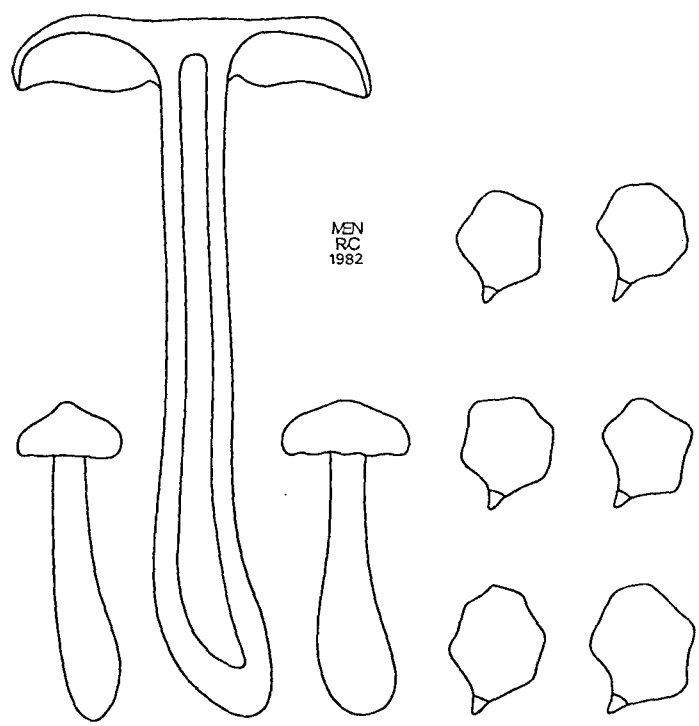

Fig. 73. *Entoloma myrmecophilum*.

Sect. **Polita** (Romagn. ex) Noordel.

Habit omphalioid or collybioid; pileus usually with depressed centre; lamellae adnate to decurrent; stipe polished.

23. Entoloma politum (Pers.: Fr.) Donk in Bull. bot. Gdns Buitenz., ser. III, 18: 158. 1949. – Fig. 74.

Agaricus politus Pers., Syn. meth. Fung.: 465. 1801; *Agaricus politus* Pers.: Fr., Syst. mycol. 1: 209. 1821; *Rhodophyllus politus* (Pers.: Fr.) Quél., Enchir. Fung.: 62. 1886; *Leptonia polita* (Pers.: Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 178. 1960. – *Leptonia pernitrosa* P.D.Orton in Trans. Br. Mycol. Soc. 43: 297. 1960; *Entoloma politum* f. *pernitrosum* (P.D.Orton) Noordel. in Persoonia 11: 211. 1981. – *Rhodophyllus nitriolens* Kühner in Bull. trimest. Soc. mycol. Fr. 93: 453. 1977.

SEL. DESCR. & FIGS. – Bon & Chevassut in Doc. mycol. 3(11): 13. 1973; Einh. in Ber. bayer. bot. Ges. 41: 107, figs. 22, 23. 1969; Kühner in Bull. trimest. Soc. mycol. Fr. 93: 453. 1977 (as *R. nitriolens*); Noordel. in Persoonia 11: 210-213, figs. 23, 24. 1981 (incl. f. *pernitrosum*); P.D.Orton in Trans. Br. mycol. Soc. 43: 297. 1960 (as *L. pernitrosa*).

VERN. NAME. – Elzesatijnzwam.

KEY TO THE FORMAE

1. Pileus dark brown; smell none or weakly nitrous. . . . f. **politum**
1. Pileus pale brown, yellowish brown or almost white; smell distinctly nitrous. . . . . f. **pernitrosum**

Pileus (7-)10-47 mm, hemispherical to convex, applanate with age, with slightly depressed to distinctly umbilicate centre, rarely with papilla, with involute margin, hygrophanous, when moist dark sepia to grey-brown (Mu. 10 YR 3-5/2-3) (in f. *politum*); horn brown to yellow-brown or cream colour (2.5 Y 7/4; 10 YR 8-5/3-4; 7.5 YR 7/4) (in f. *pernitro-pernitrosum*), slightly paler at margin, translucently striate up to half (or one-third) of the radius, pallescent on drying, often slightly rugulose at centre, shiny. Lamellae, L = (15-) 20-30, l = 1-7, (moderately) distant, broadly adnate, decurrent with tooth, or emarginate with decurrent tooth, triangular-arcuate when young, then segmentiform to ventricose, sometimes transvenose, white or cream, then pink, sometimes with brown tinge (10 YR 8/3, 8/4, 7/3 then 7.5 YR 7/4) with entire, concolorous edge. Stipe 16-85 × 1.5-6 mm, cylindrical, sometimes compressed, then up to 10 mm broad, often flexuose, sometimes tapering downwards, concolorous with pileus in pale specimens, in specimens with dark pileus distinctly paler (2.5 Y 8/4, 10 YR 8/4, 7/3, 7/4, 6/4, 5/4, 4/4)

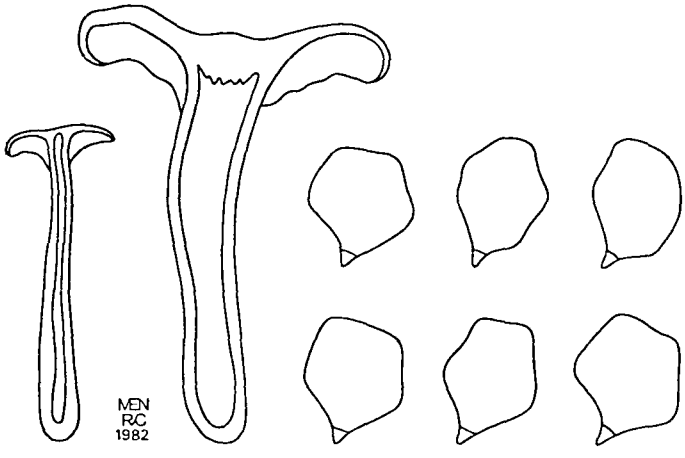

Fig. 74. *Entoloma politum.*

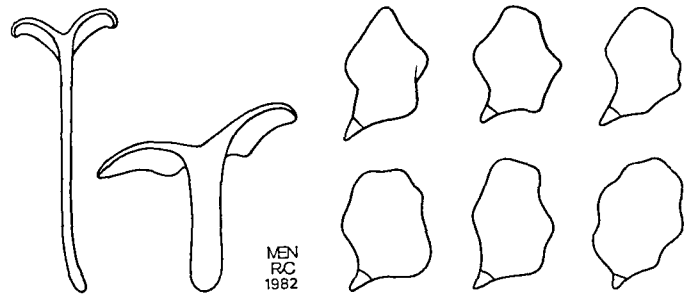

Fig. 75. *Entoloma caccabus.*

at apex rarely pruinose, entirely polished with shiny, undulating surface, rarely with some scattered, adpressed, silvery fibrils; at base white tomentose, solid or fistulose. Context thin, tough, in stipe, concolorous with surface or paler, especially in relatively fleshy specimens. Smell weakly to distinctly (in f. *politum*), even persistently nitrous (in f. *pernitrosum*). Taste unpleasantly rancid, not distinctly farinaceous.

Spores (7.5-) 8.0-10.0 (-10.5) × (6.5-) 7.0-8.0 (-8.5) µm, Q = (1.0-) 1.05-1.25, $\bar{Q}$ = 1.15, 5-6-angled in side-view. Basidia 20-40 × 7-13 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis an ixocutis of radially arranged cylindrical, 4-12 µm wide hyphae; subpellis made up of inflated elements, 25-90 (-120) × 12-25 µm. Pigment abundant, brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial. In large groups in swamp-forests of *Alnus*, *Salix*, and *Fraxinus*. Very common. Also a common fungus in N. and W.Europe from sea level up to subalpine dwarf-shrub heaths. Aug.-Nov.

Entoloma politum is a common species of swamp-forests in the lowlands of north-western Europe. *Entoloma caccabus* differs in having more elongate spores and a farinaceous smell. *Entoloma bisporigerum* has 2-spored basidia, and a strong rancid-farinaceous smell.

24. Entoloma caccabus (Kühner) Noordel. in Persoonia 11: 86. 1980. – Fig. 75.

Rhodophyllus caccabus Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 3. 1954 (Compl. Fl. anal. 1). – *Eccilia paludicola* P.D.Orton in Trans. Br. mycol. Soc. 43: 227. 1960.

SEL. DESCR. & FIGS. – Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 13-14, figs. 1, 2b. 1954 (Compl. Fl. anal. 1); Noordel. in Persoonia 11: 213-215, fig. 25. 1981.

Pileus 10-25 (-40) mm, convex to concave with depressed to umbilicate centre, with involute margin when young, with undulating marginal zone with age, hygrophanous, when moist dark (reddish) brown or date brown with grey tinge (Mu. 10 YR 3/4, 4/4; 7.5 YR 3/2, 4/2, 4/4; 5 YR 2/2, 3/2), slightly paler towards margin, translucently striate at margin only, rarely up to half the radius, pallescent on drying to reddish brown or greyish brown (7.5 YR 5/2, 4/2; 10 YR 5/3, 6/3, 6/4, 7/3), glabrous, shiny. Lamellae, L = 20-30, l = (1-) 3-7, moderately distant, arcuate then segmentiform, sometimes ventricose with broadest part near stipe, pale then pink, often with distinct brown tinge (10 YR 7/4; 7.5 YR 7/4, 6/4, 5/4) with concolorous or slightly paler, entire or eroded edge. Stipe 12-45 × 1-3 (-4) mm, cylindrical or compressed, sometimes tapering downwards, rarely slightly broadened towards base, often flexuose, yellowish brown or greyish brown, often distinctly paler than pileus, basal part usually paler than upper part, sometimes almost white (10 YR 4-7/3-4; 7.5 YR 4/2, 5/4, at base up to 2.5 Y 7-8/4), glabrous, polished.

Context concolorous with surface, brittle in pileus, tough in stipe. Smell strongly farinaceous-rancid to rancid-fetid, like that of decaying cabbage or paraffin oil. Taste rancid, nasty.

Spores 8.0-11.5 (-12.0) × (6.5-) 7.0-8.5 (-9.0) µm, Q = 1.05-1.5, $\bar{Q}$ = 1.25, mostly 6-angled in side-view. Basidia 27-45 × 8.5-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis to ixocutis of radially arranged, cylindrical 7-14 (-18) µm wide hyphae, sometimes with clavate terminal elements, up to 27 µm wide. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial in large groups, frequently found in damp *Alnus*, *Salix*, and *Fraxinus* forests on humus-rich soils. Fairly common in N. and W.Europe. Aug.-Nov.

Entoloma caccabus is found in habitats similar to that of *E. politum*, but seems to be somewhat rarer. It differs clearly from *E. politum* in larger, elongate spores and farinaceous smell.

25. Entoloma bisporigerum (P.D.Orton) Noordel. in Persoonia 11: 86. 1980. – Fig. 76.

Eccilia bisporigera P.D.Orton in Notes R. bot. Gdn Edinb. 29: 99. 1969.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 215-217, fig. 26. 1981; P.D.Orton in Notes R. bot. Gdn Edinb. 29: 99. 1969.

VERN. NAME. –Tweesporige satijnzwam.

Pileus 9-35 mm, convex or applanate with depressed, rarely umbilicate or slightly papillate centre, with involute margin, with undulating marginal zone with age, hygrophanous, when moist moderately dark to dark sepia, horn-brown or reddish brown (Mu. 10 YR 3/2, 6/4; 7.5 YR 3/2) at margin sometimes distinctly paler (10 YR 3-6/2-4; 7.5 YR 5/4), translucently striate up to half or three-quarters of radius, pallescent on drying to greyish brown (10 YR 5/4, 6/4, 6/3), often remaining darker at centre, glabrous or with granular, rugulose or subtomentose centre. Lamellae, L = 16-26 (-30), l = 1-3-5 (-7), moderately crowded, broadly adnate or with decurrent tooth to shortly decurrent, segmentiform, rarely ventricose, white then pink, finally often tinged brown (10 YR 8/2, 7/3-4, 6/4; 7.5 YR 6-7/2-4) with concolorous, often slightly irregular edge. Stipe 17-47 × 1.5-4 mm, cylindrical or with slightly swollen base, often flexuose, pale, whitish when young, then yellow or brown always paler than pileus (10 YR 8/3, 7/3, 6/3, 6/4, 5/4; 2.5 Y 6/2), glabrous, polished, rarely substriate, at base white tomentose, solid or fistulose. Context concolorous with surface, in fleshy specimens with pallid inner parts, brittle in pileus, rather tough in stipe. Smell spontaneously often weak, distinctly farinaceous when cut. Taste farinaceous-rancid.

Spores (9.5-)10.0-12.0(-13.0) × (7.0-)8.0-9.5(-10.5) µm, Q = 1.15-1.4 (-1.5), $\bar{Q}$ = 1.25, irregularly 6-9-angled in side-view. Basidia 24-40 × 8-13.5 µm, 2-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical, 3.5-12 (-18) µm wide hyphae with numerous, up to 25 µm wide clavate terminal elements; walls easily disintegrating, forming an ixocutis. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Terrestrial in groups, often on bare soil in swamp forest of *Alnus glutinosa*, *Fraxinus excelsior* and/or *Salix* spp., often together with *E. caccabus* and *E. politum*. Not uncommon. Probably with same distribution as *E. politum*. Aug.-Nov.

Entoloma bisporigerum is closely related to *E. caccabus*, from which it differs mainly in size and shape of the spores and in two-spored basidia. Other two-spored species of *Entoloma*, such as *E., cetratum* and *E. farinogustus* differ in having clampless hyphae and differently shaped tramal elements typical for subgen. *Nolanea*.

Sect. **Turfosa** (Romagn.) Noordel.

Basidiocarps tricholomatoid or collybioid; pileus distinctly hygrophanous; spores small, many-angled, 6-8(-9) µm long, cyanophilous; clamp-connections present; pigment intracellular.

26. Entoloma turbidum (Fr.: Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 119. 1872 (Champ. Jura Vosges 1).

Agaricus turbidus Fr.: Fr., Syst. mycol. 1: 205. 1821; *Rhodophyllus turbidus* (Fr.: Fr.) Quél., Enchir. Fung.: 59. 1886. – *Entoloma costatum* var. *cordae* P.Karst., Ryssl. Finl. Skand. Halföns Hattsvamp. 1: 268. 1879. – *Entoloma cordae* (P.Karst.) P.Karst. in Meddn Soc. Fl. Fauna fenn. 5: 9. 1879 (Symb. Mycol. fenn. 6).

VERN. NAME. – Zilversteelsatijnzwam.

KEY TO THE VARIETIES

1. Lamellae moderately crowded, normally thick; smell none or subfarinaceous; stipe fibrillose-striate. . . . . var. **turbidum**
1. Lamellae distant, thickish; smell sweat, aromatical or none; stipe innately fibrillose, not distinctly striate. . . var. **pachylamellatum**

var. **turbidum** – Fig. 77.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 94D. 1981; J.Lange, Fl. agar. dan. 2: pl. 76D. 1937.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 220-222, fig. 28. 1981; Romagn. in Bull. mens. Soc. linn. Lyon 43 (no. spéc.): 374. 1974.

Pileus 17-60 mm, truncate-conical or campanulate, conico-convex, expanding to plano-convex, always with low, broad umbo, with slightly involute margin when young, hygrophanous, when moist dark grey-brown or sepia, sometimes with slight reddish flush (Mu. 10 YR 2-4/2-3, 5/3; 7.5 YR 3/2), paler at margin (10 YR 3-4/4, 5-6/3, 7/6) translucently striate up to half of radius, subviscid, strongly pallescent on drying to pale grey-brown, in centre often remaining darker (centre 10 YR 4/3, 4/2, 5/2, rest 10 YR 6/3, 7/3, 8/3), dry, subtomentose at centre (under lens). Lamellae, L = 30-45, l = (1-) 3-7, fairly crowded,

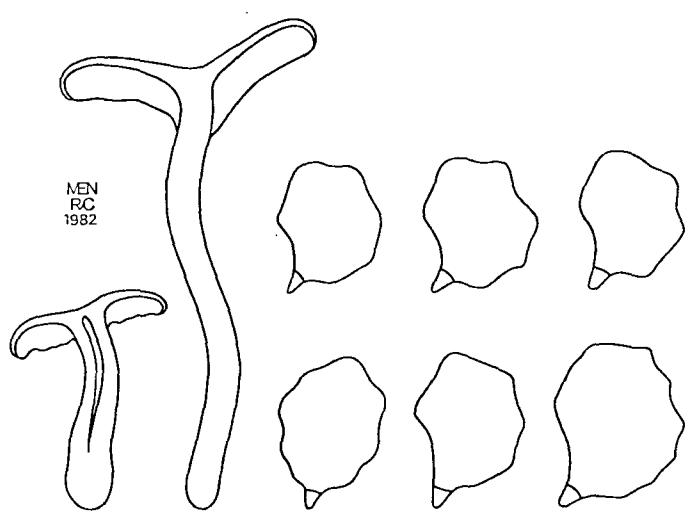

Fig. 76. *Entoloma bisporigerum*.

deeply emarginate to almost free, rarely narrowly adnexed, ventricose, grey then grey-brown, finally with slight pink tinge (10 YR 7/2, 7/3, 5/2, 5/3, 6/2; 7.5 YR 4-8/2-4) with entire or slightly irregular concolorous or slightly paler edge. Stipe (25-) 30-70 (-110) × (3-) 4-8 (-12) mm, cylindrical, often somewhat flexuose with broadened or attenuated base, pale greyish brown with dense, appressed, silvery white striation, general appearance whitish, at base often with distinct yellow tinge, particularly when bruised (10 YR 7/3, 7/4, 6/2, 6/3, 5/2, at base 5 Y 8/6, 8/8; 2.5 Y 8/2, 8/4), solid then fistulose. Context pale grey-brown or yellow-brown, firm. Smell weak, sweetish, rarely weakly farinaceous. Taste indistinct, sometimes unpleasantly rancid with bitterish after-taste.

Spores 6.5-8.5 (-9.0) × 6.0-7.0 (-7.5) µm, Q = 1.0-1.2 (-1.25), $\bar{Q}$ = 1.1, very thin-walled, subglobose in outline, many-angled. Basidia 25-45 × 8-11 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis or ixocutis of radially arranged, cylindrical hyphae, 2.5-5 (-7) µm wide with easily disintegrating walls, at centre with ascending, clavate terminal elements; subpellis well-developed, made up of inflated elements, 26-78 × 8-23 µm. Pigment abundant, brown, intracellular in pileipellis (subpellis). Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In groups in moist, mossy, coniferous forest and in moist *Calluna*-heaths on acid soils. Not uncommon. Rather common in N. and W.Europe. Aug.-Dec.

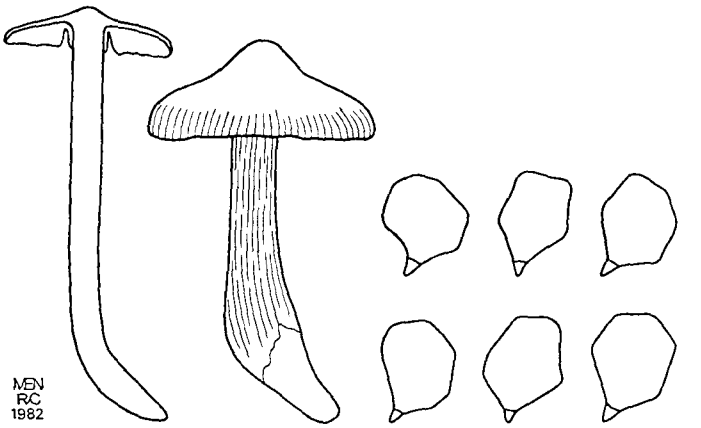

Fig. 77. *Entoloma turbidum* var. *turbidum*.

var. **pachylamellatum** Noordel. in Persoonia 11: 222. 1981. – Fig. 78.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 222-223, fig. 29. 1981.

CHARACTERISTICS – Pileus (7-)15-45 mm, conical then expanding, with margin often splitting when old, dark sepia or grey-brown, paler at margin, glabrous. Lamellae, L = 10-40, l = 1-3, distant, thickish, ventricose up to 7 mm broad, rather dark grey-brown with slight pink tinge; stipe 25-80 × 2-6.5 mm, cylindrical, often tapering to almost rooting at base, grey to grey-brown, innately fibrillose, not striate, at base yellowish; smell strongly aromatical, like cumarine (toffee, *Anthoxanthum ordoratum*); microscopical characters like the typical variety.

HABITAT & DISTR. – In extensively grazed, old dune grassland on poor sandy soil. Only known from the type-locality (Goeree: Westduinen). Oct.

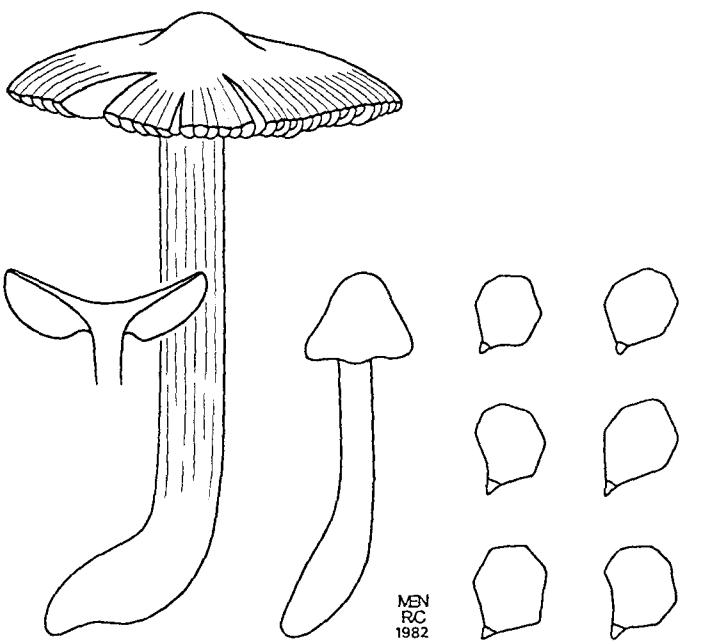

Fig. 78. *Entoloma turbidum* var. *pachylamellatum*.

27. Entoloma vinaceum (Scop.) Arnolds & Noordel. in Persoonia 10: 298. 1979. – Fig. 79.

Agaricus vinaceus Scop., Fl. carn. 1: 444. 1772; *Nolanea vinacea* (Scop.) Kumm., Führ. Pilzk.: 95. 1871; *Rhodophyllus vinaceus* (Scop.) Quél., Enchir. Fung.: 64. 1886.

MISAPPL. – *Rhodophyllus batschianus* sensu J.Lange in Dansk bot. Ark. 2(11): 32. 1921 and Fl. agar. dan. 2: pl. 76E. 1937.

VERN. NAME. – Okervoetsatijnzwam.

KEY TO THE VARIETIES

1. Stipe yellow. . . . . var. **vinaceum**
1. Stipe differently coloured.
2. Stipe grey. . . . . var. **fumosipes**
2. Stipe violaceous or lilaceous. . . . . var. **violeipes**

var. **vinaceum**

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 94a. 1981; J.Lange, Fl. agar. dan.: pl. 76E. 1937 (as *R. batschianus*).

SEL. DESCR. & FIGS. – J.Favre in Bull. trimest. Soc. mycol. Fr. 53:

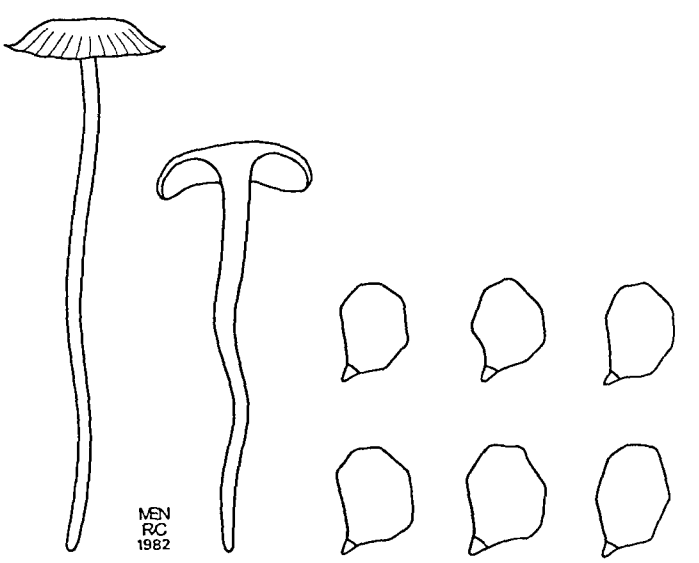

Fig. 79. *Entoloma vinaceum*.

277-279, fig. 3. 1937; Noordel. in Persoonia 11: 223-225, fig. 30. 1981.

Pileus 20-40 mm, convex with slightly depressed centre, rarely subumbonate, with involute margin when young, finally usually with straight margin, hygrophanous, when moist translucently striate at margin only or up to two-thirds of radius, horn-brown with darker brown centre, grey-brown or reddish brown, only slightly paler at margin (Mu. 10 YR 2-3/2, 3/4, 4/3; 7.5 YR 3/2, margin 10 YR 5/4), strongly pallescent on drying, glabrous or subtomentose at centre, shiny. Lamellae, L = 20-25 (-40), l = 1-3, moderately distant, adnate or slightly emarginate, segmentiform to ventricose, up to 5 mm broad, grey then with pink tinge (10 YR 7/2-3 then 10 YR 5/3 or 7.5 YR 5/4) with entire or crenulate, concolorous edge. Stipe 27-60 × 1.5-3 mm, cylindrical or flexuose, with tapering base, sometimes almost rooting, at apex greyish, downwards yellowish (2.5 Y 7-5/4, 10 YR 6/6), glabrous, polished or with some scattered silvery fibrils substriate, at base white tomentose, solid. Context thin-membranaceous in pileus, brittle-fibrillose in stipe, concolorous with surface in pileus, slightly paler in inner part of stipe. Smell none. Taste none.

Spores 6.5-8.0 (-9.0) × 5.5-7.0 (-7.5) µm, Q = 1.1-1.3 (-1.4), $\bar{Q}$ = 1.2, many-angled, thin-walled. Basidia 25-40 × 8-12.5 µm, 4-spored, clamped. Lamella edge fertile, Cystidia absent. Pileipellis a cutis with transitions to an ixocutis, made up of radially arranged, cylindrical, 2-5 (-7) µm wide hyphae with easily disintegrating walls. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Solitary or in small groups in grassland and open grassy vegetations, also in heath of *Calluna* and/or *Erica*, on poor, sandy, acid soils in the pleistocenic sandy areas and old coastal dunes. Common. Not uncommon in lowlands of western Europe. Oct.-Dec.

var. **fumosipes** Arnolds & Noordel. in Persoonia 10: 298. 1979.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 298-299, figs. 34-36. 1979; Noordel. in Persoonia 11: 225-226. 1981.

CHARACTERISTICS. – Differs from the type-variety in having a smoke grey stipe.

HABITAT & DISTR. – In mossy places in open vegetations on poor, acid soil (pleistocene sands, coastal dunes). Very rare. (Westerbork: Hullenzand; Velsen: Duin en Kruidberg; Gouderak: Stolwijkse Boezem). Nov.

var. **violeipes** Arnolds & Noordel. in Persoonia 10: 299. 1979.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 94 c, d. 1981.

SEL. DESCR. – Noordel. in Persoonia 11: 226-227. 1981.

CHARACTERISTICS. – Differs from the type-variety in having distinct violaceous tinges on the stipe.

HABITAT & DISTR. – Among mosses and grass in open grasslands on poor, acid, sandy soil on pleistocene sands and in old coastal dunes. Rare. Oct.-Dec.

Sect. **Clitopiloides** (Romagn.) Noordel.

Habit clitocyboid; pileus depressed, dark brown; lamellae broadly adnate-decurrent; stipe fibrillose-striate; hyphae clampless; spores subisodiametrical.

28. Entoloma costatum (Fr.: Fr.) Kumm., Führ. Pilzk.: 98. 1871. – Fig. 80.

Agaricus pascuus var. *costatus* Fr.: Fr., Syst. mycol. 1: 206. 1821; *Agaricus costatus* (Fr.: Fr.) Fr., Epicr.: 147. 1838; *Rhodophyllus costatus* (Fr.: Fr.) Quél., Enchir. Fung.: 59. 1886.

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 76F. 1937.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 103. 1969; Noordel. in Persoonia 11: 217-219, fig. 27. 1981; Romagn. in Bull. mens. Soc. linn. Lyon 43 (no. spéc.): 385. 1974.

Pileus (10-) 20-65 mm, convex then applanate, slightly depressed to distinctly umbilicate, with involute margin, with undulating marginal zone with age, hygrophanous, when moist dark sepia, reddish brown or blackish brown (Mu. 5 YR 4/2; 7.5 YR 3/2, 5/4; 10 YR 2/2, 3/2) not or only slightly paler towards margin, not translucently striate, pallescent on drying to golden brown, sepia or yellowish brown, and then often with grey tinge (10 YR 5/3, 6/3, 7/3, 7/4), shiny, often strongly fibrillose and fissurate towards margin, subrugulose to subtomentose at centre. Lamellae, L = 30-60, l = 1-3-5, crowded, broadly adnate with decurrent tooth or emarginate, segmentiform to subventricose, often coarsely transvenose, pale brown, then dark brown-pink (10 YR 6/4, 5/3; 7.5 YR 6/4, 5/4) with entire or subdentate, concolorous or slightly paler edge. Stipe 25-95 × 3-7 (-9) mm, cylindrical or compressed, often slightly tapering downwards, grey-brown or reddish brown, usually paler than pileus (10 YR 5/3, 6/4, 7/3; 7.5 YR 3/2, 4/2, 5/2, 6/2), coarsely fibrillose-striate lengthwise, solid, then fistulose. Context concolorous with surface, except for pale inner parts, brittle. Smell indistinct or fungoid or herbaceous, rarely subfarinaceous. Taste often somewhat rancid-nasty.

Spores (7.0-) 7.5-9.5 (-10.5) × (6.0-) 7.0-8.0 (-9.0) µm, Q = (1.0-) 1.05-1.3, $\bar{Q}$ = 1.15, subsodiametrical, (4-)5-6-angled in side-view. Basidia 28.5-40 × 9-14 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical hyphae 2.5-8 µm wide, with numerous, up to 15 µm wide, cylindrical to clavate terminal elements. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In groups in poorly manured grasslands, on dikes, etc., one collection in grass at roadside in mixed deciduous forest. Very rare. Deventer: Hengforder Waarden; Eemnes: Noordpolderse Veld; Veere: Veerse bos. Known from France, Denmark, and W.Germany. Oct.-Nov.

Entoloma costatum is a rare species with an unusual combination of characters, viz. an omphalioid habit, almost isodiametrical spores and clampless hyphae. It differs from *E. sericeum* among other things in having intracellular pigment and clampless hyphae.

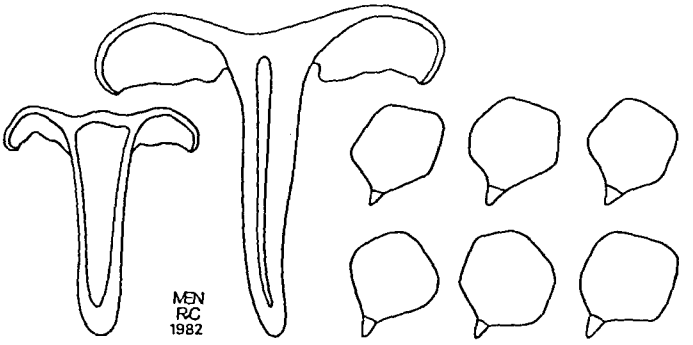

Fig. 80. *Entoloma costatum*.

Subgen. POUZARELLA (Mazzer) Noordel.

SEL. LIT. – Gulden & Markussen in Nord. J. Bot. 1: 543-549. 1981; Mazzer, Monogr. Stud. Gen. Pouzarella. 1976. – Mos. in Persoonia 7: 281-288. 1973; Noordel. in Persoonia 10: 207-243. 1979.

Habit mycenoid, rarely tricholomatoid; pileus not hygrophanous, strongly radially fibrillose to squamulose; pileipellis a transition between a cutis and a trichoderm made up of septate cylindrical to inflated hyphae with incrusted walls, sometimes with additional intracellular pigment; clamp-connections absent.

Sect. Pouzarella (Mazzer) Noordel.

Pigment incrusting only; cheilocystidia, if present, broadly fusiform to clavate.

29. Entoloma strigosissimum (Rea) Noordel. in Persoonia 10: 211. 1979. – Fig. 81.

Nolanea strigosissima Rea in Trans. Br. mycol. Soc. 6: 325. 1920; *Leptonia strigosissima* (Rea) P.D.Orton in Trans. Br. mycol. Soc. 43: 178. 1960; *Rhodophyllus strigosissimus* (Rea) Horak in Mos., Röhrlinge-Blätterpilze 3. Aufl.: 164. 1967; *Pouzaromyces strigosissimus* (Rea) Horak, Syn. Gen. Agar.: 502. 1968; *Pouzarella strigosissima* (Rea) Mazzer, Monogr. Stud. Gen. Pouzarella: 125. 1976.

MISAPPL. – *Pouzaromyces fumosellus* sensu Pilát in Acta Mus. nat. Prag. (B) 9(2): 60. 1953. – *Rhodophyllus babingtonii* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 186. 1953.

SEL. ICON. – Rea in Trans. Br. mycol. Soc. 6: pl. 7. 1920.

SEL. DESCR. & FIGS. – Horak, Syn. Gen. Agar.: 502. 1968; Mos. in Persoonia 7: 286. 1973; Mazzer, Monogr. Stud. Gen. Pouzarella: 125. 1976; Noordel. in Persoonia 10: 211-215, figs. 1-6. 1979.

Pileus 4-22 mm, conical, then conico-campanulate, never really expanding, with involute, then straight margin, when moist dark grey-brown to reddish brown, entirely covered with red-brown hairs, sometimes forming small radially arranged squamules, sometimes glabrescent with age, not hygrophanous, not translucently striate. Lamellae, L = about 20, l = 1, distant, adnate, sometimes emarginate, rarely almost free, narrowly segmentiform to subventricose, flesh-coloured grey, then reddish brown with pruinose, concolorous, slightly paler or slightly darker edge. Stipe 25-60 × 1-3.5 mm, cylindrical, sometimes flexuose, with or without longitudinal groove, dark brown, entirely woolly-hairy with red-brown hairs like the pileus, base with ochraceous-reddish radiating hairs. Context rather dark blackish brown or reddish brown, solid. Smell spontaneously none, slightly unpleasant-spermatic when bruised. Taste not recorded.

Spores (12.5-) 14.0-19.0 (-20.5) × (7.0-) 8.0-9.5 (-11.0) µm, Q = 1.5-2.3, $\bar{Q}$ = 1.9, strongly nodulose-angular in side-view. Basidia (35-) 40-58 × 12.5-18 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia (24-) 47-92 × (15-) 20-34 µm, rather variable in shape, narrowly to broadly clavate, obpyriform to subglobose, sometimes, particularly near margin of pileus with conical appendix, towards margin of pileus gradually passing into the setiform hairs of pileal surface, often yellowish brown incrusted, especially in middle part, sometimes also with brownish intracellular pigment. Pileipellis a transition between a cutis and a trichoderm, made up of cylindrical to broadly clavate, up to 25 µm wide elements, intermixed with red, septate, thick-walled, setiform hairs, up to 1000 µm long and 10-20 µm wide at base, gradually tapering towards acute apex. Stipitipellis a cutis of 8-12 µm wide, thick-walled, brown-incrusted, cylindrical hyphae with long setiform

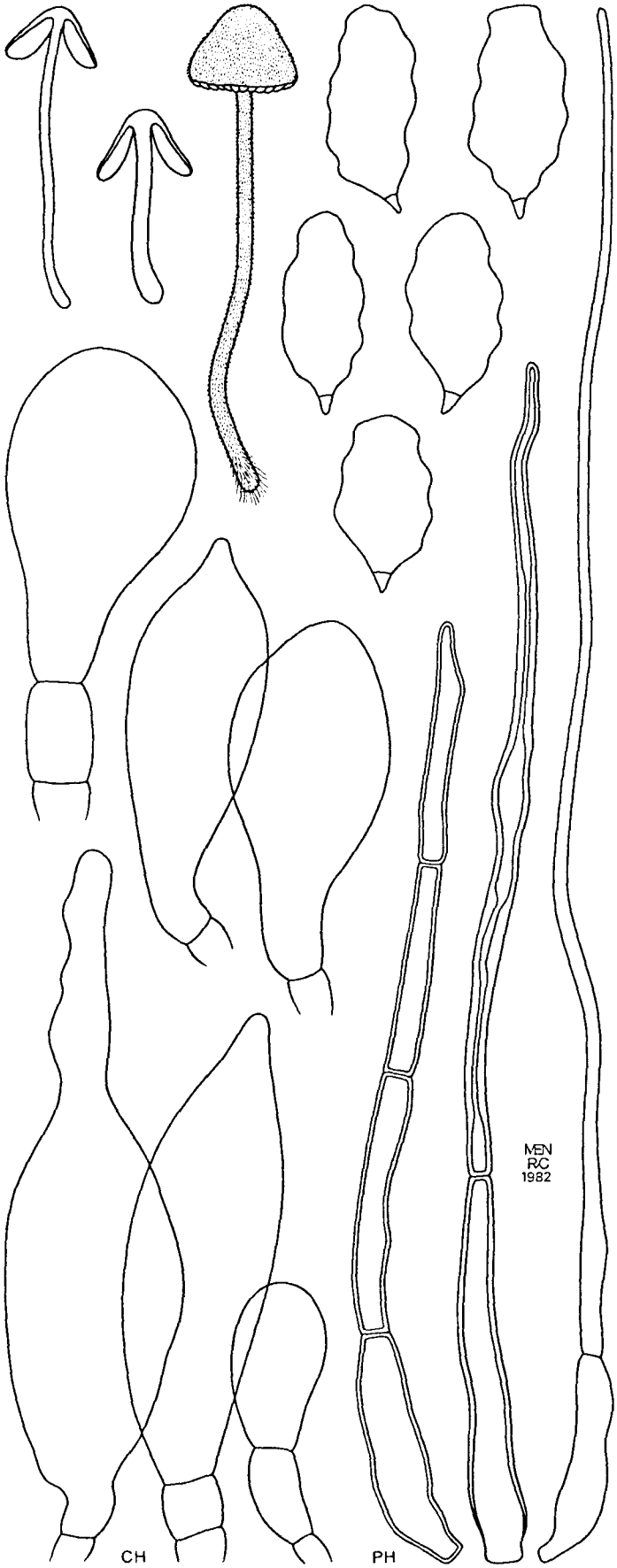

Fig. 81. *Entoloma strigosissimum.*

hairs similar to those found in pileipellis. Pigment red-brown, incrusting all hyphae and terminal elements of pileipellis, stipitipellis, and pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Gregarious, usually terrestrial, in deciduous forest on clayey, more or less calcareous soils, also found on rotten wood and in a coastal dune-valley among *Salix repens*. Rare, widespread in Europe and North America. June-Oct.

Entoloma strigosissimum is unique among all *Entoloma* species found in Europe because of the red, setiform hairs on pileus and stipe. It is rare in the Netherlands, but in some of the forest plantations in the new polders (E.Flevoland) it may occur in thousands of specimens.

30. Entoloma dysthales (Peck) Sacc., Syll. Fung. 9: 83. 1891. – Fig. 82.

Agaricus dysthales Peck in Ann. Rep. N.Y. State Mus. 32: 28. 1879; *Nolanea dysthales* (Peck) Murrill, N.Amer. Fl. 10: 101. 1917; *Rhodophyllus dysthales* (Peck) Romagn. in Bull. trimest. Soc. mycol. Fr. 53: 328. 1937; *Leptonia dysthales* (Peck) Konr. & M., Agaricales 2: 184. 1952; *Pouzarella dysthales* (Peck) Mazzer, Monogr. Stud. Gen. Pouzarella: 105. 1976. – *Inocybe bucknallii* Mass. in Ann. Bot. 18: 473. 1904; *Asterosporina bucknallii* (Mass.) Rea, Brit. Basidiomyc.: 213. 1922.

MISAPPL. – *Nolanea babingtonii* sensu Dennis in Trans. Br. mycol. Soc. 31: 206. 1948; *Leptonia babingtonii* sensu P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960.

SEL. DESCR. & FIGS. – R.Heim, Genre Inocybe: 360. 1931 (as *I. bucknallii*); Mos. in Persoonia 7: 283. 1973; Mazzer, Monogr. Stud. Gen. Pouzarella: 105, figs. 27, 31, 35, 53-57. 1976; Noordel. in Persoonia 10: 215-219, figs. 7-12. 1979.

VERN. NAME. – Vloksteelsatijnzwam.

Pileus (2-) 6-18 mm, conico-campanulate or hemispherical, expanding to conico-convex, rarely plano-convex and then with small papilla, with straight margin, with undulating marginal zone with age, weakly hygrophanous, when moist blackish grey or sepia brown (Mu. 10 YR 3/1-3/2), slightly paler at margin, translucently striate up to half of radius, on drying slightly pallescent to grey-brown, centre remaining darker, when young with silvery hyaline hairs which turn brown with age, later on with fine, pointed squamules, at margin fringed and sometimes rimose, sometimes entirely minutely squamulose. Lamellae, L = 10-17, l = 1-3, distant to moderately crowded, narrowly adnate or emarginate, narrowly segmentiform at first, then ventricose, sometimes transvenose, dark grey to grey-brown, finally with pink tinge (7.5 YR 3/2, 4/2) with flocculose, slightly paler edge. Stipe 12-48 × 0.3-2 mm, filiform to cylindrical, sometimes slightly broadened at base, concolorous with pileus (10 YR 3/2), longitudinally silvery-striate, sparsely to densely flocculose to subsquamulose with pale to dark brown hairs, especially in basal half; at base strigose with long, radiating, pale yellow-brown hairs, solid or narrowly fistulose. Context thin in pileus, relatively firm, concolorous with surface. Smell indistinct. Taste mild.

Spores (13.5-) 14.0-19.5 (-21.5) × (7.5-) 8.0-10.5 (-11.0) µm, Q = (1.5-) 1.6-2.1, $\bar{Q}$ = 1.8, irregularly nodulose-angular in outline with slightly thickened, brownish wall. Basidia 33-62 × 11-20 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia (17-) 21-82 (-90) × 8-21 µm, subglobose, obpyriform to narrowly or broadly clavate, sometimes in chains of 2-3 cells, with rounded or conical apex, rarely with finger-like projection at apex, with brown, sometimes incrusted wall. Pileipellis a transition between a cutis and a trichoderm, made up of septate hairs, with elements 32-200 µm long, 10-35 µm wide at base, 9-12 µm wide at apex. Stipitipellis a cutis of cylindrical, 4-17 µm wide, hyphae, with at apex of stipe 10-2 septate, inflated to cylindrical hairs with elements 20-55 × 10-33 µm, in basal part with longer, multiseptate

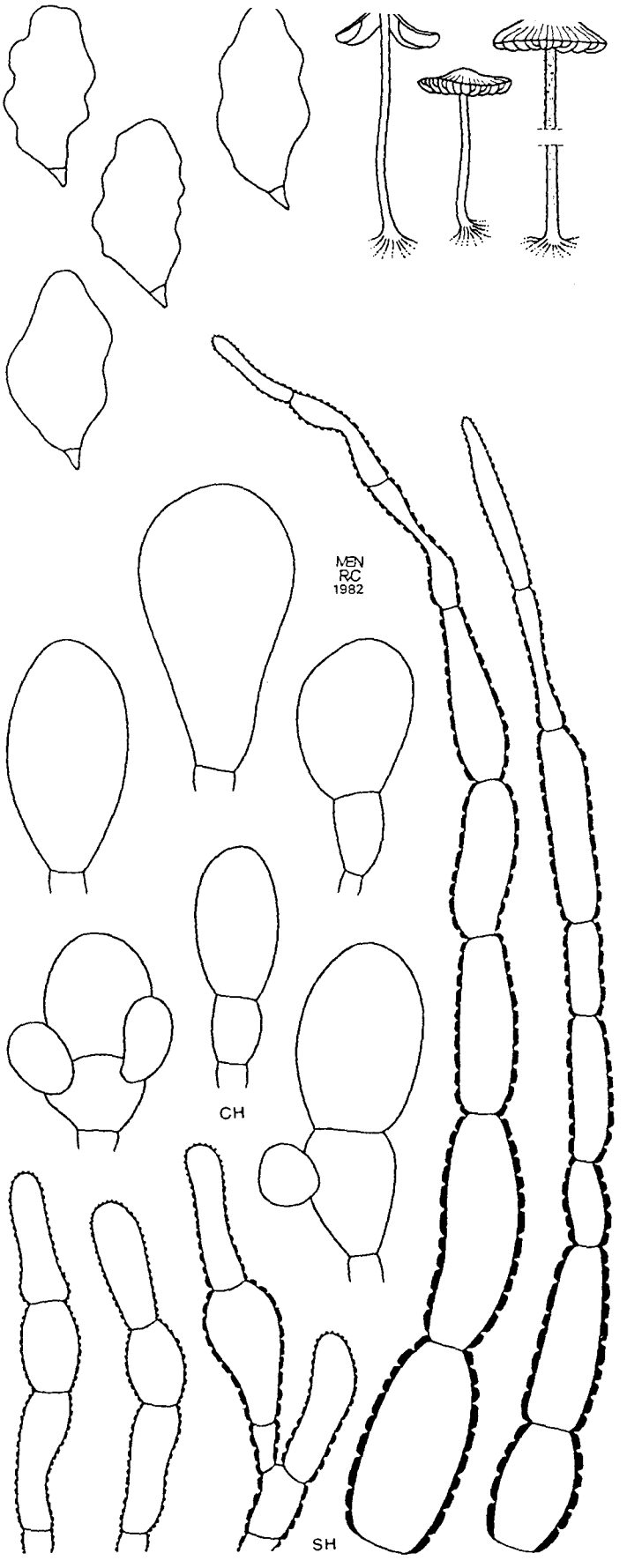

Fig. 82. *Entoloma dysthales*.

hairs, often in bundles, and similar to hairs on pileus, with elements 25-70 (-110) µm long, 27.5-30 µm wide at base, 5-12 µm wide at apex. Pigment coarsely incrusting in all parts of pileipellis, pileitrama and hymenophoral trama. Clamp-connections absent from all tissues.

HABITAT & DISTR. – In small groups, terrestrial in damp forests of *Alnus*, and/or *Fraxinus*, once found in moist dune-meadow with *Salix repens*. Rare. Wide-spread, known to occur in Europe and N.America. June-Nov.

Entoloma dysthales can be distinguished from the closely related species *E. dysthaloides* and *E. hirtum* by its large spores with average length exceeding 15 µm.

31. Entoloma dysthaloides Noordel. in Persoonia 10: 219. 1979. – Fig. 83.

MISAPPL. – *Nolanea dysthales* sensu Nath.-W. in Acta Horti Gotoburg. 16: 142. 1946; *Rhodophyllus dysthales* sensu O.v.Schulmann in Karstenia 5: 31. 1960.

SEL. DESCR. & FIGS. – Mos. in Persoonia 7: 286-287, figs. 1a, 2c, 3c-2. 1973 (as *Rhodophyllus* spec.); Noordel. in Persoonia 10: 222-223, figs. 13-20. 1979.

Pileus 3-15 (-20) mm, conico-campanulate, then expanding to conico-convex, rarely plano-convex with small umbo, with straight margin, not hygrophanous, when moist translucently striate up to half or three-quarters of radius or not striate, dark brown or fuligineous (at centre Mu. 5 YR 2.5/2, at margin 10 YR 4/3), when young with radially arranged silvery white or brownish fibrils, becoming concentrically squamulose with minute, pointed squamules with brownish tips. Lamellae, L = 15-24, l = 1 (-3), moderately crowded, adnate or emarginate, narrowly to broadly ventricose, brown to grey-brown, sometimes darker than pileus (e.g. 7.5 YR 4/2), with pink tinge, with slightly eroded, concolorous edge. Stipe 15-60 × 0.5-2 mm, cylindrical or filiform, sometimes flexuose, concolorous with or slightly paler than pileus (e.g. 7.5 YR 4/2), longitudinally silvery striate, minutely flocculose with pale, then brownish hairs, strigose at base with radiating, yellow to rusty brown hairs, solid or fistulose. Context pale to dark brown, sometimes with grey tinge, membranaceous in pileus, firm in stipe of large specimens. Smell indistinct. Taste indistinct.

Spores 10.5-13.5 (-15.0) × 7.0-8.0 (-8.5) µm, Q = 1.4-1.8, $\bar{Q}$ = 1.6, nodulose-angular with pronounced angles and pale brown walls. Basidia 40-54 × 14-19 µm, 4-spored, clampless. Lamella edge sterile, rarely heterogeneous. Cheilocystidia 26-60 × 15-28 µm, narrowly to broadly clavate, subcylindrical to obovate with rounded or attenuated, conical apex, frequently with brown-coloured or incrusted wall. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged, repent or ascending, multiseptate hairs that are gradually tapering towards the terminal elements, 25-110 µm long, 10-36 µm wide at base, 7-11 µm wide at apex. Stipitipellis a cutis of 4.5-10 µm wide hyphae with scattered fascicules of up to 400 µm long, multiseptate hairs, similar to those on pileus. Pigment coarsely incrusting the hyphae of pileipellis, stipitipellis and trama of pileus, stipe, and lamellae. Clamp-connections absent from all tissues.

HABITAT & DISTR. – Terrestrial, often in groups in moist, shadow-rich places, particularly in swamp forests of *Alnus*. Not uncommon. Wide-spread in Europe. June-Sept.

The distinctive characters of *E. dysthaloides* are the flocculose stipe with multi-septate, incrusted hairs and the small spores. *Entoloma dysthales* has much larger spores, and *E. hirtum* has non-incrusted, differently shaped hairs on the stipe, and another ecology. *Entoloma romagnesii* has smaller, less nodulose spores (see Noordeloos in Persoonia 10: 225. 1979).

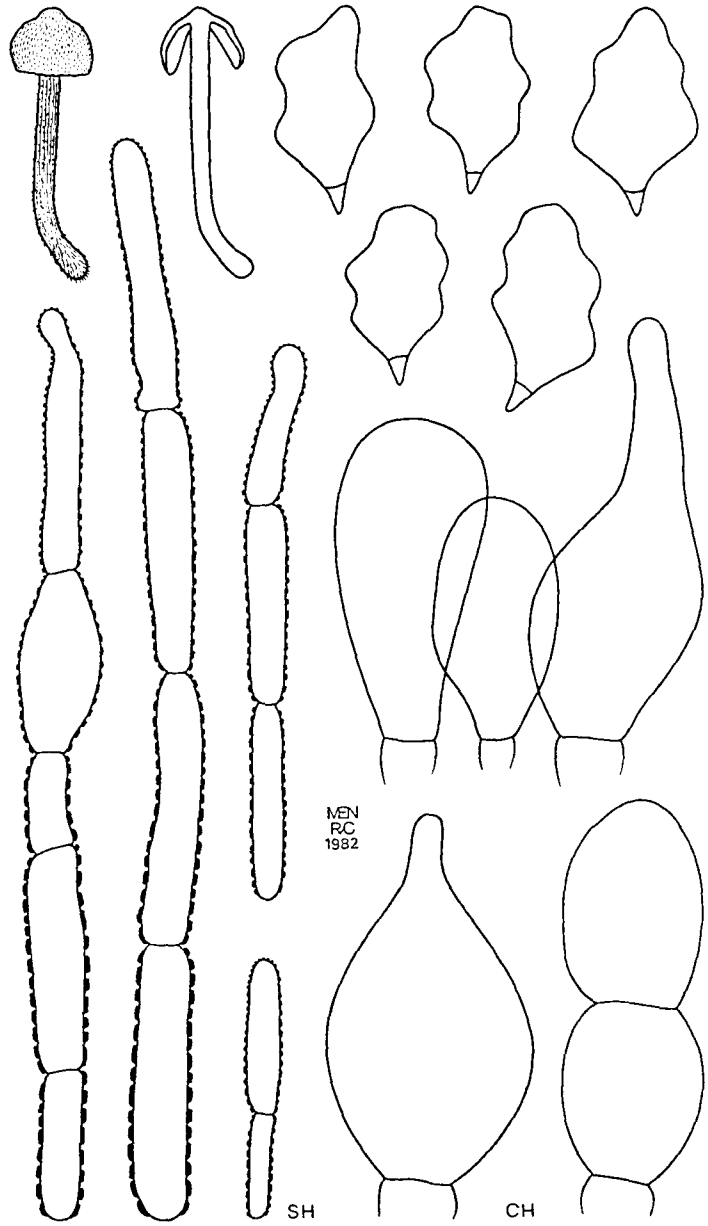

Fig. 83. *Entoloma dysthaloides*.

32. Entoloma hirtum (Velen.) Noordel. in Persoonia 10: 223. 1979. – Fig. 84.

Nolanea hirta Velen. in Mykologia 6: 28. 1979; *Pouzarella hirta* (Velen). Mazzer, Monogr. Stud. Gen. Pouzarella: 108. 1977. – *Nolanea setulosa* Velen., Novit. mycol.: 147. 1939; *Pouzarella setulosa* (Velen.) Mazzer, Monogr. Stud. Gen. Pouzarella: 108. 1976.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 223-225, figs. 21-26. 1979.

Pileus 4-20 mm, conical, sometimes truncate, usually blunt or with indistinct papilla, rarely with slight central depression, with involute, then straight, sometimes crenulate margin, not hygrophanous, not or faintly translucently striate at margin, ash grey with blackish centre, sometimes with brown tinge, entirely fibrillose-squamulose with triangular squamules, which are erect at centre, adpressed towards margin, dull. Lamellae, L = about 25, l = 1-3, moderately distant, adnate-emarginate, sometimes with slight decurrent tooth, often deeply

emarginate to almost free, ventricose, dark grey-brown with pinkish tinge, with subentire or flocculose, concolorous or slightly paler edge. Stipe 30-70 × 1-3 mm, cylindrical or slightly tapering downwards, solid, then narrowly fistulose, concolorous with pileus or slightly paler, with pale to brownish, arachnoid covering, glabrescent, strigose at base with yellow-brown radiating hairs. Context membranaceous, concolorous with surface, in thick-fleshed specimens paler in inner parts. Smell none. Taste none or bitter.

Spores (10.0-)11.0-15.0 (-15.5) × 7.0-8.0 (-9.0) µm, Q = 1.3-1.8, $\bar{Q}$ = 1.55, 6-8-angled in side-view, with pronounced angles. Basidia 34-46 × 10-15 (-20) µm, 4-spored, clampless. Lamella edge sterile or heterogeneous. Cheilocystidia 20-60(-75) × (9-)12-35 µm, narrowly to broadly clavate with rounded or conical apex, rarely subglobose or subcylindrical, with thin or slightly thickened, hyaline or brownish, often incrusted walls. Pileipellis a cutis with transitions to a trichoderm, made up of repent to ascending, multiseptate, attenuated hairs, with elements 46-110 µm long, 11-20 µm wide at base, and 4-7 µm wide at apex. Stipitipellis a cutis with scattered 0-2 septate, yellow-brown, not incrusted hairs up to 170 µm long, up to 16 µm wide. Pigment slightly to coarsely incrusting the hyphae of pileipellis, pileitrama, stipititrama and hymenophoral trama. Clamp-connections absent from all tissues.

HABITAT & DISTR. – Solitary or in small groups, terrestrial in xerophytic grassland on calcareous loamy soils in shade of *Prunus spinosa*, *Juniperus communis*, etc. Very rare (Gronsveld: Savelsbos). Widespread in Europe but rare. June-Sept.

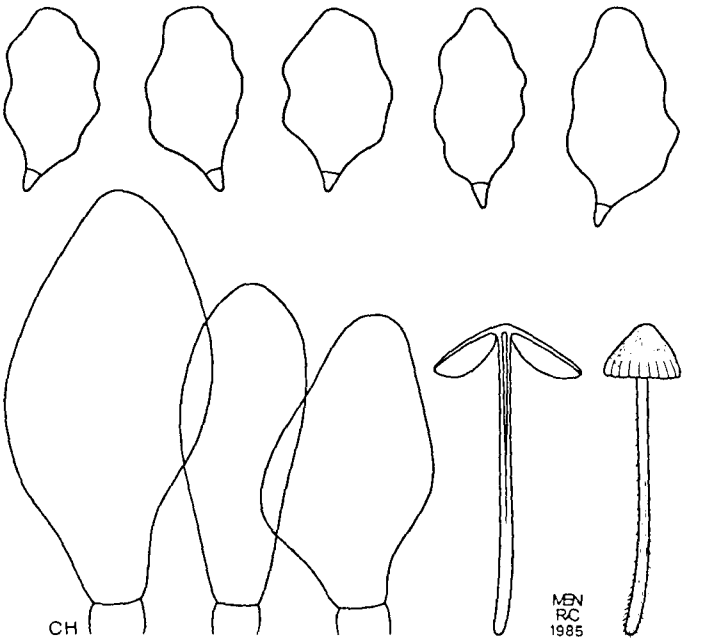

Fig. 84. *Entoloma hirtum*.

Entoloma hirtum is very rare in the Netherlands, and has been found only once. The description is based on a Netherlands' collection and supplemented by notes on Danish material (see Noordeloos in Persoonia 10: 224. 1979). *Entoloma hirtum* differs from *E. dysthaloides* mainly in the type of stipe-covering and the pigmentation of hairs on the stipe, and possibly also in the habitat. *Entoloma pulvereum* is much larger, and has smaller, less angular spores.

33. Entoloma pulvereum Rea in Trans. Br. mycol. Soc. 2: 170 ('1906') 1907. – Fig. 85.

Leptonia pulverea (Rea) P.D.Orton in Trans. Br. mycol. Soc. 43: 178. 1960; *Pouzarella pulverea* (Rea) Mazzer, Monogr. Stud. Gen. Pouzarella: 97. 1976.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 226-227, figs. 27-32. 1979; Rea in Trans. Br. mycol. Soc. 2: 170, pl. 14. ('1906') 1907.

Pileus 25 mm, conico-convex with straight margin, not hygrophanous, not translucently striate, pale grey-brown, densely covered with minute, yellow-brown squamules often with erect tips. Lamellae, L = 24, l = 1, distant, broadly adnate with small decurrent tooth, broadly ventricose, strongly transvenose, intervenose, dark grey-brown with pinkish spore-dust, slightly more yellowish brown towards flocculose edge. Stipe 95 × 2-3 mm, cylindrical, flexuose, broadened towards base, greyish yellow, silky shiny, densely punctate with reddish brown squamules, strigose at base with radiating yellowish brown hairs, becoming reddish with age, solid or fistulose. Context dark grey-brown. Smell none. Taste not recorded.

Spores 10.0-12.5 (-13.0) × 7.0-8.0 (-8.5) µm, Q = 1.3-1.6, $\bar{Q}$ = 1.4, 6-8-angled in side-view with rather obtuse angles, hyaline. Basidia 40-67 × 12-15 µm, 4-, rarely also 2-spored, clampless. Lamella edge sterile. Cheilocystidia (17-) 25-70 × 7.5-20 (-25) µm, subcylindrical to broadly clavate with rounded or attenuate apex and yellowish-brown incrusted walls. Pileipellis a transition between a cutis and a trichoderm, made up of repent to ascending septate hyphae, gradually tapering

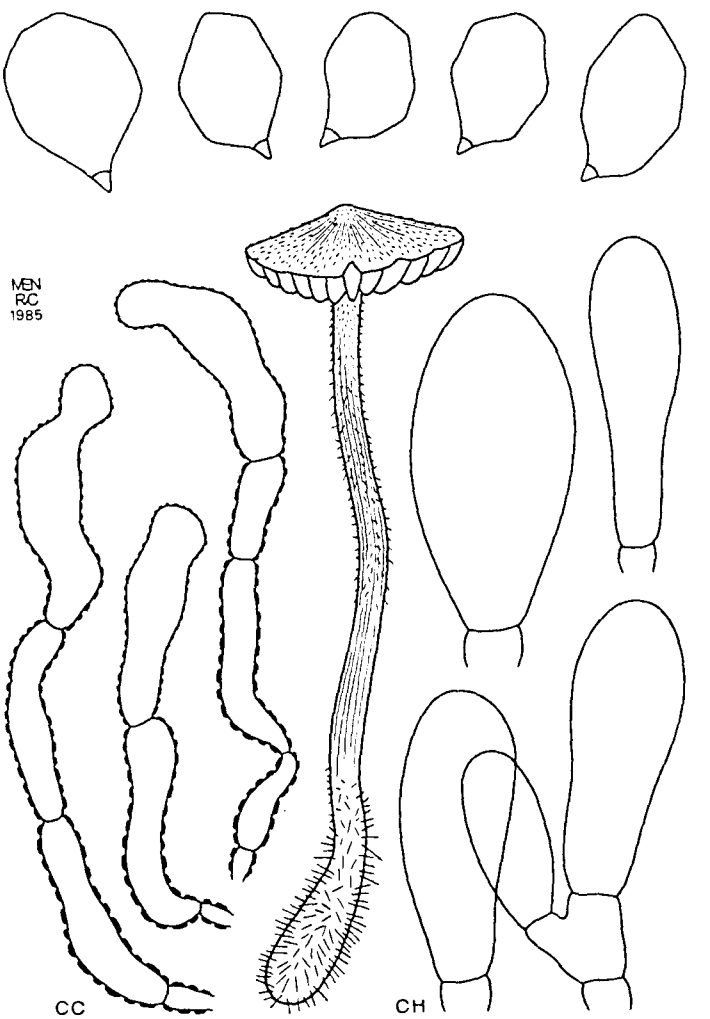

Fig. 85. *Entoloma pulvereum*.

towards apex, elements 30-110 (-120) µm long and 14-33 µm wide at base, 2.5-14 µm wide at apex. Stipitipellis a cutis of 5-14 µm wide cylindrical hyphae with scattered tufts of 1-3(-5) septate hairs with inflated cylindrical elements, 45-97(-125) × (10-)12-23 (-27) µm; terminal elements usually clavate with rounded apex, with brown, often slightly incrusted walls. Pigment coarsely incrusting the hyphae of pileipellis and trama of pileus and lamellae. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, terrestrial, in thick layer of humus near *Quercus*. Very rare (Castricum: Geversduin; Amsterdam: Amsterdamse bos). Rare in W.Europe (Great Britain). July-Oct.

Entoloma pulvereum can be distinguished from other species of subgen. *Pouzarella* by its relatively robust and pale coloured basidiocarps and its thin-walled, obtusely angled spores.

Sect. **Versatilia** (Romagn. ex Romagn.) Noordel.

Pileus micaceous to fibrillose or hirsute, never distinctly squamulose; pileipellis with intracellular and incrusting pigment; cheilocystidia lageniform.

34. Entoloma versatile (Fr. → Gillet) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 208. 1978. – Fig. 86.

Agaricus versatilis Fr., Monogr. Hymenomyc. Sueciae 2: 297. 1863, non *A. versatilis* Bertero & Mont., 1837; *Nolanea versatilis* Fr. → Gillet, Hyménomycètes: 418. 1874; *Rhodophyllus versatilis* (Fr. → Gillet) Quél., Enchir. Fung.: 63. 1886; *Pouzarella versatilis* (Fr. → Gillet) Mazzer, Monogr. Stud. Gen. Pouzarella: 76. 1976. – *Rhodophyllus viridulus* Herink in Ceská Mykol. 9: 6. 1955.

SEL. ICON. – Ryman & Holmåsen, Svampar: 385. 1984.

SEL. DESCR. & FIGS. – Herink in Ceská Mykol. 9: 6-8. 1955 (as *R. viridulus*); Noordel. in Persoonia 10: 230-234, figs. 41-46. 1979; Reijnders in Fungus 14: 63-64. 1943; Romagn. in Rev. Mycol. 2: 87. 1937.

Pileus 15-30 mm, conical, then conico-campanulate, usually with papilla, rarely truncate, with involute margin, weakly hygrophanous, when moist translucently striate at margin or not, olivaceous brown to olivaceous grey, (Mu. 2.5 Y 4/4; 5 Y 3-4/2), slightly paler when dry, minutely radially fibrillose with metallic sheen, finally with minute fibrillose squamules at centre. Lamellae, L = about 30, l = 1-3, distant, narrowly adnate to almost free, triangular, then ventricose, grey, then grey-brown, finally with pink tinge (10 YR 4-5/2-4), with flocculose, concolorous edge. Stipe 25-50 × 2-3 mm, cylindrical, sometimes slightly broadened at base, pale at apex, downwards darker to rather dark grey, sometimes with olivaceous tinge, at base often with red tinges, entirely silvery-fibrillose to flocculose, at base strigose with white or reddish radiating hairs. Context brown-grey in pileus with olive-green tinge, grey-brown in upper half of stipe, becoming darker downwards. Smell none or sourish-spermatic. Taste not recorded.

Spores (9.0-) 9.5-11.5 (-12.5) × 7.0-8.0 (-9.0) µm, Q = 1.2-1.5, $\bar{Q}$ = 1.3-1.35, 6-8-angled in side-view. Basidia 35-50 × 11.5-13 (-15) µm, 4-spored, clampless. Lamella edge heterogeneous. Cheilocystidia (42-) 60-110 × 10.5-25 (-30) µm, narrowly to broadly lageniform with broad basal part and long, tapering often submoniliform neck, colourless, thin-walled, numerous, almost always mixed with basidia. Pileipellis a transition between a cutis and a trichoderm, made up of radially arranged, cylindrical to inflated hyphae with up to 20 µm wide terminal elements. Pigment pale, intracellular in pileipellis and incrusting the hyphae of lower pileipellis and upper pileitrama. Clamp-connections absent.

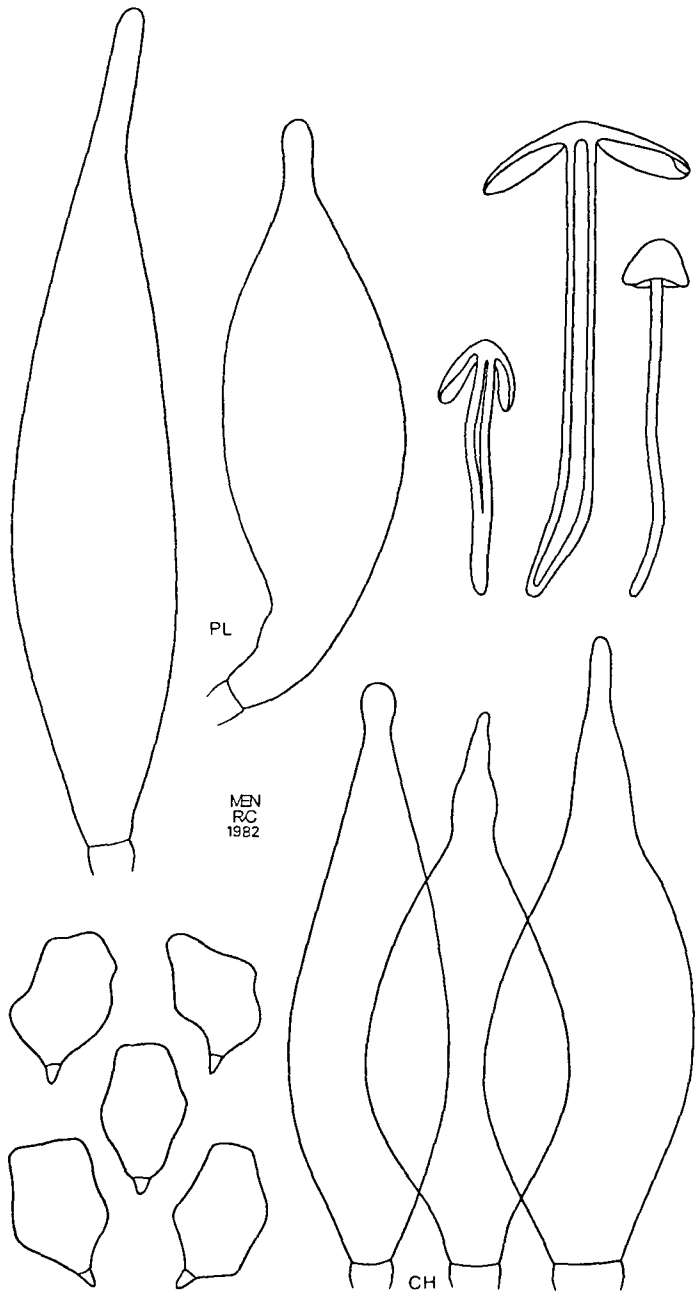

Fig. 86. *Entoloma versatile*.

HABITAT & DISTR. – Solitary or in small groups, terrestrial on bare soil or in humus of deciduous forests on rich soils. Very rare (Stroe). Widespread, known to occur in Europe and N.America. Aug.-Sept.

Entoloma versatile has been found in the Netherlands only once with certainty (Reijnders in Fungus 14: 63-64. 1943). The description above is based on several collections from Norway, Sweden, Great Britain, Germany and France.

35. Entoloma araneosum (Quél.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 208. 1978. – Fig. 87.

Nolanea araneosa Quél. in Bull. Soc. bot. Fr. 23: 327. ('1876') 1877

(Champ. Jura Vosges 4); *Rhodophyllus araneosus* (Quél.) Quél., Enchir. Fung.: 63. 1886; *Pouzarella araneosa* (Quél.) Mazzer, Monogr. Stud. Gen. Pouzarella: 100. 1976. – *Agaricus fulvostrigosus* B. & Br. in Ann. Mag. Nat. hist., ser. V, 1: 19. 1878 (Notic. Brit. Fungi 1650); *Leptonia fulvostrigosa* (B. & Br.) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960; *Pouzarella fulvostrigosa* Mazzer, Monogr. Stud. Gen. Pouzarella: 100. 1976; *Entoloma fulvostrigosum* (B. & Br.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 208. 1978; *Entoloma araneosum* f. *fulvostrigosum* (B. & Br.) Noordel. in Persoonia 10: 236. 1979.

SEL. DESCR. & FIGS. – Døssing in Friesia 6: 335-337, fig. 1. 1961; Noordel. in Persoonia 10: 234-239, figs. 47-56. 1979; D.Reid in Fung. rar. Ic. col. 3: 21-23, fig. 10a-e, pl. 19C. 1968 (as *L. fulvostrigosa*).

KEY TO THE FORMAE

1. Stipe with grey hairs at base. . . . . f. **araneosum**
1. Stipe with red hairs at base. . . . . f. **fulvostrigosum**

Pileus 7-35 mm, conico-campanulate, sometimes truncate, only slightly expanding with age, finally usually with papilla, with straight margin, with slightly undulating, often sulcate, margin when old, not hygrophanous, not or very obscurely translucently striate at margin only, mouse-grey sometimes with brown tinge, densely covered in radially arranged silvery-white or grey fibrils, when young flocculose at margin, with grey veil. Lamellae, L = 20-35, l = 1-3, moderately distant, ventricose, up to 5 mm broad, sometimes thickened, occasionally transvenose, pale grey, then pinkish grey with brown tinge, with entire or flocculose, concolorous edge. Stipe 25-70 × 1-5 mm, cylindrical usually broadened at base, sometimes flexuose, grey to grey-brown, paler than pileus, rarely tinged red at base, white pruinose or flocculose at apex, downwards covered with silvery fibrils, at base with grey (f. *araneosum*) or red (f. *fulvostrigosum*) radiating hairs. Context concolorous with surface in pileus and stipe, relatively firm. Smell faint, farinaceous or more or less nauseating like lightgas. Taste not recorded.

Spores (9.5-) 10.0-14.0 (-15.0) × 7.0-8.0 (-9.0) µm, Q = 1.4-1.8, $\bar{Q}$ = 1.5, 6-8-angled in side-view, relatively thin-walled, pale. Basidia 38-60 × 10-16 µm, 4-spored, clampless. Lamella edge sterile or heterogeneous. Cheilocystidia 45-75 (-100) × 10-30 µm, lageniform with rather broad base and long, tapering, moniliform or subcapitate neck (2.5-5.5 µm) colourless or slightly brown-incrusted. Pileipellis a transition between a cutis and a trichoderm, made up of up to 400 µm long, repent and/or ascending hairs with cylindrical or inflated terminal elements, 65-250 × (8-) 13-27 µm, with slightly thickened, refractive apex. Stipitipellis a differentiated cutis of 5.5-14 µm wide cylindrical hyphae with reflexed cylindrical to clavate, up to 20 µm wide terminal elements, with colourless or pale yellow-brown, not incrusted walls. Pigment grey-brown, intracellular in pileipellis, incrusting in pileipellis and trama of pileus and lamellae. Clamp-connections absent.

HABITAT & DISTR. – Terrestrial, solitary or in small groups in deciduous forest on rich soil. Not uncommon. May-Sept.

Entoloma araneosum resembles a grey species of *Inocybe*, but is easily recognized as a species of *Entoloma* because of the pink, angular spores, and the large lageniform cystidia. *Entoloma versatile* comes very close but differs in having distinct olivaceous tinges.

The Netherlands' collections of *E. araneosum* all belong to f. *araneosum* with greyish hairs at base of stipe.

Subgen. **ALLOCYBE** Noordel.

SEL. LIT. – Noordel. in Persoonia 11: 251-256. 1981.

Basidiocarps tricholomatoid; pileus not hygrophanous, not striate; pileipellis a cutis of cylindrical to inflated, up to 20 µm wide hyphae with membranal incrusting pigment; spores heterodiametrical with basal facet; large cheilocystidia often present; clamp-connections present in hymenium; hymenophoral trama made up of long, inflated elements.

36. Entoloma excentricum Bres., Fungi trident. 1: 11. 1881. – Fig. 88.

Rhodophyllus excentricus (Bres.) Kühn. & Romagn., Fl. anal. Champ. sup.: 198. 1953 (not valid, basionym not mentioned).

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 556. 1929; Cetto, Funghi Vero 1: pl. 98. 1975; Konr. & M., Ic. sel. Fung. 2: pl. 191. 1929; Ryman & Holmåsen, Svampar: 376. 1984.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 103, fig. 18, 21, 23, pl. 9c. 1969; Konr. in Bull. trimest. Soc. mycol. Fr. 43: 174-176. 1927; Noordel. in Persoonia 11: 252-254, fig. 51. 1981.

Pileus 23-57 mm, convex, then plano-convex, usually with applanate, rarely subumbonate centre, with involute margin, not hygrophanous, not translucently striate, very pale brown or leather brown (Mu. 10 YR 7/3), glabrous or subtomentose with micaceous patches. Lamellae, L = about 50, l = 1-5, crowded, adnate-emarginate, segmentiform, rarely ventricose, pale pink with brown tinge when old, with irregular to flocculose, concolorous or brown edge. Stipe 30-80 × 4-8 mm, cylindrical or slightly tapering towards base, sometimes twisted, whitish with brown or yellowish tinges, fibrillose to costate lengthwise, at base white tomentose, solid or narrowly fistulose. Context white, sometimes with brown tinge. Smell weak, rarely more or less farinaceous. Taste unpleasant, subfarinaceous.

Spores (10.0-)11.0-12.5(-14.0) × 7.0-8.5(-9.5) µm, Q = 1.25-1.7, $\bar{Q}$ = 1.5, irregularly 5-7-angled in side-view. Basidia 35-60 × 11-18 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 50-90 (-108) × 10-25 µm, broadly fusiform to lageniform with broad base and long, protruding neck, sometimes with brown granular intracellular pigment, abundant, mixed with basidia. Pileipellis a (ixo)cutis with transitions to a (ixo)trichoderm made up of radially arranged cylindrical hyphae, up to 10 µm wide, with cylindrical to clavate terminal up to 20 µm wide elements with easily disintegrating walls. Pigment membranal, rarely slightly incrusting in pileipellis and pileitrama.

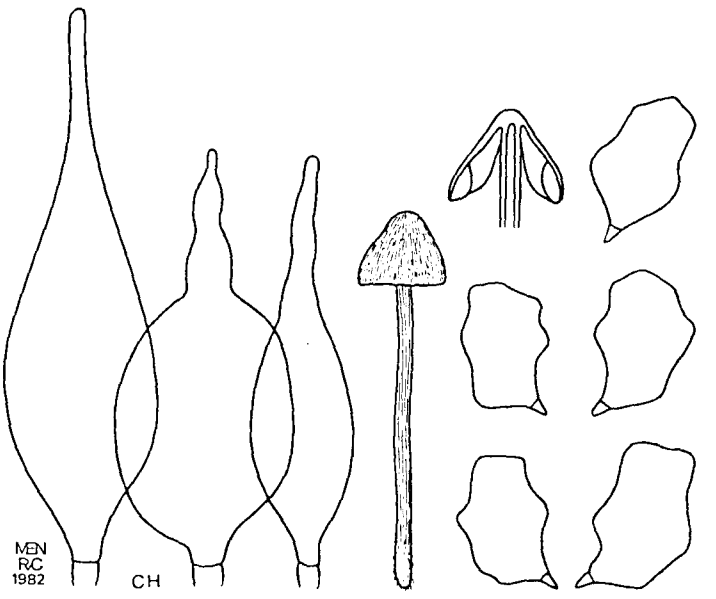

Fig. 87. *Entoloma araneosum*.

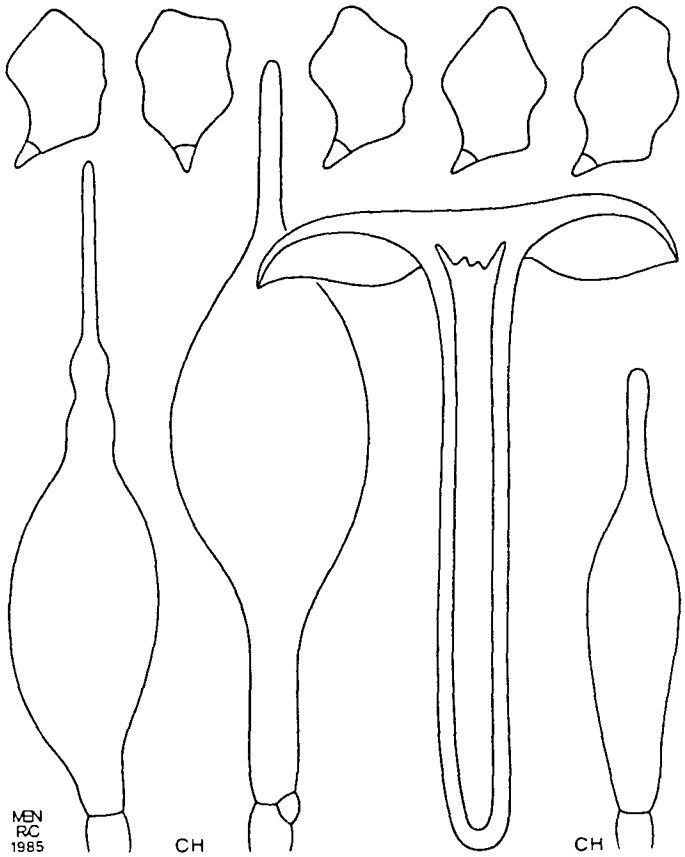

Fig. 88. *Entoloma excentricum.*

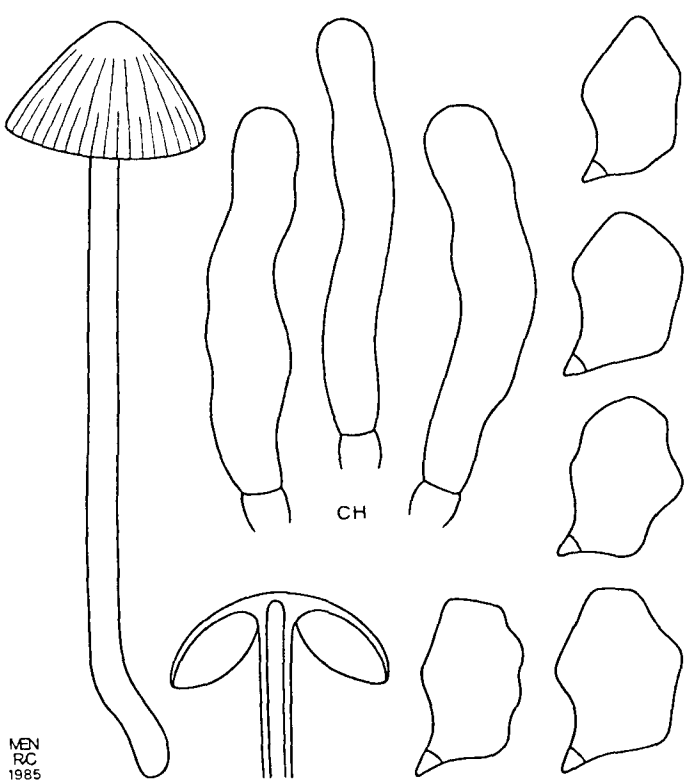

Fig. 89. *Entoloma hirtipes.*

Clamp-connections present in hymenium, rare in other tissues.

HABITAT & DISTR. – Solitary or in small groups, terrestrial, in grassland. Very rare. Once found in coastal dunes in the Netherlands (Voorne). Widespread all over Europe, probably more common in dry steppe in central and eastern Europe. Aug.-Sept.

The non-hygrophanous pileus, pale colours and large cheilocystidia are distinctive for *E. excentricum*.

The description is based also on material from Sweden, Belgium, France and Germany.

Subgen. **NOLANEA** (Fr.) Noordel.

SEL. LIT. – Noordel. in Persoonia 10: 427-534. 1980.

Habit mycenoid, rarely tricholomatoid or collybioid; pileus generally hygrophanous; spores isodiametrical to heterodiametrical with dihedral base or basal facet; hymenophoral trama and pileitrama made up of long, cylindrical to inflated elements 200-450 × 5-30 µm; pileipellis typically a cutis, rarely with transitions to a trichoderm; pigment intracellular and/or incrusting; clamps-connections present or absent.

Sect. **Nolanea** Larg.

Pigment incrusting, sometimes accompanied by a pale, diffuse intracellular pigment in pileipellis; cheilocystidia present, cylindrico-clavate; spores heterodiametrical with basal facet; clamp-connections present.

37. Entoloma hirtipes (Schum.: Fr.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 206. 1978. – Fig. 89.

Agaricus hirtipes Schum., Enum. Plant. 2: 272. 1803; *Agaricus hirtipes* Schum.: Fr., Syst. mycol. 1: 206. 1821; *Nolanea hirtipes* (Schum.: Fr.) Kumm., Führ. Pilzk.: 95. 1871; *Rhodophyllus hirtipes* (Schum.: Fr.) Quél., Enchir. Fung.: 64. 1886. – *Agaricus acceptandus* Britz. in Ber. naturw. Ver. Schwaben, Augsburg 26: 140. 1881; *Nolanea acceptanda* (Britz.) Sacc., Syll. Fung. 5: 724. 1887.

MISAPPL. – *Rhodophyllus mammosus* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 188. 1953.

SEL. ICON. – Cetto, Funghi Vero 1: pl. 100. 1975; Konr. & M., Ic. sel. Fung. 2: pl. 177. 1930; J.Lange, Fl. agar. dan. 2: pl. 78G. 1937.

SEL. DESCR. & FIGS. – Konr. in Bull. trimest. Soc. mycol. Fr. 45: 47-49. 1929; Noordel. in Persoonia 10: 438-442. 1980; P.D.Orton in Trans. Br. mycol. Soc. 43: 329. 1960; Trimb. in Doc. mycol. 8(29): 39-41. 1978.

VERN. NAME. – Vissige satijnzwam.

Pileus 30-70 mm, acutely conical, then expanding to conico-convex, campanulate or hemispherical with involute then deflexed or straight margin, with or without small papilla, hygrophanous, when moist dark sepia or reddish brown (Mu. 10 YR 3/2; 7.5 YR 3/2), slightly paler towards margin (7.5 YR 5/2-6), translucently striate up to half the radius, pallescent on drying to grey-brown (10 YR 4/2, margin 7/3), glabrous, innately radially fibrillose. Lamellae, L = 25-35, l = 1-5, moderately distant, adnate to emarginate, broadly ventricose up to 7 mm broad, pale, then fairly dark brown-pink (10 YR 7-8/3 then 7.5 YR 7-8/4 finally 5 YR 5/4) with eroded, concolorous edge. Stipe 90-160 × 3-7 (-10) mm, cylindrical, usually gradually broadened towards base, yellow-brown to sepia with paler apex (10 YR 4/2-3, apex 7-6/3-2), innately silvery striate, often twisted, pruinose at apex, downwards

glabrous, tomentose at base. Context thin, concolorous with surface in cortex, inner parts pale. Smell strongly farinaceous. Taste farinaceous-rancid.

Spores 10.5-13.5 (-14.5) × 8.0-9.0 (-9.5) µm, Q = (1.25-) 1.3-1.5 (-1.6), $\bar{Q}$ = 1.4, 5-7-angled in side-view. Basidia 30-50 × 9-14 µm, 4-spored, clamped. Lamella edge sterile or heterogeneous. Cheilocystidia 35-70 × 5.5-15 µm, subcylindrical to lageniform with rounded to capitate apex, abundant, sometimes mixed with basidia. Pileipellis a cutis of 4-11 µm wide, cylindrical hyphae. Pigment incrusting in pileipellis and the narrow hyphae of pileitrama, sometimes in addition intracellular. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary, rarely in small groups, in humus and litter of coniferous or deciduous forest in the coastal dunes, late in the autumn. Very rare (Overveen; IJmuiden; Castricum; Warmond). In the montane and boreal regions of Europe usually in coniferous forest in spring. Wide-spread.

The Netherlands' collections are morphologically perfectly identical with the vernal forms from central Europe. There is, however, a striking difference in habitat and periodicity.

38. Entoloma kuehnerianum Noordel. in Persoonia 12: 461. 1985. – Fig. 90.

Rhodophyllus mammosus var. *sericoides* Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 10. 1954 (Compl. Fl. anal. 1); *Entoloma hirtipes* var. *sericoides* (Kühner) Noordel. in Persoonia 10: 442. 1980.

SEL. DESCR. & FIGS. – Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 10-12, figs. 1, 2. 1954 (as *R. mammosus* var. *sericoides*); Noordel. in Persoonia 10: 442, fig. 2. 1981 (as *E. hirtipes* var. *sericoides*).

Pileus 15-40 mm, conical, then conico-convex, finally expanded with or without umbo, with involute then deflexed margin, strongly hygrophanous, when moist dark reddish brown (Mu. 7.5 YR 2/2, 5 YR 2/2) slightly paler at margin, translucently striated up to one-third of radius, pallescent on drying to grey-brown, glabrous. Lamellae, L = 20-25, l = 1-5, moderately distant, adnate to deeply emarginate, pale grey, then moderately dark grey-brown with pink tinge, paler towards eroded edge. Stipe 25-45 × (1.5-) 2-4 mm, cylindrical, grey-brown, pruinose at apex, downwards slightly to distinctly silvery striate, sordid white tomentose at base. Context brittle, concolorous with surface. Smell strongly farinaceous to rancid or reminiscent of putty. Taste nasty rancid-farinaceous.

Spores 9.5-11.0 × 8.0-9.5 µm, Q = 1.2-1.4, $\bar{Q}$ = 1.3, 6-7-angled in side-view. Basidia 30-45 × 8-12 µm, 4-spored, clamped. Lamella-edge heterogeneous or sterile. Cheilocystidia 25-55 × 2.5-8 µm, cylindrical to sublageniform, often with rounded, subcapitate rarely attenuate apex. Pileipellis a cutis of 2.5-8 µm wide, cylindrical hyphae. Pigment incrusting in pileipellis and upper pileitrama, in addition intracellular in pileipellis. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or in small groups in semi-natural or short-grazed, not manured grassland on acid, sandy soil. Very rare, in the Netherlands only known from the old coastal dunes (Castricum; Goeree; Schouwen). Also known from France. Sept.-Oct.

Entoloma kuehnerianum differs from *E. hirtipes* in habit, colour of pileus and lamellae, smaller spores, and habitat and therefore is considered now a species in its own right; this is contrary to our earlier opinion (Noordeloos, 1980). *Entoloma hebes* has narrower spores and occurs in humus-rich forests.

39. Entoloma hebes (Romagn.) Trimbach in Docum. mycol. 11(44): 6-7. 1981. – Fig. 91.

Rhodophyllus hebes Romagn. in Rev. Mycol. 19: 4. 1954. (Compl. Fl. anal. 1). – *Rhodophyllus mammosus* var. *obsoletus* Romagn. in Rev. Mycol. 19: 7. 1954 (Compl. Fl. anal. 1). – *Nolanea tenuipes* P.D.Orton in Trans. Br. mycol. Soc. 43: 334. 1960, non *Entoloma tenuipes* Murrill 1917. – *Entoloma leptopus* Noordel. in Persoonia 10: 442. 1980.

MISAPPL. – *Rhodophyllus mammosus* var. *tenuis* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 188. 1953; *Entoloma mammosum* sensu Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 206. 1978.

SEL. ICON. – Dähncke & Dähncke, 700 Pilze: 261. 1979 (as *E. mammosum*).

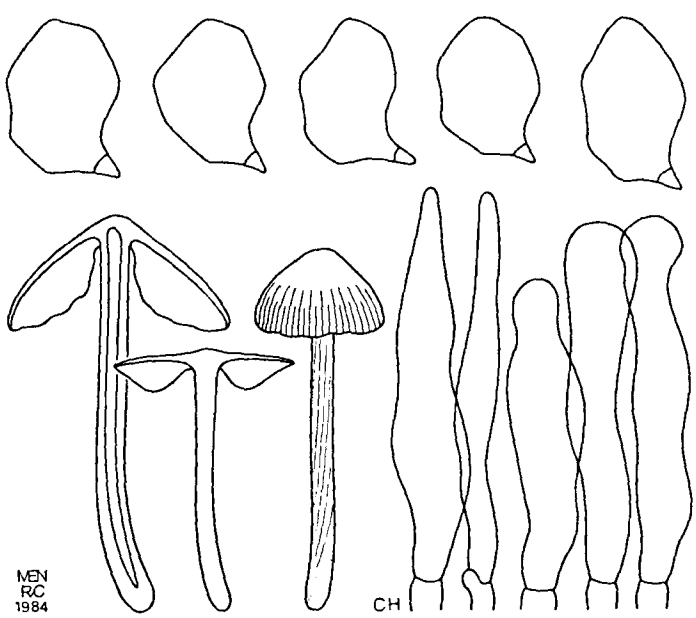

Fig. 90. *Entoloma kuehnerianum.*

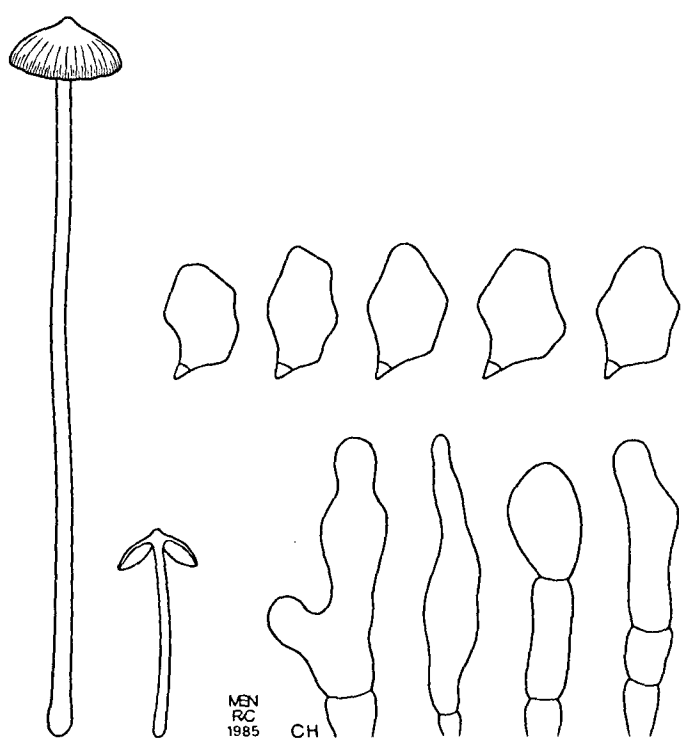

Fig. 91. *Entoloma hebes.*

SEL. DESCR. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 334-335 ('1982') 1983; Noordel. in Persoonia 10: 442-444, fig. 3. 1981 (as *E. leptopus*); Trimb. in Docum. mycol. 11(44): 6-7, fig. 3. 1981.

VERN. NAME. – Dunsteelsatijnzwam.

Pileus 9-40 (-45) mm, conico-convex, campanulate or hemispherical, then expanding to plano-convex, usually with distinct papilla, with slightly involute margin when young, then straight, often splitting with age or crenate, strongly hygrophanous, when moist yellow-brown, grey-brown, reddish brown (Mu. 10 YR 6-3/2-3 rarely 2/2; 7.5 YR 5/4, 4/2, 3/2) towards margin and between striae distinctly paler (10 YR 6-7/3-4; 7.5 YR 7/4, 6/4) translucently striate up to centre, strongly pallescent on drying to yellowish brown or grey-isabella (10 YR 7/2, 8/3-4), smooth, strongly radially fibrillose, shiny when dry. Lamellae, L = 20-30, l = 1-5 (-7), moderately crowded, almost free or adnate-emarginate, ventricose, pale (brown) then pink finally brownish pink (10 YR 8/3; 7.5 YR 6-8/3-4 to 6/6), with almost entire, concolorous edge. Stipe 20-85 (-110) × 1-3 (-5) mm, cylindrical, rigid, usually slightly broadened towards base, solid then fistulose, pale (reddish) brown or grey-brown, paler than pileus (10 YR 5-7/3-4, 5/6-8; 7.5 YR 5/4), darker at base (10 YR 3/2; 7.5 YR 3/2), pruinose-flocculose at apex, downwards sparsely to abundantly fibrillose-striate, never absolutely glabrous, sometimes twisted, white tomentose at base. Context thin, rather brittle in pileus, more firm in stipe, concolorous with surface, pale in inner part of stipe. Smell usually strongly farinaceous-rancid, like cucumber, rarely weak or absent. Taste strongly farinaceous-rancid, rarely indistinct.

Spores (8.0-) 8.5-12.0 (-14.0) × (5.0-) 6.0-7.5 (-8.0) µm, Q = 1.2-1.8, $\bar{Q}$ = 1.45, heterodiametrical, 7-8-angled in side-view. Basidia 24-40 × 7.5-13 µm, 4-spored, rarely also 2-spored, clamped. Lamella edge sterile or heterogeneous. Cheilocystidia 25-55 × 4-10 µm, cylindrical and capitate to clavate, usually with rounded, rarely attenuate apex. Pileipellis a cutis made up of radially arranged, cylindrical hyphae, 3-9.5 (-13) µm wide; subpellis usually well-developed, made up of inflated elements, 32-80 × 11.5-32 µm. Pigment incrusting the hyphae of pileipellis and pileitrama, in addition often pale brown, intracellular in subpellis and upper pileitrama. Clamp-connections abundant in hymenium, rare in other tissues.

HABITAT & DISTR. – In groups, terrestrial on damp, humus-rich soil in frondose forests, particularly in *Fraxinus* and *Alnus* woods (*Alno-Padion* and *Ulmion carpinifoliae* associations), rarely in mossy grassland (*Festuco-Thymetum*). Fairly common. Widespread and common in W. and N.Europe in similar habitats. June-Nov.

Entoloma hebes is easy to recognize in the field by its rather slender basidiocarps, conical, shiny pileus, slender, brittle, silvery striate stipe, and farinaceous smell. Microscopically the slender, heterodiametrical spores and the cheilocystidia are distinctive. *Entoloma hirtipes* differs in having considerably larger and broader spores, and darker colours.

Sect. Staurospora (Larg. & Thiers) Noordel.

Spores cuboid or cruciform-stellate; pigment membranal, incrusting and/or intracellular.

40. Entoloma conferendum (Britz.) Noordel. in Persoonia 10: 446. 1980. – Fig. 92.

Agaricus conferendus Britz. in Ber. naturw. Ver. Schwaben, Augsburg 26: 140. 1881; *Nolanea conferenda* (Britz.) Sacc., Syll. Fung. 5: 723. 1887. – *Nolanea staurospora* Bres., Fungi trident. 1: 18. 1882; *Rhodophyllus staurosporus* (Bres.) J.Lange, Fl. agar. dan. 2: 99. 1937; *Entoloma staurosporum* (Bres.) Horak in Sydowia 28: 222. ('1974/75') 1976. – *Rhodophyllus rickenii* Romagn. in Bull. trimest. Soc. mycol. Fr. 48: 320. 1932; *Rhodophyllus staurosporus* subsp. *rickenii* (Romagn.) Romagn. in Rev. Mycol. 2: 86. 1937; *Nolanea rickenii* (Romagn.) Konr. & M., Agaricales 1: 264. 1948; *Rhodophyllus staurosporus* var. *rickenii* (Romagn.) Kühn. & Romagn., Fl. anal. Champ. sup.: 187. 1953 (not valid, basionym not mentioned). – *Rhodophyllus rickenii* var. *obscurior* Romagn. in Bull. trimest. Soc. mycol. Fr. 48: 320. 1932; *Rhodophyllus staurosporus* var. *obscurior* (Romagn.) Romagn. in Rev. Mycol. 2: 86. 1937. – *Rhodophyllus rickenii* var. *subrugosus* Romagn. in Bull. trimest. Soc. mycol. Fr. 48: 321. 1932; *Rhodophyllus staurosporus* var. *subrugosus* (Romagn.) Romagn. in Rev. Mycol. 2: 86. 1937; – *Rhodophyllus staurosporus* var. *typicus* Kühn. & Romagn., Fl. anal. Champ. sup.: 187. 1953 (not valid, inadmissible epithet). – *Rhodophyllus staurosporus* var. *platyphyllus* Romagn. & Favre in Rev. Mycol. 3: 77. 1938.

VERN. NAME. – Sterspoorsatijnzwam.

KEY TO THE VARIETIES

1. On the ground; pileus 20-50 mm; stipe 25-80 × 2-6.5 mm. var. **conferendum**
1. On wood; pileus 10-15 mm; stipe 20-50 × 1-1.5 mm. var. **pusillum**

var. **conferendum**

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 584. 1929 (as *N. staurospora*); Cetto, Funghi Vero 2: pl. 533. 1976 (as *N. staurospora*); Konr. & M., Ic. sel. Fung. 2: pl. 178, fig. 1. 1930 (as *N. staurospora*); J.Lange, Fl. agar. dan. 2: pl. 77A. 1937 (as *R. staurosporus*); R.Phillips, Mushr. other Fungi: 118. 1981 (as *N. staurospora*).

SEL. DESCR. & FIGS. – Horak in Sydowia 28: 222. 1976 (as *E. staurosporum*); Noordel. in Persoonia 10: 446, fig. 4. 1980.

Pileus 23-50 mm, conical or hemispherical, then conico-campanulate to conico-convex slightly expanding to convex rarely plano-convex with weak papilla or not, rarely with acute papilla, sometimes truncate, with slightly involute margin when young, later on straight, sometimes splitting with age, strongly hygrophanous, when moist deeply translu-

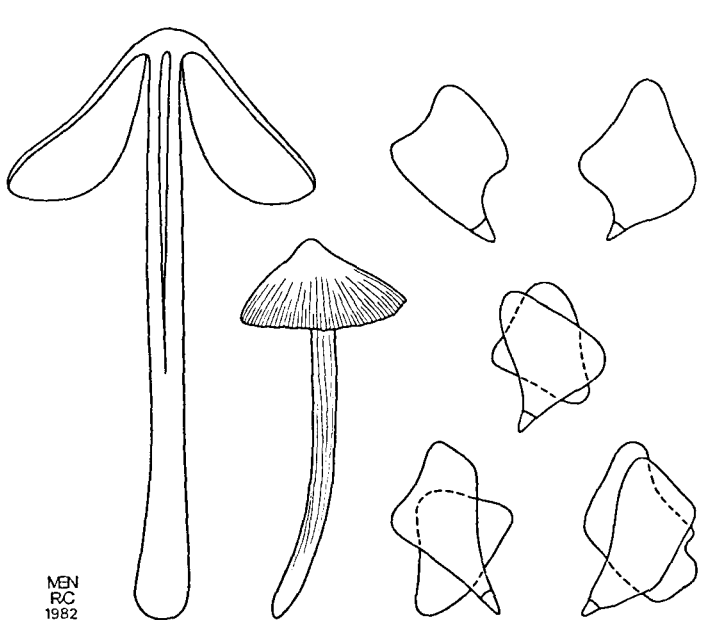

Fig. 92. *Entoloma conferendum*.

cently striate often up to centre, dark grey-brown, sepia, horn-brown or reddish brown, often very dark at centre and paler towards margin (centre Mu. 10 YR 2-3/2-4; 7.5 YR 3/2; 5 YR 2/2, 3/2, 4/2, towards margin 10 YR 5/4, 6/4, 6/3; 7.5 YR 5/2, 4/2; 5 YR 5/4, 5/6 outermost margin 10 YR 7/4; 7.5 YR 7/4) strongly pallescent on drying to greyish brown or ochraceous-greyish, centre long staying darker (centre 10 YR 5/2, 5/3, 5/4; 2.5 Y 5/4, rest 10 YR 6/3, 7/3, 8/3) strongly shiny, at centre often almost villose with aeriferous fibrils or subsquamulose, towards margin sometimes radially rugulose. Lamellae, L = 20-50, l = 1-3-5 (-7), rather crowded, (almost) free, moderately to broadly ventricose up to 10 mm broad, pale then pink often with grey or grey-brown tinge, becoming reddish brown with age (7.5 YR 7/4, 6/4; 5 YR 7/6, 7/4, 6/4, 6/6) with entire or dentate, concolorous edge. Stipe 25-80 × 2-6.5 mm, cylindrical, or compressed with longitudinal groove, with slightly to distinctly broadened base (up to 12 mm wide) or not, strongly silvery-fibrillose striate on brown to greyish brown or yellowish brown background (upper part 2.5 Y 7/6 or 7/2, lower part 10 YR 4/2, 3/2, 5/4 or 2.5 Y 4/4), often twisted, sometimes minutely pruinose at apex, at base usually white tomentose, solid then fistulose. Context concolorous with surface in cortex, inner part paler, very brittle. Smell none or farinaceous. Taste none or strongly rancid-farinaceous, disagreeable.

Spores 8.0-13.0 (-14.0) × (7.0-) 7.5-11.5 (-13.0) µm, Q = 1.0-1.6, $\bar{Q}$ = 1.3, rather variable in shape from almost cuboid to cruciform-stellate, often with distorted or twisted longitudinal axis, also with transitions to a heterodiametrical 5-6-angled type. Basidia 25-40 × 10-16.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged 6-12 (-14) µm wide cylindrical hyphae, at centre often transitions to a trichoderm. Pigment brown, intracellular in pileipellis. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, terrestrial, on grass litter, among *Sphagnum*, in grasslands, peat-bogs, and forests, with a preference for neutral or acidulous soils. Very common. Wide-spread and common throughout Europe, both in the lowlands and the montane areas. Probably less common in (sub-)alpine habitats. May-Dec.

var. **pusillum** (Velen.) Noordel. in Persoonia 10: 450. 1980.

Nolanea pusilla Velen., Ceské Houby: 626. 1921; *Rhodophyllus pusillus* (Velen.) Romagn. in Bull. trimest. Soc. mycol. Fr. 53: 332. 1937; *Entoloma staurosporum* var. *pusillum* (Velen.) Noordel. in Persoonia 10: 252. 1979. – *Rhodophyllus xylophilus* J.Lange in Dansk bot. Ark. 2(11): 35. 1921; *Nolanea xylophila* (J.Lange) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960.

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 77B. 1937 (as *R. xylophilus*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 450, fig. 5. 1980.

CHARACTERISTICS. – Pileus 10-15 mm, convex to applanate, usually slightly depressed or with minute papilla at centre, yellow-brown or reddish brown, hygrophanous, translucently striate; lamellae distant, free, white, then pink with concolorous edge; stipe 20-50 × 1-1.5 mm, cylindrical, pale yellow, glabrous, silvery striate; smell and taste none or farinaceous; spores (8.0-) 9.0-12.0 (-12.5) × 7.0-10.5 (-11.0) µm, Q = 1.0-1.5, $\bar{Q}$ = 1.2, cruciform-stellate.

HABITAT & DISTR. – On rotten wood (*Betula, Alnus, Corylus, Fagus*) in forest. Very rare (Roden: Mensingerbos; Bergen N.H.). Known from Denmark, Great Britain and France, but apparently rare.

Entoloma conferendum is a common fungus that has a very wide ecological range, as it occurs in various habitats. However, it seems to prefer neutral and acidulous soils above calcareous habitats, at least in the lowlands in W.Europe. It is no surprise therefore that the species is rather variable, and many taxa have been described in the past on account of morphological variation. I do not attach much value to smell, broadness of lamellae and colour to distinguish varieties or forms; var. *pusillum*, however, has a very aberrant ecology and always very slender basidiocarps.

41. Entoloma rhombisporum (Kühn. & Bours.) Horak in Sydowia 28: 228. ('1974-1975') 1976. – Fig. 93.

Leptonia rhombispora Kühn. & Bours. in Bull. trimest. Soc. mycol. Fr. 45: 276. 1929; *Rhodophyllus rhombisporus* (Kühn. & Bours.) Romagn., Rhodoph. Madagascar: 36. 1941.

SEL. DESCR. & FIGS. – J.Favre, Assoc. fong. Hauts-Marais: 53-54, fig. 16. 1948; Noordel. in Persoonia 10: 451-453, fig. 6. 1980.

Pileus 20-35 mm, truncate-conical or conico-campanulate with blunt, rarely depressed centre with papilla, later on expanding to campanulate-convex or applanate, then with broad papilla, with straight margin, strongly hygrophanous, when moist dark yellowish brown (Mu. 10 YR 4/4, 4/6) at centre and on striae, between striae and at margin paler (10 YR 5/4), translucently striate up to three-quarters of radius, pallescent on drying to pale yellowish brown (2.5 Y 6/4, 7/4), in centre remaining slightly darker, glabrous when moist, becoming radially fibrillose on drying, shiny. Lamellae, L = 20-25, l = 3-5, distant, almost free, triangular, then ventricose, pink with yellow tinge (10 YR 7/6, 6/6; 7.5 YR 7/6, 6/6), slightly pallescent on drying, sometimes transvenose, with entire concolorous edge. Stipe 30-60 × 2-4 mm, cylindrical, sometimes broadened at base, yellow to yellow-brown, with apex, sometimes also

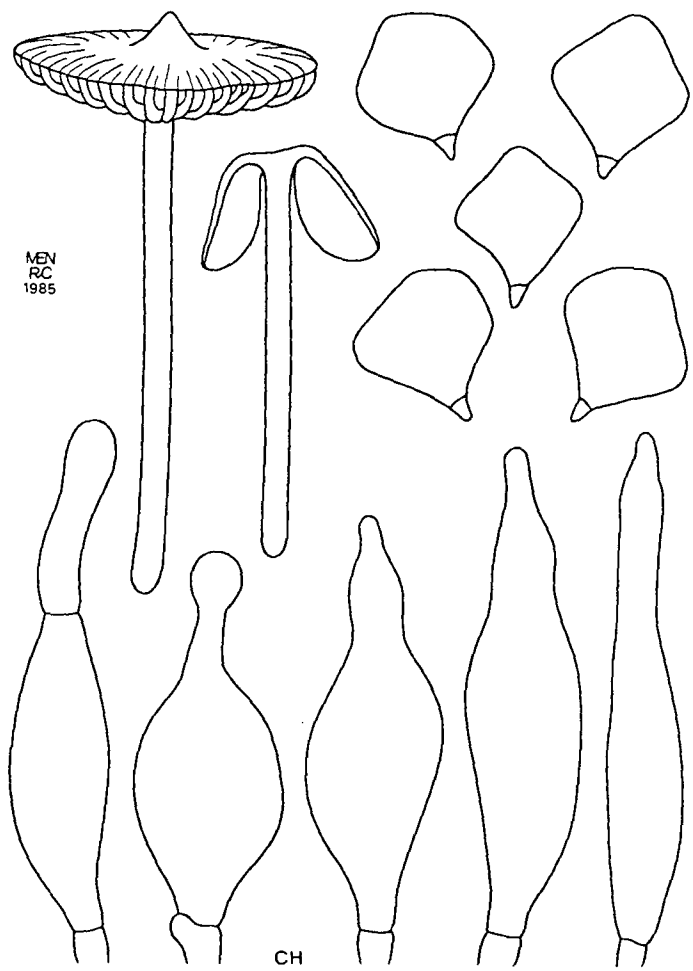

Fig. 93. *Entoloma rhombisporum*.

base, distinctly paler, (10 YR 5/4, 6/4; 2.5 Y 5/4, apex and base 2.5 Y 6/4, 7/4 or entire stipe 5 Y 6/4), glabrous, shiny, almost polished, solid then narrowly fistulose. Context slightly paler than surface, subcartilagineous in stipe, brittle in pileus. Smell absent or faintly fruity, distinctly farinaceous when cut. Taste farinaceous.

Spores 8.0-10.5 × (7.0-) 7.5-10.5 µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, cuboid, rarely 5-angled in side-view. Basidia 35-52 × 10-17 µm, 4-spored, clamped. Lamella edge sterile, rarely heterogeneous. Cheilocystidia lageniform to tibiiform, 40-70 µm long, with 10-21 µm wide, rather swollen base and 3.5-8 µm wide tapering moniliform or capitate neck. Pileipellis a thin cutis of radially arranged, 2-8 µm wide cylindrical hyphae, with or without well-developed subpellis of inflated elements, 70-120 × 10-32 µm. Pigment minutely incrusting the hyphae of pileipellis and in addition pale brown intracellular, especially in subpellis. Clamp-connections numerous in hymenium, rare elsewhere.

HABITAT & DISTR. – Solitary or in small groups in moist-dune valley among moss (*Sphagnum*) with *Salix repens* and *Menyanthes trifoliata*. Very rare (Callantsoog: Zwanenwater; Texel). Widespread but rare in N. and W.Europe in *Sphagnum* bogs or moist grassland (hayfields). May-Nov.

Entoloma rhombisporum is one of the few European species of *Entoloma* with cuboid spores, and therefore easy to recognize. It also has remarkable cheilocystidia.

Sect. **Papillata** (Romagn.) Noordel.

Pigment incrusting at least the narrowest hyphae of pileipellis and upper pileitrama, sometimes also intracellular pigment present; spores iso- or heterodiametrical; cystidia usually absent.

42. Entoloma papillatum (Bres.) Dennis in Bull. trimest. Soc. mycol. Fr. 69: 162. 1953. – Fig. 94.

Nolanea papillata Bres., Fungi trident. 1: 75. 1887; *Rhodophyllus papillatus* (Bres.) J.Lange, Fl. agar. dan. 2: 101. 1937; *Nolanea mammosa* subsp. *papillata* (Bres.) Konr. & M., Ic. sel. Fung. 2; pl. 180, fig. 2. 1932. – *Agaricus mammosus* var. *tenuior* Fr., Ic. sel. Hymenomyc. 1: 113. 1867. – *Leptonia papillata* Velen., Ceské Houby: 622. 1921. – *Leptonia mamillata* Velen., Ceské Houby: 622. 1921.

MISAPPL. – *Agaricus mammosus* sensu Cooke, Ill. Brit. Fungi: pl. 363 (377). 1876; *Rhodophyllus mammosus* sensu J.Lange in Dansk bot. Ark. 2(11): 36. 1921; *Nolanea clandestina* sensu Bres., Iconogr. mycol. 12: pl. 585, fig. 2. 1929; sensu Konr. & M., Ic. sel. Fung. 2: 178, fig. 2. 1930.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 91d. 1981; Bres., Iconogr. mycol. 12: pl. 583, fig. 1 and pl. 585, fig. 2. 1929

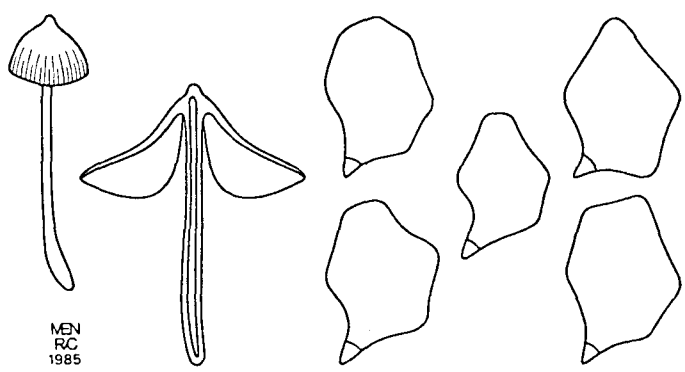

Fig. 94. *Entoloma papillatum*.

(as *N. clandestina*); Konr. & M., Ic. sel. Fung. 2: pl. 180, fig. 2. 1932; J.Lange, Fl. agar. dan. 2: pl. 78D. 1937.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 454-456, fig. 8. 1980.

Pileus 6-35 mm, acutely conical to conico-campanulate or hemispherical, expanding to conico-convex, finally convex, usually with well delimitated conical papilla, with slightly involute margin when young, strongly hygrophanous, when moist fairly dark sepia, reddish brown or blackish brown (Mu. 10 YR 2-3/2-3, 4/4; 7.5 YR 3/2, 4/4; 5 YR 3/2; 2.5 YR 3/2) not or only slightly paler towards margin (10 YR 5/4, 6/4; 7.5 YR 4/4; 5 YR 5/4; 5/6) translucently striate up to two-thirds of radius, pallescent on drying to (pale) sepia brown (7.5 YR 4/4, 4/2, 6/4 at centre, rest 10 YR 5-7/3-4, 7/6) smooth, shiny, rarely minutely radially rugulose. Lamellae, L = 15-24, l = (1-) 3-7 (-9), moderately distant, thin, emarginate to almost free, rarely adnate, triangular to broadly ventricose, pale grey to white when young then greyish pink finally brownish pink (young 10 YR 8/3, 7/3 then 4/4; 7.5 YR 6/4, 5/4, 4/4, 4/2; 5 YR 7/3, 6/3, 5/3, 5/2, 4/3) with entire or slightly eroded, concolorous or slightly paler edge. Stipe 20-50 × 1-3 mm, cylindrical usually slightly broadened towards base, sepia with paler apex often without reddish tinges (2.5 Y 7/6, 7/4; 10 YR 4-6/2-4; 7.5 YR 3/2), pruinose to flocculose at apex, downwards minutely silky striate, white tomentose at base. Context thin, concolorous with surface, paler in inner part of stipe. Smell weakly to strongly farinaceous, rarely absent. Taste farinaceous.

Spores 9.0-11.5 (-13.5) × 7.0-8.0 (-8.5) µm, Q = 1.1-1.6, $\bar{Q}$ = 1.3, 6-9-angled in side-view. Basidia 30-50 × 8-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow cylindrical hyphae, 4-9 (-12) µm wide; subpellis not or weakly developed, then made up of short, inflated elements, 60-100 × 12-30 µm. Pigment minutely to coarsely incrusting the hyphae of pileipellis, pileitrama and hymenophoral trama. Clamp-connections present in hymenium, elsewhere rare.

HABITAT & DISTR. – In small groups in poorly manured, extensively grazed grassland usually with well-developed moss-layer, on dry, basic to acid soil. Common and widespread in the temperate, boreal and subalpine regions of Europe. May-Nov.

Entoloma papillatum is well characterised by its conical pileus, often with pronounced papilla, dark colour, large spores and usually pronounced farinaceous smell. *Entoloma clandestinum* differs in having darker, thickish lamellae, slightly smaller spores and in absence of smell.

43. Entoloma clandestinum (Fr.: Fr.) Noordel. in Persoonia 10: 456. 1980. – Fig. 95.

Agaricus clandestinus Fr.: Fr., Syst. mycol. 1: 206. 1821; *Nolanea clandestina* (Fr.: Fr.) Kumm., Führ. Pilzk.: 95. 1871; *Rhodophyllus clandestinus* (Fr.: Fr.) Quél., Enchir. Fung.: 64: 1886.

EXCL. – *Nolanea clandestina* sensu Bres., Iconogr. mycol. 12: pl. 585, fig. 2. 1929; sensu Konr. & M., Ic. sel. Fung. 2: pl. 178, fig. 2. 1930 (= *E. papillatum*).

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 91e. 1981; J.Lange, Fl. agar. dan. 2: pl. 78C. 1937.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 456-458, fig. 7. 1980.

Pileus 6-30 mm, conical or hemispherical, then slightly expanding to conico-convex finally convex with or without small papilla, with margin involute when young then straight, hygrophanous, when moist very dark blackish brown often with reddish tinge (Mu. 2.5 YR 2.5/2; 5 YR

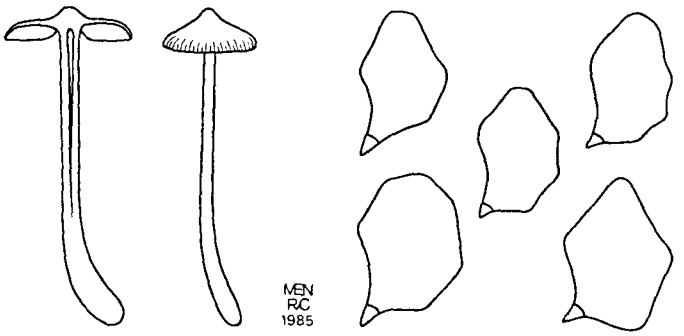

Fig. 95. *Entoloma clandestinum.*

2/2, 3/2; 7.5 YR 2/2, 3/2, K. & W. 6F4), not or only slightly paler at margin (7.5 YR 4/4), translucently striate at least at margin, pallescent on drying to grey-brown (e.g. K. & W. 6E6-6E5), smooth or with minute radially arranged warts or wrinkles, shiny. Lamellae, L = 12-20, l = 1-3 (-7), fairly distant, broadly adnate or emarginate, uncinate to almost free, thickish, narrowly ventricose, dark grey brown already when young, darkening with age (7.5 YR 5/4, 5 YR 4/3; 6D5-6E5) sometimes transvenose, sometimes anastomosing, with concolorous or slightly paler, entire or slightly eroded edge. Stipe 18-40 × 1-2.5 mm, cylindrical often broadened towards base, concolorous with pileus or paler (6E6; 5 YR 2.5/2, 3/3, 3/2, 3/1) not striate, glabrous or pruinose at apex, rarely entirely pruinose. Context thin, concolorous with surface in cortex, inner parts of stipe paler. Smell none. Taste indistinct.

Spores 8.0-10.5 × (5.5-) 6.5-7.5 (-8.0) µm, Q = 1.2-1.4 (-1.5), $\bar{Q}$ = 1.3, regularly 6-angled in side-view. Basidia 30-50 × 8-15 µm, 2-4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 4.5-11 µm wide cylindrical hyphae. Pigment incrusting the hyphae of pileipellis, pileitrama and hymenophoral trama. Clamp-connections abundant in hymenium, rare or absent in other tissues.

HABITAT & DISTR. – In small groups among mosses in poor, short-grazed grassland on dry, weakly acid sandy soil or in frondose forest on clearing, roadside, etc. on slightly basic soil. Rare. Widespread but rare in N. and W.Europe. June-Sept.

Entoloma clandestinum is a remarkable species because of its dark colour, thickish and fairly distant lamellae, and glabrous stipe.

44. Entoloma lucidum (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 206. 1978. – Fig. 96.

Nolanea lucida P.D.Orton in Trans. Br. mycol. Soc. 43: 331. 1960; *Rhodophyllus lucidus* (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 3. Aufl.: 166. 1967.

SEL. ICON. – R.Phillips, Mushr. other Fungi: 118. 1981.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 458, fig. 9. 1980; P.D.Orton in Trans. Br. mycol. Soc. 43: 331-332, figs. 150-155, 338. 1960.

Pileus 18-32 mm, conico-convex soon expanding to convex, finally applanate with faint papilla, with straight margin, hygrophanous, when moist rather dark sepia or umber brown (Mu. 10 YR 4/3, 3/3) translucently striate up to halfway radius, pallescent on drying to pale grey-brown or ochraceous grey (10 YR 7/3, 7/2) innately radially fibrillose, dull or shiny. Lamellae, L = about 35, l = 1-3, crowded, adnate to almost free, segmentiform to ventricose, pallid grey then pinkish grey, finally brown-pink (7.5 YR 8/2, 8/4 then 7/4, 6/4, finally 5 YR 6/4) with almost entire concolorous edge. Stipe 35-58 × 1.5-3 mm, cylindrical usually slightly curved and broadened towards base, concolorous with pileus or paler especially at base (10 YR 5/4, base 7/6), minutely silvery-striate lengthwise. Context thin, brittle, concolorous with surface in cortex, paler in inner parts. Smell strongly farinaceous-rancid. Taste strongly farinaceous-rancid.

Spores 8.0-10.5 × 6.5-8.5 (-9.0) µm, (5-)6(-8)-angled in side-view. Basidia 24-40 × 9-15 µm, 4-, a few 2-spored. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow cylindrical hyphae, 3-11 (-20) µm wide, gradually passing into pileitrama. Pigment brown, incrusting the hyphae of pileipellis and upper pileitrama, sometimes in addition pale intracellular in pileipellis. Clamp-connections present in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – Solitary or in small groups in poorly manured grassland, terrestrial. Very rare (Oost Flevoland: Roggebotszand, Revebos; Winterswijk: Korenburgerveen). Distribution in Europe unknown, recorded from Great Britain. June-Sept.

With *Entoloma ortonii* and *E. sericeonitens*, *E. lucidum* belongs to a small group of closely related taxa which are difficult to discriminate, that is in need of revision.

45. Entoloma sericeonitens (P.D.Orton) Noordel. in Persoonia 10: 459. 1980. – Fig. 97.

Nolanea sericeonitens P.D.Orton in Trans. Br. mycol. Soc. 43: 333. 1960.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 459, fig. 12. 1980.

Pileus up to 30 mm, conical, then expanding with straight margin, hygrophanous, when moist reddish brown, slightly paler at margin, translucently striate up to centre, strongly pallescent on drying to pale brown, strongly fibrillose with aeriferous fibrils, shiny. Lamellae, L = about 28, l = 1-3, almost free, ventricose, brownish pink with concolorous edge. Stipe 50 × 2 mm, cylindrical, concolorous with pileus, slightly silky striate lengthwise, white tomentose at base. Context concolorous with surface, membranaceous-brittle. Smell none. Taste none.

Spores 9.0-10.5 (-11.5) × (7.0-) 7.5-8.5 µm, Q = 1.2-1.4, $\bar{Q}$ = 1.3, irregularly 6-angled in side-view. Basidia 22-37 × 7.5-11.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of narrow, cylindrical hyphae, 4-9 µm wide; subpellis not devel-

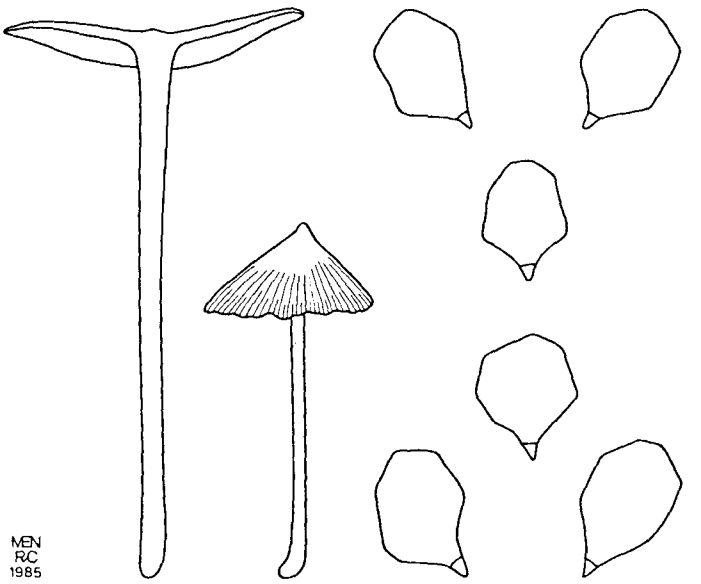

Fig. 96. *Entoloma lucidum.*

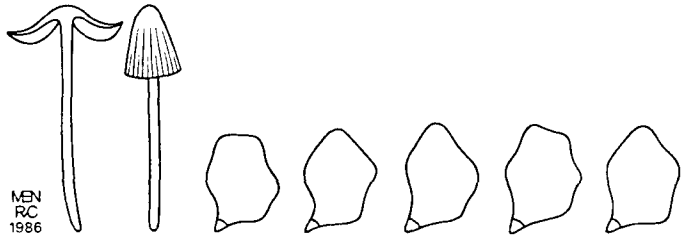

Fig. 97. *Entoloma sericeonitens.*

oped. Pigment minutely incrusting the hyphae of pileipellis. Clamp-connections present in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – In grassland on peaty soil. Very rare (Winterswijk: Korenburgerveen). Distribution in Europe unknown. Recorded from Great Britain. Sept.-Dec.

The description given above is based on only one collection from the Netherlands and supplementary information from the original diagnosis. The *E. lucidum-E. sericeonitens* complex is in need of revision.

46. Entoloma ortonii Arnolds & Noordel. in Persoonia 10: 292. 1979. – Fig. 98.

Nolanea farinolens P.D.Orton in Trans. Br. mycol. Soc. 43: 330. 1960; *Rhodophyllus farinolens* (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 3 Aufl.: 166. 1967; *Entoloma farinolens* (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 206. 1978, non *Entoloma farinolens* Horak, 1973.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 92b. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 16-18, fig. 13. 1981; Noordel. in Persoonia 10: 459-461, fig. 10. 1980.

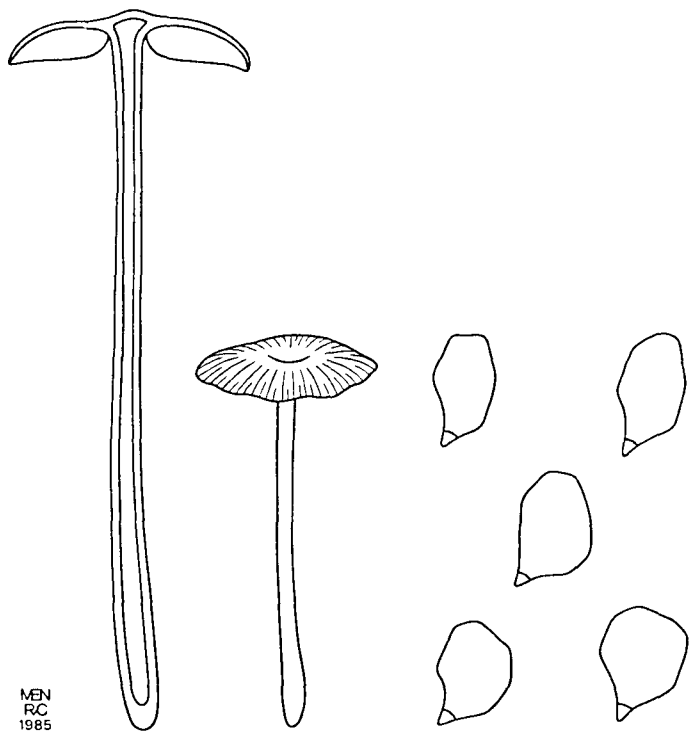

Fig. 98. *Entoloma ortonii.*

Pileus 24-35 mm, convex to plano-convex, sometimes with weak papilla or slightly depressed at centre, with margin slightly involute then straight, hygrophanous, when moist dark grey-brown at centre (K. & W. 5E6; Mu. 10 YR 3/2-4/2), paler towards margin (5D5; 10 YR 4/3, 5/3) translucently striate up to centre, pallescent on drying to brown-grey or ochraceous grey, dull. Lamellae, L = 18-23, l = 3-7, adnate or emarginate, segmentiform to subventricose, brown-grey with pink tinge (5C4; 7.5 YR 8/4-6/4), paler towards entire edge. Stipe 50-95 × (2-) 2.5-5 mm, cylindrical with or without broadened base, grey-brown (10 YR 6/4, 5/4, 4/4) strongly silvery striate lengthwise, sometimes twisted, pruinose at apex, white tomentose at base. Context in pileus rather firm and stiff, watery grey-brown, in stipe rigid-fibrillose, grey-brown or ochraceous brown. Smell rancid-farinaceous. Taste rancid-farinaceous.

Spores 7.5-8.5 (-9.5) × 5.5-7.5 (-8.0), Q = 1.05-1.3 (-1.4), $\bar{Q}$ = 1.2, rather rounded 5-6-angled in side-view, with thin walls. Basidia 25-40 × 10.5-14 µm, 4- (rarely also 2-)spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of radially arranged, cylindrical hyphae, 4-12 µm wide. Pigment minutely incrusting the narrow hyphae of pileipellis and upper pileitrama and diffusely intracellular in pileipellis.

HABITAT & DISTR. – Solitary in grassland or on grassy spots in frondose forest. Very rare (Anloo: de Burgwallen; Warmond: Huys te Warmont). Distribution in Europe unknown. Recorded from Great Britain. July-Oct.

The very thin-walled, rounded-angular spores are distinctive for *E. ortonii* and make it easy to distinguish this species from *E. juncinum* and *E. sericeum*, which both also differ in habit and pigmentation.

47. Entoloma cuspidiferum Kühn. & Romagn. ex Noordel. in Persoonia 10: 461. 1980. – Fig. 99.

Rhodophyllus cuspidifer Kühn. & Romagn., Fl. anal. Champ. sup.: 189. 1953 (not valid, no Latin diagn.); *Nolanea cuspidifer* (Kühn. & Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960. – *Agaricus junceus* var. *cuspidatus* Fr., Ic. sel. Hymenomyc. 1: pl. 99, fig. 2. 1867; *Rhodophyllus cuspidatus* (Fr.) J.Favre, Assoc. fong. Hauts-Marais: 44. 1948, non *Entoloma cuspidatum* (Peck) Sacc., 1887.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 47: 125, fig. 4. 1976; J.Favre, Assoc. fong. Hauts-Marais: 44. 1948; Noordel. in Persoonia 10: 461-463, fig. 13. 1980.

Pileus 17-35 mm, up to 18 mm high, acutely conical with small papilla, only slightly expanding to conico-campanulate with age, with margin slightly inflexed then straight, strongly hygrophanous, when moist (greyish) sepia to grey-brown, only slightly paler at margin (Mu. 10 YR 4/4, margin 5/4-6/4) translucently striate up to half of radius, pallescent on drying to very pale brown (10 YR 7/4, 7/3) strongly silvery-fibrillose, shiny. Lamellae, L = about 30, l = 3-5, moderately distant (almost) free, triangular-ventricose up to 7 mm broad, grey then grey-pink finally tinged brown (10 YR 7/2, 7/3, 7/4 then 7.5 YR 7/4 (6/4)) with eroded, concolorous edge. Stipe 60-80 × 2.5-4 mm, cylindrical, straight, paler and more yellow than pileus (10 YR 8/4, 7/4, 8/6), browner at base (10 YR 6/4, 5/4), upper part pruinose-puberulous, downwards almost glabrous with some scattered silvery fibrils, white tomentose at base. Context relatively firm in pileus and concolorous with surface, fibrillose, paler in inner parts of stipe. Smell strongly raphanoid. Taste rancid-farinaceous to raphanoid.

Spores 10.0-13.0 × 9.5-11.0 µm, Q = 1.05-1.4, $\bar{Q}$ = 1.2, 5-6-angled in side-view. Basidia 25-41 × 9-15 µm, 2-, rarely also 4-spored, clamped. Lamella edge fertile or heterogeneous. Cheilocystidia, if present, 42-60 × 12-17 µm, cylindrical to narrowly clavate, sometimes subcapitate.

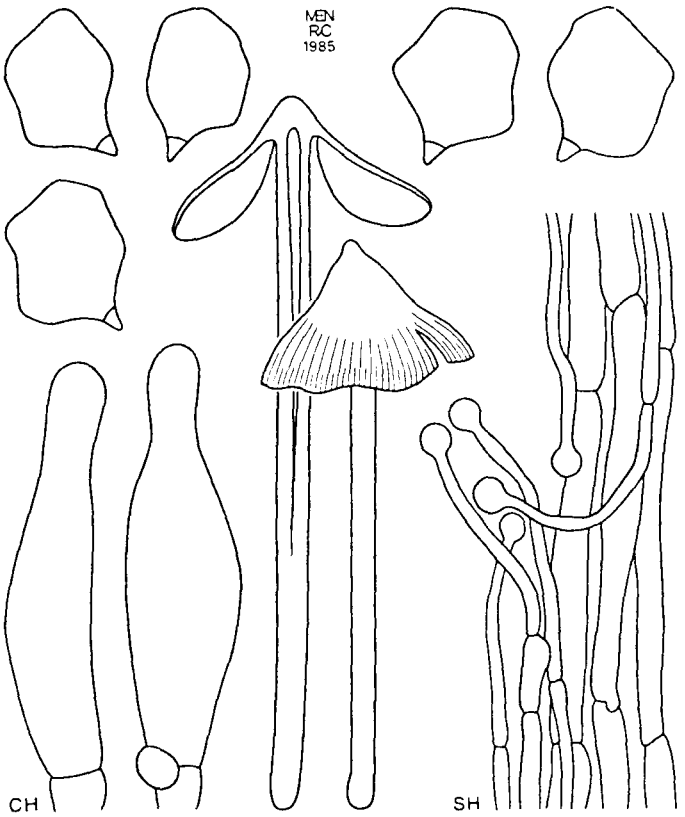

Fig. 99. *Entoloma cuspidiferum.*

Pileipellis a cutis of radially arranged, cylindrical hyphae 2.5-10 (-14) µm wide; subpellis well-developed, consisting of inflated elements. Pigment very finely incrusting the hyphae of pileipellis, in some superficial hyphae also pale intracellular. Stipitipellis at apex with 2-5 µm wide, capitate hairs. Clamp-connections frequent in all tissues studied.

HABITAT & DISTR. – Solitary or in small groups on acid, peaty soils, among *Sphagnum* or in marshes with *Salix repens*, *S. aurita* and *Menyanthes trifoliata* in coastal dunes. Very rare (Callantsoog: Zwanewater). Widespread but very rare in N. and W.Europe. Aug.-Nov.

Entoloma cuspidiferum is easy to recognize by its conical pileus, raphanoid smell, 2-spored, clamped basidia and the capitate hairs on its stipe.

48. Entoloma favrei Noordel. in Int. J. Mycol. Lich. 1: 56. 1982. – Fig. 100.

Leptonia cinerascens Velen., Ceské Houby: 623. 1921, non *Entoloma cinerascens* Hesler, 1967.

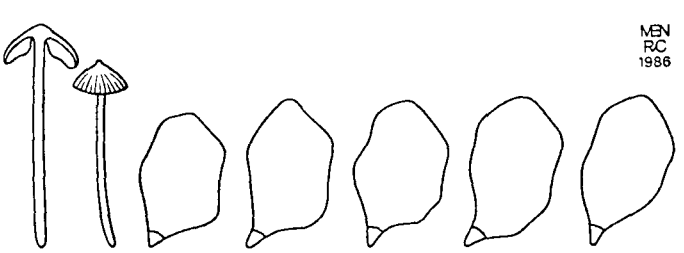

Fig. 100. *Entoloma favrei.*

MISAPPL. – *Entoloma tenellum* sensu Noordel. in Persoonia 10: 470. 1980.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 470-472, fig. 18. 1980 (as *E. tenellum*).

Pileus 5-13 mm, conico-convex often with small papilla and slightly involute margin, hygrophanous, when moist brown-grey to beige-grey (Mu. 10 YR 5/3) translucently striate up to two-thirds of radius, strongly pallescent on drying to sordid white (10 YR 7/2), brilliantly shiny, glabrous. Lamellae moderately distant, narrowly adnate to almost free, broadly ventricose, 2.5-3 mm broad, greyish brown with pink tinge (10 YR 5/2, 5/3) with entire, concolorous edge. Stipe 30 × 1.5-2 mm, cylindrical, hyaline, ochraceous-yellow to grey-brown, minutely pruinose at apex, downwards glabrous, shiny. Context very thin, relatively firm-subcartilagineous, concolorous with surface. Smell indistinct. Taste indistinct.

Spores (8.0-) 9.5-12.0 (-14.0) × 7.0-9.5 µm, Q = 1.1-1.3, $\bar{Q}$ = 1.25, (5-)6-7(-8)-angled in side-view. Basidia 32-48 × 9.5-12 µm, 4- (rarely also 2-)spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, narrow cylindrical 2.5-14 µm wide hyphae. Pigment finely incrusting in pileipellis. Stipitipellis at apex of stipe with cylindrical often capitate hairs, 50-150 × 6.5-10 (base) × 3.5-9 (apex) µm. Clamp-connections present in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – Solitary or in small groups in marshy vegetation with *Filipendula*, in mosses on acid, sandy soil with *Juniperus communis*, and in *Quercus* forest. Rare, but widespread in Europe. July-Oct.

Entoloma favrei resembles *E. minutum* very much but differs from it mainly in shape of the pileus, dark lamellae, and larger spores.

49. Entoloma pygmaeopapillatum Arnolds & Winterhoff in Z. Mykol. 52: 255. 1986. – Fig. 101.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 345, fig. 156 ('1982') 1983 (as *E. pygmaeopapillatum* nov. spec. prov.).

Pileus 5-10 mm, convex to plano-convex with acute papilla, with straight margin, hygrophanous, when moist pale grey-brown (K. & W. 5B-C3, 5C4) with darker striation and centre (5E4), translucently striate up to centre, pallescent on drying, smooth, glabrous. Lamellae, L = 10-16, l = 1-5, narrowly adnate, deeply emarginate, rather crowded, ventricose, up to 2 mm broad, pale grey at first then pinkish brown with entire, concolorous edge. Stipe 10-18 × 0.6-0.7 mm, cylindrical, pale grey-brown, smooth, polished, white tomentose at base. Context membranaceous in pileus, concolorous with surface. Smell not distinctive. Taste none.

Spores 7.5-9.5 (-10.5) × 6.0-8.0 (-8.5) µm, Q = (1.1-) 1.15-1.3 (-1.4), $\bar{Q}$ = 1.2-1.25, rounded 5-6-angled in side-view. Basidia 26-38 × 8-12.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 3-9 (-15) µm wide, cylindrical hyphae. Pigment minutely incrusting in pileipellis. Clamp-connections sparsely present in hymenium, elsewhere lacking.

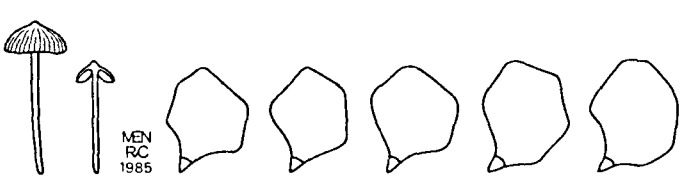

Fig. 101. *Entoloma pygmaeopapillatum.*

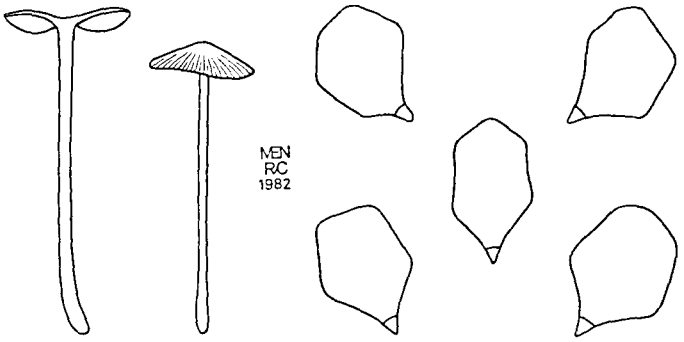

Fig. 102. *Entoloma minutum.*

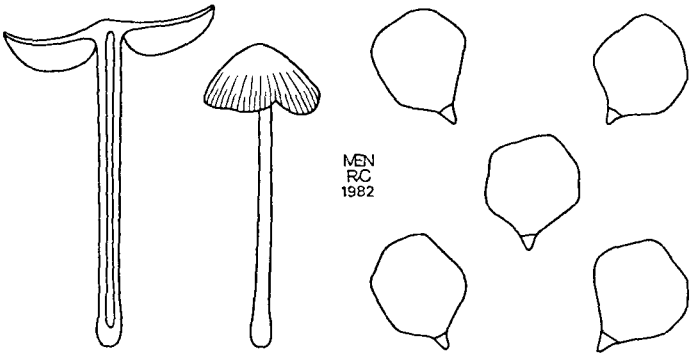

Fig. 103. *Entoloma juncinum.*

HABITAT & DISTR. – On wet, peaty soil, in unfertilized hayfield along rivulet (*Calthion palustris*) and among tussocks of *Carex* in bog (*Magnocaricion*). Very rare (De Wijk: Reest-Valley). Also known from one collection from the German Federal Republic. Sept.-Nov.

Entoloma pygmaeopapillatum is very close to *E. minutum* and *E. favrei* but differs from these two species by the spore-size and the lack of modified hairs on the stipe.

50. Entoloma minutum (P.Karst.) Noordel. in Persoonia 10: 248. 1979. – Fig. 102.

Nolanea minuta P.Karst. in Meddn Soc. Fauna Fl. fenn. 5: 10. 1879 (Symb. Mycol. fenn. 6); *Rhodophyllus minutus* (P.Karst.) J.Lange in Dansk bot. Ark. 2(11): 37. 1921.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 93a, b. 1981; J.Lange, Fl. agar. dan. 2: pl. 79H. 1937.

SEL. DESCR. & FIGS. – Joss. in Bull. trimest. Soc. mycol. Fr. 53: 213-215. 1937; Nath.-W. in Friesia 8: 13. 1966; Noordel. in Persoonia 10: 468-470, fig. 16. 1980.

Pileus 5-25 mm, conical then expanding to convex finally applanate, often with small papilla, with straight margin, hygrophanous, when moist pale pinkish brown or yellow-brown with contrastingly darker almost black central spot, translucently striate up to centre, pallescent on drying to almost white, at centre remaining darker, glabrous or innately radially fibrillose with some loose fibrils. Lamellae, L = 10-25, l = 1-3, moderately distant, ventricose, up to 5 mm broad, white to pale grey then pink with concolorous, entire edge. Stipe 25-65 × 1-1.5 (-2) mm, cylindrical sometimes with slightly broadened base, hyaline yellowish or grey-brown, sometimes with some innate silvery fibrils to substriate, sometimes minutely pruinose at apex. Context thin, with same colour as surface. Smell weak. Taste none or slightly bitter to subfarinaceous.

Spores 8.0-10.5 (-11.5) × 6.5-8.0 (-9.0) µm, Q = 1.1-1.4 (-1.5), $\bar{Q}$ = 1.25-1.3, rather regularly 5-7-angled in side-view. Basidia 25-40 × 9-12.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a rather simple cutis of 2.5-13 (-15) µm wide, cylindrical hyphae, gradually passing into pileitrama. Pigment minutely incrusting the hyphae of pileipellis and upper pileitrama, rarely in addition pale, intracellular. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or in small groups on humus in damp forests of *Alnus*, *Betula*, and *Salix*, rarely also in moist grassland. Fairly common and widespread in Europe. Aug.-Nov.

51. Entoloma juncinum (Kühn. & Romagn.) Noordel. in Persoonia 10: 255. 1979. – Fig. 103.

Rhodophyllus juncinus Kühn. & Romagn. in Rev. Mycol. 19: 3. 1954 (Compl. Fl. anal. 1); *Nolanea juncina* (Kühn. & Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960.

MISAPPL. – *Rhodophyllus junceus* sensu J.Lange in Dansk bot. Ark. 2(11): 37. 1921. – *Nolanea proletaria* sensu Rick., Blätterpilze: 299. 1910.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 464-466, fig. 14. 1980.

VERN. NAME. – Bruinsteelsatijnzwam.

Pileus 10-40 mm, conico-convex soon expanding finally applanate, obtuse, more rarely with small papilla or slightly depressed at centre, with straight margin, strongly hygrophanous, when moist rather dark reddish brown or grey-brown, slightly paler at margin (in centre Mu. 10 YR 3-4/3-3; 7.5 YR 3-4/2, at margin 10 YR 4-6/3-4; 7.5 YR 5-6/3), translucently striate up to two-thirds of radius, pallescent on drying, glabrous. Lamellae, L = 15-30, l = (1-) 3-7, moderately distant, deeply emarginate, sometimes almost free or broadly adnate, ventricose, up to 7 mm broad, rather dark grey-brown then with pink tinge (10 YR 5/3-4, 7.5 YR 5-6/4; 5 YR 5-6/3-4) with entire, concolorous edge. Stipe 40-80 × 1-4 mm, cylindrical or compressed with groove, slightly broadened towards base, concolorous with or slightly paler than pileus (10 YR 3-4/3-4; 7.5 YR 4-3/2; 5 YR 3-4/2-3), glabrous, sometimes minutely pruinose at apex, rarely substriate, white tomentose at base. Context concolorous with surface when moist, pallescent and paler than surface on drying. Smell farinaceous, spontaneously sometimes weak, but then distinct when cut or bruised. Taste strongly farinaceous-rancid.

Spores 8.0-10.5 × 7.0-9.0 (-9.5) µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, isodiamet-

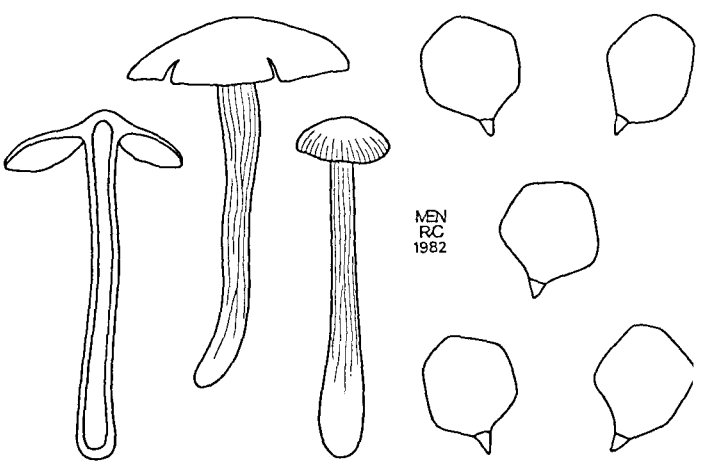

Fig. 104. *Entoloma nitens.*

rical, 5-6-angled in side-view. Basidia 25-50 × 10-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of radially arranged, 2.5-15 µm wide, cylindrical hyphae, sometimes with scattered suberect, clavate, up to 20 µm wide, terminal elements. Pigment incrusting the hyphae of pileipellis and upper pileitrama, in addition pale brown, intracellular in upper pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – In humus-rich deciduous forest (*Alnus*, *Salix*, *Betula*, *Quercus*), more rarely in poorly manured grassland. Not uncommon. Widespread all over Europe. July-Nov.

52. Entoloma nitens (Velen.) Noordel. in Persoonia 10: 252. 1979. – Fig. 104.

Nolanea nitens Velen., Ceské Houby: 627. 1921; *Rhodophyllus nitens* (Velen.) Kühn. & Romagn., Fl. anal. Champ. sup.: 190. 1953 (not valid, basionym not mentioned).

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 93c. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 21-22, fig. 16. 1981; Noordel. in Persoonia 10: 466-468, fig. 15. 1980.

Pileus 10-42 mm, conical or hemispherical then expanding finally flattened, usually with small, indistinct papilla, more rarely with acute papilla, with straight, deflexed or reflexed margin, hygrophanous, when moist grey-brown sometimes with ochraceous tinge (Mu. 10 YR 4-5/3-4) slightly paler towards margin, translucently striate up to half the radius, pallescent on drying to ochraceous-grey (10 YR 6-7/2-3), smooth, sometimes with some aeriferous fibrills especially when dried out. Lamellae, L = 20-30, l = 1-3 (-5), moderately distant, narrowly to broadly ventricose, up to 7 mm broad, sometimes transvenose, grey-brown finally with pink tinge (10 YR 5-6/4, 7.5 YR 6-5/4), with concolorous, entire edge. Stipe 40-70 × 2-4 mm, cylindrical or compressed, with or without broadened base, concolorous with moist pileus or paler, strongly silvery striate, often twisted, minutely pruinose at apex, white tomentose at base. Context concolorous with surface in cortex of pileus and stipe, paler in inner parts, fibrillose-brittle. Smell weak, sometimes terroid or raphanoid. Taste weak, more or less raphanoid.

Spores 8.0-10.5 × 7.5-9.5 (-10.5) µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, isodiametrical, 5-6-angled in side-view. Basidia 32-53 (-60) × 9-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of 3.5-9 µm wide, cylindrical hyphae. Pigment minutely incrusting the hyphae of pileipellis and pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – In frondose forests on rich, loamy soil and in grassland, also found in *Juniperus*-heath. Rare. Recorded also from France and Czechoslovakia. Aug.-Oct.

Entoloma nitens resembles *E. juncinum*, from which it differs in colour and in the surface-structure of the stipe. Also the smell is strikingly different.

53. Entoloma tibiicystidiatum Arnolds & Noordel. in Persoonia 10: 294. 1979. – Fig. 105.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 294-295, figs. 23-26. 1979; Noordel. in Persoonia 10: 473, fig. 17. 1980.

Pileus 10-15 mm, irregularly plano-convex without papilla, with straight margin, hygrophanous, when moist rather pale grey-brown,

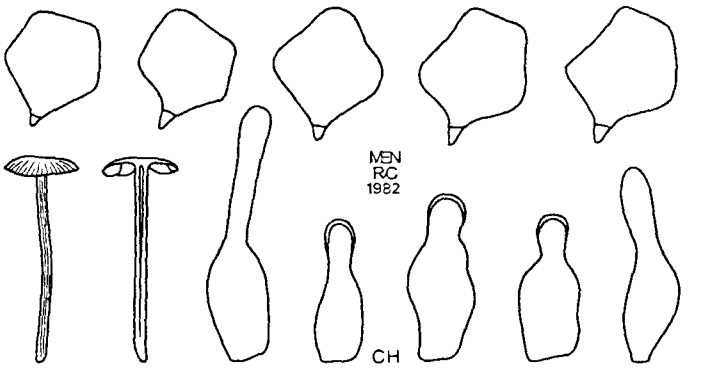

Fig. 105. *Entoloma tibiicystidiatum*.

translucently striate up to centre, pallescent on drying. Lamellae fairly distant, almost free, pale salmon-pink. Stipe up to 38 × 2 mm, cylindrical, pale grey-brown, silvery striate. Context thin, concolorous with surface. Smell farinaceous. Taste not known.

Spores (7.0-) 8.0-10.5 (-11.0) × (6.5-) 7.0-9.5 µm, Q = 1.0-1.2, $\bar{Q}$ = 1.1, 5-6-angled in side-view. Basidia 4- (rarely also 2-) spored, clamped. Lamella edge heterogeneous. Cheilocystidia subcylindrical and subcapitate to tibiiform, 17-35 × 6-8 (middle) × 2.5-5 (apex) µm. Pileipellis a cutis of radially arranged, cylindrical, 2.5-5 µm wide hyphae. Pigment membranal to incrusting in pileipellis and upper pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – In small groups or solitary, in poorly fertilized hayfield (*Calthion palustris*) on wet in winter inundated soil, also found on loamy soil. Very rare (De Wijk: Reest-valley; Udenhout: loampits). Oct.

Entoloma tibiicystidiatum is a rare species, which looks like a small *E. sericeum*, but is easily distinguished from the latter by the presence of conspicuous cheilocystidia.

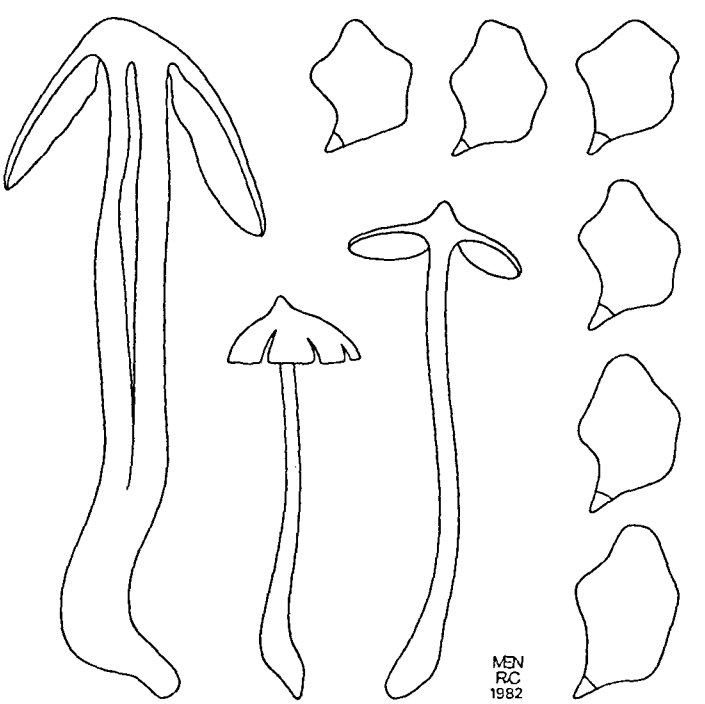

Fig. 106. *Entoloma ameides*.

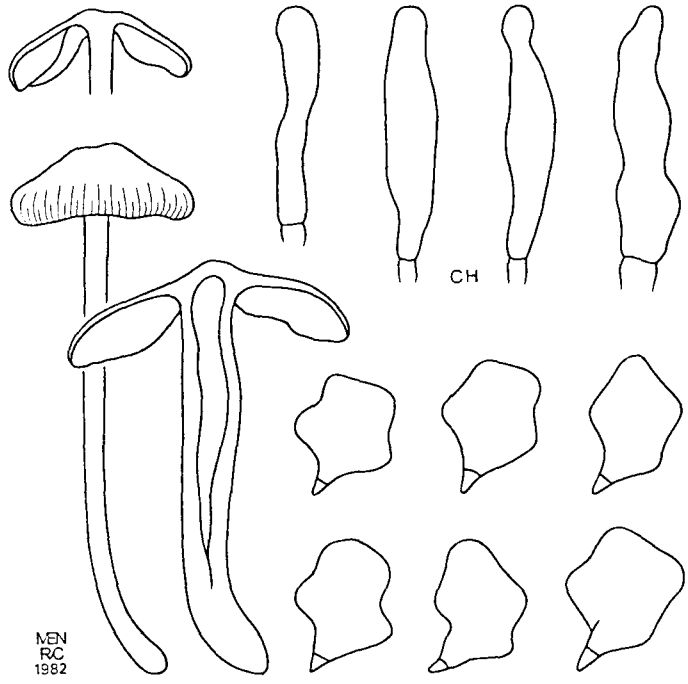

Fig. 107. *Entoloma sacchariolens.*

54. Entoloma ameides (B. & Br.) Sacc., Syll. Fung. 5: 686. 1887. – Fig. 106.

Agaricus ameides B. & Br., Ann. Mag. nat. Hist., ser. III, 15: 315. 1865 (Notic. Brit. fungi 999); *Rhodophyllus ameides* (B. & Br.) Quél., Enchir. Fung.: 58. 1886.

SEL. DESCR. & FIGS. – Einh. in Ber. Bayer. bot. Ges. 41: 102-103, figs. 17, 21, pls. 9a, 11c. 1969; Konr. in Bull. trimest. Soc. mycol. Fr. 41: 45-46. 1925; Konr. in Bull. trimest. Soc. mycol. Fr. 45: 52. 1929; Noordel. in Persoonia 10: 473-474, fig. 19. 1980.

Pileus 10-45 mm, conical to conical-campanulate, expanding to (conico-)convex, usually with (pointed) papilla, with involute margin when young, then straight, strongly hygrophanous, when moist grey-ochre to (pale) grey-brown (Mu. 10 YR 6/2, 6/3, 5/2, 5/3, sometimes 5/4) translucently striate up to half of the radius, pallescent on drying to greyish, pale brown or ochraceous, in centre remaining darker (centre 10 YR 5/4, rest 7/4, 8/3), glabrous, shiny. Lamellae, L = 22-35, l = (1-) 3, narrowly adnate-emarginate, almost free, ventricose, often somewhat thickish, grey, then pink, finally dark grey-brown with pink tinge (10 YR 7/4, 7/3, then between 7/4 and 7.5 YR 7/4, finally 10 YR 6/3, 5/2 with pink tinge), slightly pallescent on drying, with irregular, concolorous edge. Stipe 30-80 × 3-7 mm, cylindrical, pale isabella ochraceous (10 YR 8/2, 8/3 up to 7/3 or 8/4), brilliantly silvery-striate lengthwise, slightly pruinose at apex, white tomentose at base. Context concolorous with surface, relatively thin in pileus and brittle-fibrous in stipe. Smell usually distinctly and strongly aromatical, reminiscent of the smell of *Hebeloma sacchariolens*. Taste sweet, like caramel.

Spores 9.5-11.5 (-12.0) × 7.5-9.5 µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25, 5-6-angled in side-view. Basidia 35-42 × 10.5-16.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of radially arranged, 2.5-9 µm wide, cylindrical hyphae. Pigment minutely incrusting the hyphae of pileipellis and upper pileitrama. Clamp-connections abundant in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – In groups in hayfields and extensively grazed meadows, preferably on basic soil. Very rare (Wijlre: Dolsberg). Aug.-Sept.

Entoloma ameides is a very rare species in the Netherlands. It seems to have a boreal-montane distribution in Europe.

The habit is rather variable. In the Netherlands, the slender form has been observed. The typical, entolomatoid form was excellently depicted by Cooke (Ill. Brit. Fungi: pl. 329 (341). 1886).

On account of habit and pigmentation, *E. ameides* belongs to sect. *Papillata* and close to *E. sericeum*, from which it differs in colour, shape of spores, and strong, aromatic smell. *Entoloma sacchariolens* comes close, but has cheilocystidia.

55. Entoloma sacchariolens (Romagn.) Noordel. in Persoonia 10: 474. 1980. – Fig. 107.

Rhodophyllus sacchariolens Romagn. in Bull. mens. Soc. linn. Lyon 43 (no. spéc.): 385. 1974.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 474-476, fig. 20. 1980; Romagn. in Bull. mens. Soc. linn. Lyon. 43 (no. spéc.): 385. 1974.

Pileus 20-24 mm, conico-convex then expanding to plano-convex with blunt or subpapillate centre and irregularly undulating marginal zone with age, weakly hygrophanous, when moist brown with grey or ochraceous tinge (Mu. 10 YR 4/2, 4/3, rarely 3/2), paler towards margin (10 YR 7/4, 7/6), translucently striate at margin only, pallescent on drying to greyish-ochraceous (10 YR 8/3, 8/6) with surface already when moist with some aeriferous fibrils, becoming strongly shiny when dry; centre often slightly hirsute. Lamellae, L = 21-30, l = 3-7, moderately distant, deeply emarginate to almost free or adnate, segmentiform then narrowly ventricose, brown (10 YR 6/3), later on with pink tinge, slightly paler towards denticulate edge. Stipe 40-75 × 2-5 mm, cylindrical, often curved at base, concolorous with pileus, with pruinose apex, with white tomentose base, solid or narrowly fistulose. Context in cortex concolorous with surface, inner parts pallid, firm in pileus, fibrous in stipe. Smell strong, sweet, like that of *Hebeloma sacchariolens*, sometimes spontaneously weak, but distinct after being kept in a closed box. Taste unpleasant, like soap.

Spores 9.5-10.5 (-11.0) × 7.0-8.0 µm, Q = 1.15-1.4, $\bar{Q}$ 1.3, 5-6-angled in side-view with pronounced angles. Basidia 28.5-35 × 10.5-12 µm, 4- (rarely also 2-)spored, clamped. Lamella edge heterogeneous. Cheilocystidia 25-45 × 3.5-8 (-12) µm, cylindrical to narrowly clavate, sometimes subcapitate. Pileipellis a cutis of radially arranged cylindrical 1.5-6 µm wide hyphae. Pigment pale brown, membranal-incrusting in hyphae of pileipellis and pileitrama. Clamp-connections abundant in hymenium, rare or absent in other tissues.

HABITAT & DISTR. – Solitary or in small groups, terrestrial among grasses and mosses near *Salix repens* in moist dune-meadows. Very rare (Callantsoog: Zwanewater). (July)Nov.

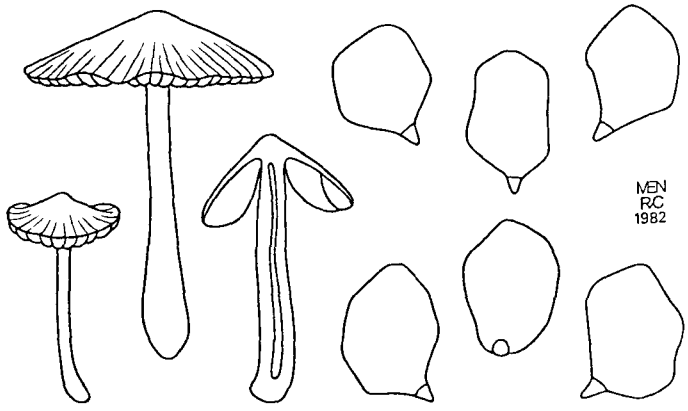

Fig. 108. *Entoloma vernum.*

Entoloma sacchariolens is closely related to *E. ameides*, but differs in the markedly shiny pileal surface and in the occurrence of cheilocystidia.

56. Entoloma vernum Lundell in Svensk bot. Tidskr. 31: 193. 1937. – Fig. 108.

Rhodophyllus vernus (Lundell) Romagn. in Bull. trimest. Soc. mycol. Fr. 63: 195. 1947; *Nolanea verna* (Lundell) Kotl. & P. in Ceská Mykol. 26: 221. 1972. – *Rhodophyllus cucullatus* J.Favre, Champ. sup. Zone alpine: 62. 1955; *Nolanea cucullata* (J.Favre) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960.

MISAPPL. – *Nolanea pascua* sensu Bres., Iconogr. mycol. 12: pl. 580. 1929.

SEL. DESCR. & FIGS. – Mazzer in Mich. Bot. 16: 195-200, figs. 1-6. 1977; Noordel. in Persoonia 10: 476-478, fig. 21. 1980.

Pileus 10-60 mm, acutely conical then expanding, finally (plano-) convex usually with conical papilla, with slightly involute margin when young, strongly hygrophanous, when moist dark sepia, blackish brown at centre, paler at margin (Mu. 10 YR 3/3, 3/2; 2.5 Y 3/2, 4/3, rarely 6/4; margin 10 YR 5/4, 6/4; 5 Y 6/6), translucently striate at least at margin, but up to centre in small, thin-fleshed specimens, pallescent on drying to golden-brown or grey-brown, ochraceous-grey or isabella (2.5 Y 6/4 to 6/6; 10 YR 6/4, 5/4), glabrous, shiny. Lamellae, L = 19-40, l = 1-3(-5), rather crowded, adnexed to almost free, ventricose, up to 7 mm broad, pale grey-brown then brown-pink or rusty-brown (10 YR 6/4; 7.5 YR 7/4, 6/4), with concolorous, entire or eroded edge. Stipe 20-67 × 2-7 (up to 10 at base) cylindrical usually slightly to distinctly broadened at base, sometimes compressed with groove, concolorous with pileus or paler and with ochraceous tinge, pruinose at apex (rarely pruinose all over in young specimens), glabrous, innately fibrillose, not striate, white tomentose at base. Context pale brown in pileus and stipe, brittle. Smell none or faintly herbaceous. Taste mild.

Spores (8.0-) 9.0-11.5 (-12.0) × 7.0-9.0 (-9.5) µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25, 5-6-7-angled in side-view with dihedral base. Basidia 27-50 × 8.5-12.5 (-16) µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical hyphae, 4-11 µm wide. Pigment coarsely incrusting in pileipellis and upper pileitrama. Clamp-connections abundant in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – Solitary or in groups, terrestrial in grass or in grasslands on sandy soil, preferably near coniferous trees (*Pinus*, *Juniperus*). Widespread but rare. Strictly vernal. March-May.

Like in other species of sect. *Papillata*, such as *E. ameides* and *E. sericeum*, the habit of *E. vernum* varies from slenderly mycenoid (*cucullatus*-type) to rather robust tricholomatoid. In the Netherlands, it is mostly the slender type that has been found.

57. Entoloma sericeum (Bull. →) Quél., Mém. Soc. Emul. Montbéliard, sér. II, 5: 119. 1872 (Champ. Jura Vosges 1).

Agaricus sericeus Bull., Herb. France: pl. 413, fig. 2. 1789, non *A. sericeus* Schaeff., 1774; *Rhodophyllus sericeus* (Bull. → Quél.) Quél., Enchir. Fung.: 59. 1886; *Nolanea sericea* (Bull. → Quél.) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960. – *Rhodophyllus sericeus* var. *typicus* Kühn. & Romagn., Fl. anal. Champ. sup.: 193. 1953 (not valid, incorrect epithet). – *Rhodophyllus sericeus* var. *nolaniformis* Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 9. 1954 (Compl. Fl. anal. 1); *Entoloma sericeum* f. *nolaniforme* (Kühner) Noordel. in Persoonia 10: 480. 1980.

VERN. NAME. – Bruine satijnzwam.

KEY TO THE FORMAE AND VARIETIES

1. Pileus dark brown to almost black, not translucently striate or at outermost margin only, entirely covered with a whitish pruinum causing a hoary, often zonate impression; lamellae dark grey almost without pink tinges. . . . . var. **cinereoopacum**
1. Pileus sepiaceous, red-brown or very dark grey-brown, always distinctly translucently striate, smooth; lamellae grey-brown or red-brown, always distinctly pink when mature. . . . . var. **sericeum**
   2. Habit tricholomatoid: pileus relatively fleshy; translucently striate to half the radius; stipe about as long as diameter of pileus. f. **sericeum**
   2. Habit mycenoid: pileus thin-fleshed, translucently striate to centre; stipe usually much longer than diameter of pileus. f. **nolaniforme**

var. **sericeum** – Fig. 109.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 92a. 1981; J.Lange in Fl. agar. dan. 2: pl. 76G, Gl. 1937; Dähncke & Dähncke, 700 Pilze: 253. 1979.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 15-16, fig. 12. 1981; Einh. in Ber. bayer. bot. Ges. 41: 107, fig. 19. 1969; Noordel. in Persoonia 10: 478-482, figs. 22, 23. 1980.

Pileus 12-75 mm, conical then conico-convex, expanding to convex, finally applanate, usually slightly depressed or blunt, rarely with acute pailla, with margin involute at first, then straight, strongly hygrophanous, when moist dark sepia, brown or reddish brown (Mu. 10 YR 2-4/1-3; 7.5 YR 3-4/2; 5 YR 3/2-3), paler towards margin (10 YR 5/2-4, 6-7/4; 7.5 YR 4-6/2-4), translucently striate up to half the radius in f. *sericeum*, translucently striate up to centre in f. *nolaniformis*, strongly pallescent on drying to pale sepia-brown, ochraceous brown, or greyish brown (10 YR 4/3, 5-7/4; 2.5 Y 7/2; 5 Y 7/3), glabrous or minutely radially fibrillose or rugulose, shiny. Lamellae, L = 22-50, l = 3-7, crowded to moderately distant, adnate-emarginate to deeply emarginate or almost free, segmentiform to ventricose, pale or pale grey-brown at first then pink, finally reddish brown (10 YR 7-6/3; 7.5 YR 6-5/2-4; 5 YR 5/3) with irregular, concolorous edge. Stipe 13-75 × 2-6 mm, cylindrical or compressed, about as long as diameter of pileus in f. *sericeum*, much longer in f. *nolaniforme*, grey-brown or yellow-brown, almost concolorous with pileus or paler, strongly silvery striate lengthwise with loose fibrils, rarely glabrescent or almost glabrous with only a few, scattered fibrils, at apex sometimes pruinose, white tomentose at base. Context concolorous with surface, in fleshy specimens pallid in inner part, rather fragile in pileus, more or less firm in stipe. Smell strongly farinaceous to rancid. Taste farinaceous-rancid.

Spores (7.0-) 7.5-10.5 × 6.5-8.5 (-9.5) µm, Q = 1.0-1.25, $\bar{Q}$ = 1.1,

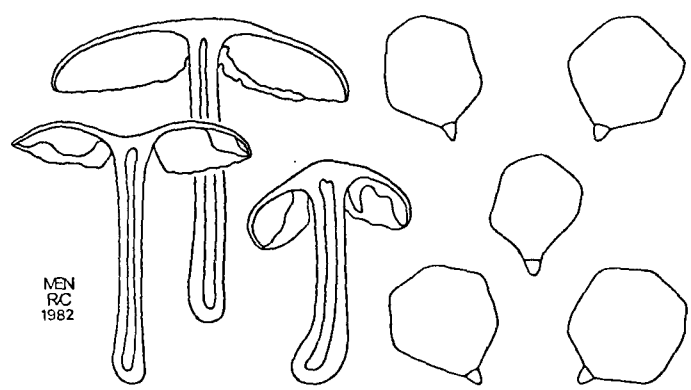

Fig. 109. *Entoloma sericeum* var. *sericeum*.

subisodiametrical, 5-angled in side-view with pronounced angles. Basidia 24-45 × 10.5-12.5 (-17.5) µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2.5-12 µm wide, cylindrical hyphae. Pigment incrusted in pileipellis and pileitrama. Clamp-connections numerous in hymenium.

HABITAT. & DISTR. – Usually gregarious in grassland, both in poorly manured, (semi)natural grassland and in manured meadows, on dry to wet, acid or basic soils. Wide-spread in Europe. Jan.-Dec.

var. **cinereoopacum** Noordel. in Persoonia 10: 482. 1980. – Fig. 110.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 482-483, fig. 25. 1980.

CHARACTERISTICS. – Pileus dark brown, usually almost black, not translucent, minutely pruinose all over, often zonate; lamellae very dark grey with hardly a pink tinge even when mature; stipe concolorous with pileus or slightly paler, silvery striate; smell strongly rancid-farinaceous.

HABITAT & DISTR. – In unmanured, semi-natural grasslands in the coastal dunes of the West Friesian Islands and the provinces Noord- and Zuid-Holland, not uncommon, usually in large groups. Oct.-Nov.

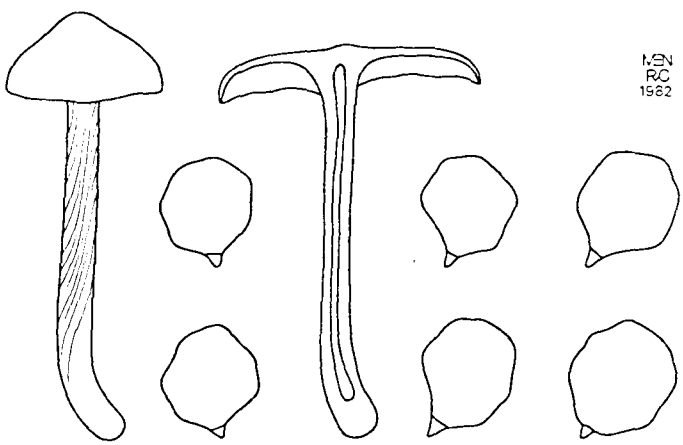

Fig. 110. *Entoloma sericeum* var. *cinereoopacum*.

58. Entoloma sericeoides (J.Lange) Noordel. in Persoonia 10: 483. 1980. – Fig. 111.

Rhodophyllus sericeoides J.Lange, Fl. agar. dan. 5: VIII. 1940; *Leptonia sericeoides* (J.Lange) P.D.Orton in Trans. Br. mycol. Soc. 43: 176. 1960.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 483-485, fig. 24. 1980.

Pileus 15-30 mm, convex with rather shallow to deep umbilicus, with involute then straight margin, hygrophanous, when moist dark sepia brown at centre (Mu. 10 YR 3/2 to 5 YR 3/2), slightly paler towards margin (about 7.5 YR 3/2-4/2), translucently striate up to half of radius, pallescent on drying to moderately dark brown (10 YR 6/3), brilliantly shiny. Lamellae, L = about 40, l = 3-5, crowded, broadly adnate with decurrent tooth to slightly ascending-emarginate, segmentiform to narrowly ventricose, brown then with pink tinge (7.5 YR 6/4 to 5/4) with slightly irregular, concolorous edge. Stipe 35-40 × (2-) 3-5 mm, cylindrical or tapering upwards, sometimes twisted, concolorous with dry pileus, fibrillose-striate, shiny. Context cartilagineous, white. Smell indistinct or weakly farinaceous. Taste not known.

Spores 7.5-9.5 × (6.0-) 6.5-8.0 µm, Q = 1.0-1.25, $\bar{Q}$ = 1.1, 5-6-angled

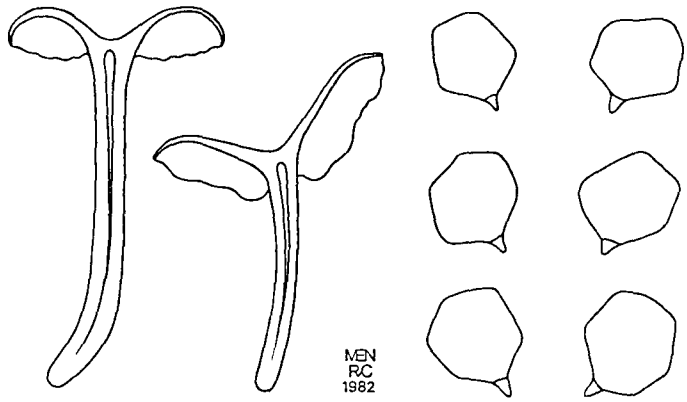

Fig. 111. *Entoloma sericeoides*.

in side-view. Basidia 30-36 × 10.5-11.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical 6-12 µm wide hyphae. Pigment minutely incrusting the hyphae of pileipellis and upper pileitrama. Clamp-connections absent.

HABITAT. & DISTR. – In small groups in extensively grazed grassland on dyke along river. Very rare (Deventer: Hengforder waarden). Distribution in Europe poorly known, also recorded from Denmark and Italy. Oct.

Entoloma sericeoides is closely related to *Entoloma sericeum* on account of the colours of pileus and stipe and the isodiametrical spores, but differs in having a deeply umbilicate pileus and in the absence of clamp-connections.

59. Entoloma sphaerocystis Noordel. in Persoonia 10: 485. 1980. – Fig. 112.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 485-486, fig. 11, 49. 1980.

Pileus about 16 mm, conical with straight margin, hygrophanous, when moist reddish brown (Mu. 7.5 YR 4/4, 5/4; 5 YR 4/4), paler at margin, translucently striate up to three-quarters of radius, strongly pallescent on drying to pale grey, strongly fibrillose with loose fibrils, shiny. Lamellae, L = 24, l = 1-3, moderately distant, almost free, ventricose, brownish pink (7.5 YR 6/4, 5/4). Stipe 32 × 1.5 mm, cylindrical, pale yellow-brown (10 YR 5/4, 4/4), contrasting with pileus, almost smooth with only few silvery fibrils lengthwise. Context concolorous with surface. Smell absent. Taste none.

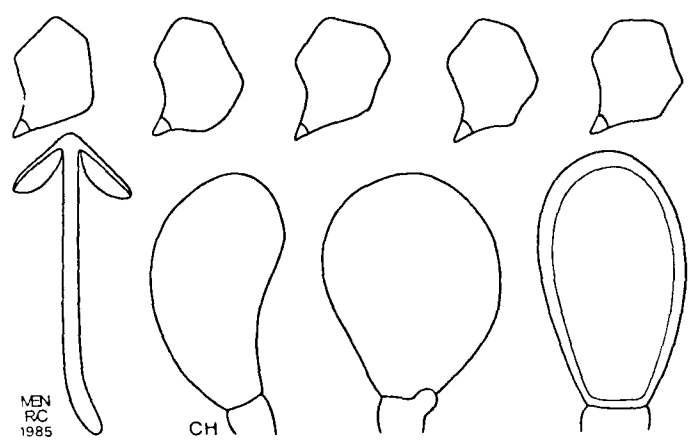

Fig. 112. *Entoloma sphaerocystis*.

Spores 8.5-11.0 × 7.0-8.0 µm, Q = 1.15-1.25, $\bar{Q}$ = 1.4, 6-7-angled in side-view. Basidia 26-38 × 8-15 µm, 4-spored, clamped. Lamella edge sterile or heterogeneous. Cheilocystidia 25-38 (-45) × 13-35 µm, (sub-)-globose, rarely broadly clavate, sometimes with thickened, colourless walls. Pileipellis a cutis of radially arranged, cylindrical, 3-9 µm wide hyphae. Pigment brown, minutely incrusting in pileipellis and pileitrama. Clamp-connections abundant in hymenium, elsewhere rare.

HABITAT & DISTR. – Solitary in hayfield on rich, loamy soil and on branchlet in moist *Fraxinus* forest. Very rare (Winterswijk: Willinks Weust; Nw. Ginneken: Ulvenhoutse bos). Not yet known from other localities. Aug.

Entoloma sphaerocystis is a remarkable species because of its globose cheilocystidia. The only other *Entoloma*-species with such cheilocystidia, *E. globuliferum*, differs in size and shape of the spores, type of pigmentation and lack of clamp-connections.

Sect. Fernandae Noordel.

Always with two types of pigmentation: one incrusting the hyphae of pileipellis and pileitrama, the other intracellular and granular in the hyphae of the pileipellis; spores 5-7-angled with dihedral base; clamp-connections always absent.

60. Entoloma fernandae (Romagn.) Noordel. in Persoonia 10: 250. 1979. – Fig. 113.

Rhodophyllus fernandae Romagn. in Rev. Mycol. 1: 162. 1936; *Nolanea fernandae* (Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960. – *Entoloma fernandae* f. *eccilioides* Noordel. in Persoonia 10: 488. 1980.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 90b. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 10-12, fig. 10. 1981; Noordel. in Persoonia 10: 487-488. fig. 29. 1980; Romagn. in Rev. Mycol. 1: 162. 1936.

VERN. NAME. – Heidesatijnzwam.

KEY TO THE FORMAE

1. Fruitbodies omphalioid with deeply infundibuliform pileus. f. **eccilioides**
1. Fruitbodies mycenoid; pileus usually with papilla. . . f. **fernandae**

Pileus 12-35 mm, conical or campanulate-convex, soon expanding to plano-convex with or without faint papilla or slight central depression, umbilicate in f. *eccilioides*, with straight margin, with irregularly undulating often radially splitting marginal zone when old, weakly hygrophanous, when moist translucently striate at margin only or not, pale to moderately dark grey-brown sometimes with reddish tinge (Mu. 10 YR 3/3, 3/4; 7.5 YR 4/4; at centre 10 YR 4/3, 5/3, 6/3) paler towards margin, slightly pallescent on drying, (strongly) radially fibrillose-satiny becoming subtomentose minutely squamulose with age and on drying, particularly at centre. Lamellae, L = 22-30, l = 1-3 (-5), moderately distant, almost free, deeply decurrent in f. *eccilioides*, (sub-)ventricose, white, then (sordid) pink, finally brownish pink (7.5 YR 6/4, 5/4) with concolorous, slightly irregular edge. Stipe 20-45 × 2-4 mm, cylindrical or compressed with longitudinal groove, tapering or slightly broadened downwards, concolorous with pileus or slightly paler, sometimes pruinose at apex and white tomentose at base, remaining surface polished, rarely somewhat pruinose. Context concolorous with surface in cortex, inner part pallid, fibrous. Smell farinaceous. Taste farinaceous.

Spores (7.0-) 7.5-9.0 (-9.5) × 5.5-7.0 (-7.5) µm, Q = 1.15-1.4 (-1.5), $\bar{Q}$ = 1.3, mostly 6-angled in side-view. Basidia 23-33 (-34) × 8-14 µm, 4- (rarely also 2-)spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm at centre of radially arranged, repent or ascending, up to 20 µm wide, cylindrical, septate hyphae, often with brown-coloured, slightly thickened terminal elements. Pigment brown, incrusting the hyphae of pileipellis and upper pileitrama, in addition brown intracellular granular in the hyphae of pileipellis. Clamp-connections absent.

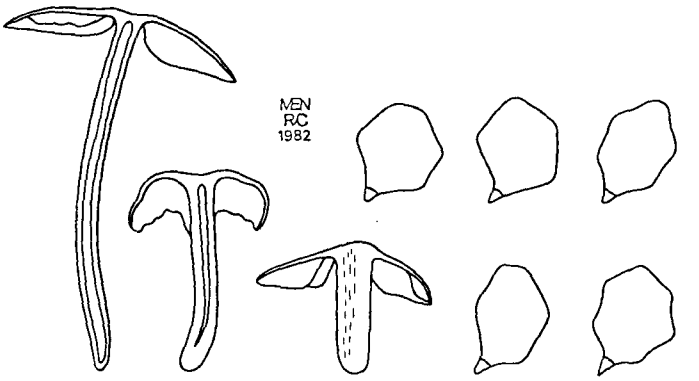

Fig. 113. *Entoloma fernandae*.

HABITAT & DISTR. – In small groups, terrestrial, on poor, acid soil, frequently met with in *Calluna*-heaths on pleistocene sands, but also found on peaty soil, although never among *Sphagnum*, not uncommon. Widespread in N.W.Europe. Aug.-Oct.

Entoloma fernandae belongs to a small group of closely related species, from which it is distinguished by the weakly hygrophanous, hardly striate, never entirely glabrous pileus and the glabrous stipe.

61. Entoloma psilopus Arnolds & Noordel. in Persoonia 10: 293. 1979. – Fig. 114.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 293-294. 1979; Noordel. in Persoonia 10: 489. 1980.

VERN. NAME. – Gladsteelsatijnzwam.

Pileus 8-23 mm, conical then expanding finally flattened, sometimes with weak papilla, often slightly depressed at centre when old, with straight margin, hygrophanous, when moist dark grey-brown at centre, paler at margin (Mu. 10 YR 3/2, K. & W. 6E6, 6F6, 7E6), translucently striate up to centre, pallescent on drying to pale grey-brown (10 YR 6/4, 7/4, K. & W. 6C4, 5C4), glabrous, shiny. Lamellae, L = 20-25, l = 3-7, moderately distant, narrowly to broadly adnate or deeply emarginate, ventricose, white then salmon pink or flesh-colour, sometimes with slight brown tinge (7.5 YR 7/4, 6/4; 7A4, 7B4, 6B4), sometimes

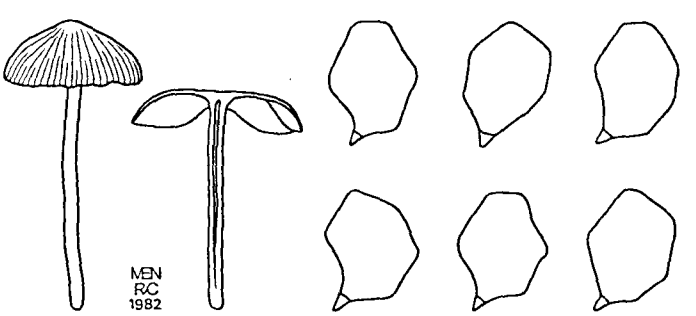

Fig. 114. *Entoloma psilopus*.

transvenose, with entire, concolorous edge. Stipe 15-50 × 1-2.5 mm, cylindrical, with slightly broadened base or not, pale to rather dark grey-brown (10 YR 7/4, 6/4, base 5/4; 4C4, 6C4, 6D4, 6D5, 6E5), not striate, glabrous as if polished, with (strongly) white tomentose base. Context thin-membranaceous in pileus, rather firm or fragile in stipe, concolorous with surface, in fleshy specimens inner parts pale. Smell mostly distinctly farinaceous, sometimes spontaneously none, but distinct when cut. Taste weakly to distinctly farinaceous.

Spores (6.5-) 7.0-9.0 (-10.0) × 5.5-7.0 (-7.5) µm, Q = 1.15-1.4, $\bar{Q}$ = 1.25-1.3, 5-6-angled in side-view. Basidia 20-40 (-45) × 8.5-12.5 (-14) µm, 4- (rarely also 2-)spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis made up of 3-8 µm wide hyphae sometimes with trichodermal tufts of ascending terminal elements at centre. Pigment incrusting and intracellular in pileipellis. Clamp-connections absent.

HABITAT & DISTR. – In groups, terrestrial on oligotrophic, pleistocene sandy soils. Fairly common. July-Nov.

Fig. 115. *Entoloma acidophilum*.

62. Entoloma acidophilum Arnolds & Noordel. in Persoonia 10: 285. 1979. – Fig. 115.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 91a. 1980.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 490. 1980.

Pileus 10-50 mm, convex then flattened with small papilla, finally more or less concave, strongly hygrophanous, when moist pale greyish brown with weak pink tinge (K. & W. 5C5) with darker grey-brown striae and centre (6E5), strongly pallescent on drying to pale grey-ochraceous, glabrous or slightly rugulose at centre. Lamellae, L = 12-17, l = (1-) 3-5, fairly thick and distant, very narrowly adnate, ventricose, white then pink, with entire, concolorous edge. Stipe 10-32 × 1-2 mm, slender, short, slightly broadened towards base, pale greyish brown (5C5, 5C5-6), minutely silvery striate lengthwise, white pruinose at apex. Context very thin, concolorous with surface. Smell strongly farinaceous. Taste not known.

Spores 8.5-10.5 (-11.0) × (6.5-) 7.0-8.0 µm, Q = (1.15-) 1.2-1.45, $\bar{Q}$ = 1.3, 5-7-angled in side-view. Basidia 30-42 × 8.5-11.5 µm, 2- and 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow cylindrical, 2.5-7 µm wide hyphae with, particularly at centre, numerous ascending terminal elements. Pigment incrusting and intracellular in pileipellis. Clamp-connections absent.

HABITAT & DISTR. – In small groups on humus in dry grass heath (*Violion caninae*) on poor acid soil; rare. July-Sept.

Entoloma acidophilum is distinguished from related species in sect. *Fernandae* by the combination of a glabrous, deeply striate pileus, and striate, grey-brown stipe.

63. Entoloma argenteostriatum Arnolds & Noordel. in Persoonia 10: 285. 1979. – Fig. 116.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 285-287, figs. 1-4. 1979; Noordel. in Persoonia 10: 490. 1980.

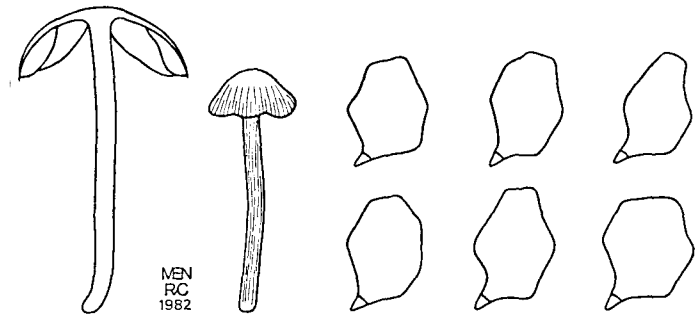

Fig. 116. *Entoloma argenteostriatum*.

Pileus 9-25 mm, conico-convex or convex then expanding with straight, often undulating margin, strongly hygrophanous, when moist dark grey-brown, translucently striate up to centre, pallescent on drying to pale brown-grey. Lamellae moderately distant, broadly to narrowly adnate, pale brown-grey then sordid flesh-colour with concolorous, entire edge. Stipe 23-32 × 2-4 mm, cylindrical sometimes compressed (then up to 7 mm broad), grey-brown, paler than pileus, silvery striate lengthwise; upper part densely pruinose. Context thin, greyish white, relatively firm in pileus, fibrous in stipe. Smell farinaceous when fresh, later on more like that of cucumber. Taste rancid-farinaceous.

Spores 7.5-9.5 (-10.5) × 6.0-7.0 (-7.5) µm, Q = (1.15-) 1.2-1.5; $\bar{Q}$ = 1.35, 5-7-angled in side-view. Basidia 30-40 × 8.5-21 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of cylindrical, 4-13 µm wide hyphae at centre with up to 25 µm wide ascending terminal elements. Pigment brown, incrusting the hyphae of pileipellis and pileitrama, in addition intracellular, granulose in pileipellis and upper pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups in poor vegetation of short grasses and mosses on dry, acid, sandy soil. Very rare (Wijster; Spier). Sept.

Entoloma argenteostriatum is distinguished from the other species in sect. *Fernandae* by its dark, smooth pileus and strongly silvery-fibrillose stipe.

64. Entoloma cuniculorum Arnolds & Noordel. in Persoonia 10: 289. 1979. – Fig. 117.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 289-290, figs. 11-14. 1979; Noordel. in Persoonia 10: 490. 1980.

Pileus 12-16 mm, bluntly conical or hemispherical with small papilla, with straight margin, hygrophanous, when moist rather pale grey-brown with paler margin, dark grey-brown striate up to dark grey-brown centre, on drying expallent to pale grey-brown, smooth, glabrous. Lamellae moderately distant, narrowly adnate, slightly ventricose up to

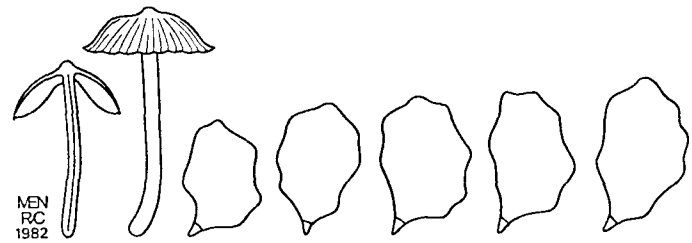

Fig. 117. *Entoloma cuniculorum*.

3 mm broad, pale grey-brown, then flesh-colour with concolorous edge. Stipe 20-32 × 1.5-2 mm, cylindrical, rather pale grey-brown, smooth, not striate, finely pruinose at base. Context very thin in pileus, dark brown-grey, in stipe concolorous with surface, fairly brittle. Smell rather strongly farinaceous. Taste farinaceous.

Spores (8.5-) 9.0-11.5 (-12.5) × (6.0-) 6.5-7.5 (-8.0) µm, Q = 1.3-1.7, $\bar{Q}$ = 1.45 (-1.8), 5-7-angled in side-view. Basidia 23-46 × 10-12 (-13) µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 4.5-14 µm wide, cylindrical hyphae. Pigment incrusting the hyphae of pileipellis and pileitrama, also intracellular in pileipellis. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in poor vegetation of mosses and grasses, on acid, sandy soil. Very rare (Beilen; Ruinen). Also known from Denmark in a similar habitat. Oct.-Nov.

Entoloma cuniculorum is distinguished from other species in sect. *Fernandae* by the large spores.

65. Entoloma defibulatum Arnolds & Noordel. in Persoonia 10: 290. 1979. – Fig. 118.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 290-291, figs. 15-18. 1979; Noordel. in Persoonia 10: 492, fig. 28. 1980.

Pileus 19-21 mm, conico-campanulate, then expanding, finally applanate with straight margin, with undulating, sometimes splitting margin with age, hygrophanous, when moist dark grey-brown (K. & W. 6F5) paler towards margin (6E5, 6D4) darker translucently striate up to centre, pallescent on drying to pale brown-grey, dull. Lamellae, L = 16-21, l = 2-7, moderately distant, narrowly adnate to almost free, ventricose, up to 4 mm broad, pale grey-brown then flesh-colour with entire, concolorous edge. Stipe 28-40 × 2 mm, straight, cylindrical, narrowly fistulose, rather dark greyish brown (6E6), finely striate under lens, base white tomentose. Context thin, concolorous with surface in pileus, hyaline and grey-brown in stipe. Smell farinaceous-rancid, cucumber-like. Taste farinaceous-rancid, cucumber-like.

Spores 6.5-8.0 × 5.5-7.0 µm, Q = 1.1-1.3 (-1.4), $\bar{Q}$ = 1.2, rounded-angular in side-view with very blunt angles. Basidia 28-35 × 7.5-10 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of (3-) 5-12 (-15) µm wide cylindrical hyphae. Pigment incrusting the hyphae of pileipellis and pileitrama, and intracellular in pileipellis, rarely also in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in poor vegetation of mosses and grasses on rather moist to fairly dry acid peat or humus-rich sand. Very rare. Only known from two localities near Dwingeloo. Oct.-Nov.

The small spores with rather rounded angles are distinctive for *Entoloma defibulatum*.

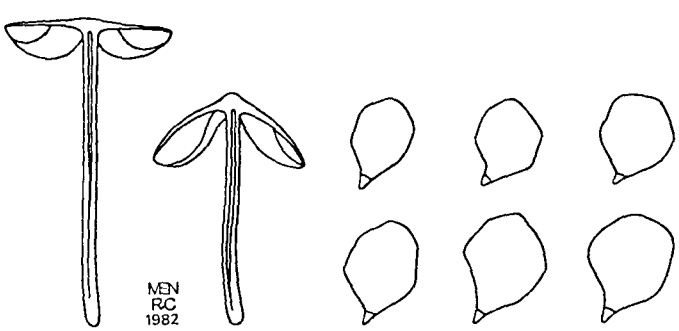

Fig. 118. *Entoloma defibulatum*.

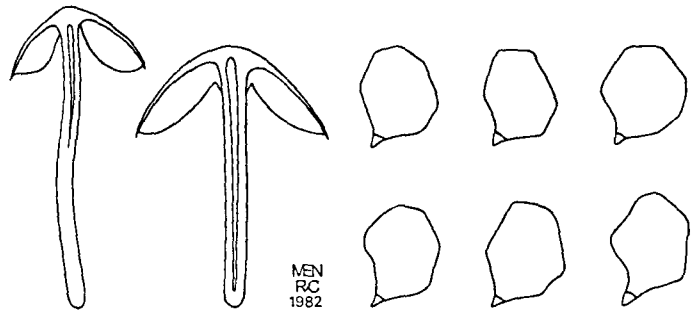

Fig. 119. *Entoloma xanthocaulon*.

66. Entoloma xanthocaulon Arnolds & Noordel. in Persoonia 10: 299. 1979. – Fig. 119.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 91C. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 12-13, fig. 11. 1981; Noordel. in Persoonia 10: 493-494, fig. 26. 1980.

VERN. NAME. – Geelsteelsatijnzwam.

Pileus 13-32 mm, conical, then expanding to convex, finally flattened, rarely with small papilla, sometimes with slight central depression, with margin often slightly to distinctly involute, strongly hygrophanous, when moist pale to rather dark reddish or pinkish brown (centre Mu. 10 YR 6/3, 5/3; 7.5 YR 4/3, 4/4, 3/2; 5 YR 3/3), paler towards margin (10 YR 6/3, 6/4, rarely 7/3), translucently striate up to centre, pallescent on drying to ochraceous-greyish (10 YR 7/2, 7/3), glabrous, shiny. Lamellae, L = (15-) 20-30, l = (1-) 3-5, rather crowded, adnate or emarginate, sometimes almost free, pale then pink, often without any brown or grey tinge (7.5 YR 7/4) with entire concolorous edge. Stipe 20-50 × 1-3 mm, cylindrical sometimes slightly broadened towards base with yellow tinge (10 YR 7/4, 5/4; 2.5 Y 5-7/4) strongly contrasting with pileus-colour, smooth, polished, sometimes slightly pruinose at apex, white tomentose at base. Context thin-membranaceous, fragile, concolorous with surface. Smell strongly farinaceous. Taste strongly farinaceous.

Spores 7.0-9.0 (-9.5) × 5.5-7.5 µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25-1.3, 5-6-angled in side-view. Basidia 24-42 × 8-11.5 (-12.5) µm, 4- (rarely also 2-)spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged 2.5-11 µm wide hyphae, rarely with clavate terminal elements up to 15 µm wide; subpellis well developed, made up of short inflated elements, 50-110 × 14-27 µm. Pigment incrusting the hyphae of pileipellis and pileitrama, in pileipellis (subpellis) also brown, granular, and intracellular. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in mossy grassland, usually on acid soil, not uncommon on the pleistocene soils and in coastal dunes. Aug.-Sept.

Entoloma xanthocaulon is recognized by the yellow colour of its stipe, which does not occur in other species of sect. *Fernandae*. *Entoloma verecundum* is distinguished by its large spores, intracellular pigment, and clamped basdia. *Entoloma rhombisporum* has cuboid spores.

Sect. **Endochromonema** (Larg. & Thiers) Noordel.

Pigment intracellular, rarely also membranal or very finely incrusting; spores with dihedral base.

67. Entoloma cetratum (Fr.: Fr.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 206. 1978. – Fig. 120.

Agaricus cetratus Fr.: Fr., Syst. mycol. 1: 207. 1821; *Nolanea cetrata*

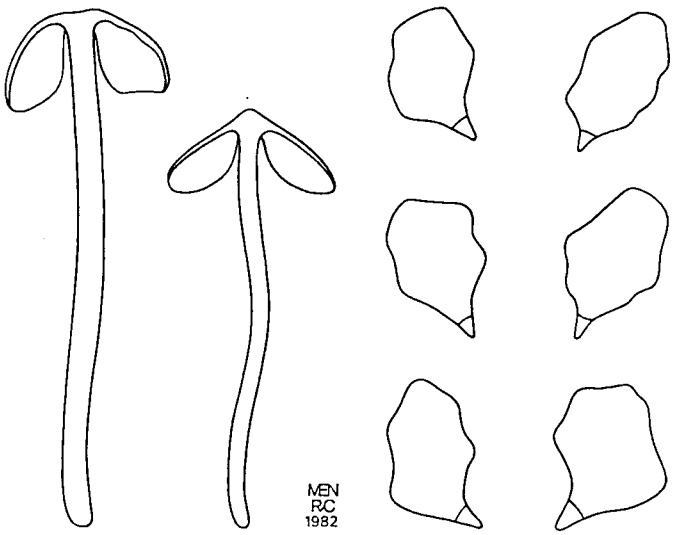

Fig. 120. *Entoloma cetratum.*

(Fr.: Fr.) Kumm., Führ. Pilzk.: 95. 1871; *Rhodophyllus cetratus* (Fr.: Fr.) Quél., Enchir. Fung.: 64. 1886; *Hyporrhodius cetratus* (Fr.: Fr.) Schroet. in Cohn., Krypt.-Fl. Schlesien 3(1): 613. 1889.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 89a. 1981; Cetto, Funghi Vero 4: pl. 1429. 1983; Dähncke & Dähncke, 700 Pilze: 263. 1979; Konr. & M., Ic. sel. Fung. 2: pl. 179, fig. 1. 1930; J.Lange, Fl. agar. dan. 2: pl. 78F. 1937; Ryman & Holmåsen, Svampar: 384; R.Phillips, Mushr. other Fungi: 117. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 2-3, fig. 1. 1981; Konr. in Bull. trimest. Soc. mycol. Fr. 45: 51-52. 1929; Noordel. in Persoonia 10: 496-497, figs. 32a-c. 1980.

VERN. NAME. – Dennesatijnzwam.

Pileus 9-50 mm, conical or hemispherical usually expanding to almost flat with broad, rounded papilla or not, rarely slightly depressed at centre, with straight or slightly inflexed margin, strongly hygrophanous, when moist pale ochraceous, yellow-brown or reddish brown, distinctly paler and more yellow towards margin (Mu. 7.5 YR 4/4, 4/2, 5/4, rarely 3/2 at centre, margin 7.5 YR 7/4, 10 YR 7/4, 8/4) translucently striate up to two-thirds of radius, strongly pallescent on drying to pale yellowish or ochraceous (10 YR 7/4, 7/6, 8/3, 8/4), glabrous when moist, shiny, radially fibrillose when dry. Lamellae, L = (15-) 20-30, l = (1-) 3-5 (-7), moderately crowded, narrowly adnate to almost free, triangular then ventricose, up to 7 mm broad, yellowish-ochraceous then pink finally brown-pink (10 YR 7/4 then 7.5 YR 8/4, 7/4, 6/4 rarely 5/4) with irregularly crenate, concolorous edge. Stipe (20-) 35-85 × (1.5-) 2-4 (-5) mm, cylindrical, with gradually broadened base, sometimes twisted or compressed, pale yellow to yellowish brown (2.5 Y 7/4, 6/4, 5/4; 10 YR 7/3, 7/4), strongly silvery striate with loose fibrils, at base white tomentose. Context concolorous in cortex, inner parts pale. Smell indistinct, sometimes very slightly farinaceous. Taste weak or slightly farinaceous-rancid.

Spores (9.5-) 10.0-13.5 (-14.0) × 7.0-8.0 (-9.0) µm, Q = 1.2-1.8, $\bar{Q}$ = 1.45, irregularly (5-)6-7(-8)-angled in side-view. Basidia 25-50 × 8-13.5 µm, 2-spored (rarely a few 1- or 4-spored), clampless. Lamella edge fertile. Cystidia absent. Pileipellis a thin cutis of radially arranged, 4-7 (-10) µm wide cylindrical hyphae; subpellis well-developed, made up of inflated elements, 50-90 (-140) × 15-30 µm. Pigment intracellular, very pale, sometimes also slightly membranal, never incrusting. Clamp-connections absent.

HABITAT & DISTR. – In small groups, typically among needles and other litter in coniferous plantations on sandy soil, but also frequent in heath-like vegetations (*Ericetum*, *Callunetum*) on pleistocene sands and in coastal dunes. Also found on peat and among *Sphagnum*. Very common. Common and widespread in Europe. May-Dec., occasionally also in other months.

Entoloma cetratum is a common species which can be easily recognised in the field by its yellowish colours, and microscopically by its large spores and 2-spored, clampless basidia. *Entoloma farinogustus* differs in habit, not or hardly striate stipe, and a strong mealy taste.

Entoloma cuneatum and *E. lanuginosipes* have some resemblance in habit, and sometimes also in colour, to *E. cetratum*, but differ in having 4-spored, clamped basidia, but almost similar spores.

68. Entoloma farinogustus Arnolds & Noordel. in Persoonia 10: 292. 1979. – Fig. 121.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 89b. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 3, fig. 3. 1981; Noordel. in Persoonia 10: 497-498, fig. 34. 1980.

Pileus 6-20 mm, bluntly conical or hemispherical then flattened with or without weak papilla, rarely slightly depressed, with straight margin, strongly hygrophanous, when moist pale ochraceous brown, slightly darker at centre, translucently striate up to centre, pallescent on drying to pale cream-colour or pinkish, glabrous. Lamellae, L = 20-25, l = 1-5, moderately distant, narrowly adnate, narrowly ventricose, pale then pink with concolorous entire edge. Stipe 11-28 × (1.4-) 2-3 mm, cylindrical slightly broadened at base, yellowish or orange-brown, glabrous, polished, sometimes minutely pruinose at apex. Smell weak, slightly farinaceous. Taste strongly farinaceous-rancid or like cod-liver oil.

Spores 9.0-12.0 (-12.5) × (6.5-) 7.0-8.0 (-9.5) µm, Q = 1.2-1.6, $\bar{Q}$ = 1.35, irregularly 6-8-angled in side-view with dihedral base. Basidia 25-40 × 8-12 µm, 2-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical, 4-12 µm wide hyphae with well-developed subpellis of short, inflated elements 24-85 × 13-28 µm. Pigment pale membranal and intracellular in pileipellis and upper pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups on the ground and on litter of grasses and *Calluna vulgaris*, also found in moss in *Quercus*-forest, on poor, acid, sandy soil. Very rare (Dwingeloo; Schoonloo). May-Nov.

Entoloma farinogustus is distinguished by its small basidiocarps, glabrous, polished stipe, and 2-spored, clampless basidia.

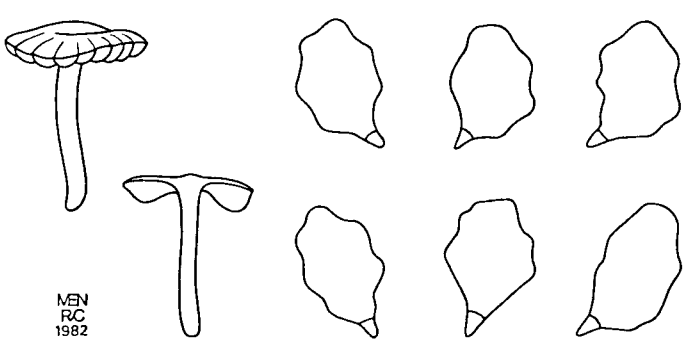

Fig. 121. *Entoloma farinogustus.*

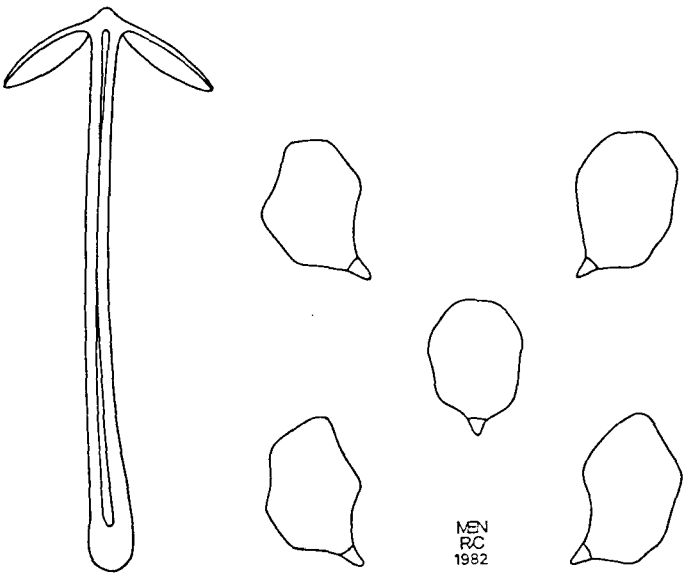

Fig. 122. *Entoloma cuneatum.*

69. Entoloma cuneatum (Bres.) Mos., Röhrlinge-Blätterpilze 4. Aufl.: 205. 1978. – Fig. 122.

Nolanea cuneata Bres., Fungi trident. 1: 77. 1887.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 583, fig. 2. 1929.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 498-499, fig. 35. 1980; P.D.Orton in Trans. Br. mycol. Soc. 43: 330. 1960.

Pileus 23-56 mm, conical then expanding to conico-convex or convex, usually with small papilla, with straight margin, strongly hygrophanous, when moist rather dark reddish brown (Mu. 5 YR 4/3, 4/4; K. & W. 5E8) with contrasting yellowish-hyaline apex (papilla), translucently striate up to centre, strongly pallescent on drying to sordid ochraceous-greyish (10 YR 7/2, 8/4), smooth. Lamellae, L = up to 35, l = 1-3, moderately distant, almost free, ventricose, sordid ochraceous pink, finally brownish pink (e.g. 5 YR 6/6) with concolorous or slightly paler, entire edge. Stipe 25-70 × 2-4 mm, cylindrical, sometimes slightly broadened towards base, yellowish to yellowish brown, paler than pileus, silvery striate, pruinose at apex or upper half, rarely entirely pruinose. Context concolorous with or slightly paler than surface. Smell indistinct. Taste none.

Spores (10.0-) 10.5-12.5 × 7.5-8.5 (-9.0) µm, Q = 1.25-1.45 (-1.6), $\bar{Q}$ = 1.4, 5-7-angled in side-view with dihedral base. Basidia 36-50 × 11-14.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, 2.5-7 (-9) µm wide, cylindrical hyphae; subpellis not or only weakly developed. Pigment pale membranal and intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium, elsewhere rare.

HABITAT & DISTR. – Solitary or subgregarious in coniferous forest. In the Netherlands very rare (Flevoland). Widespread in northwestern Europe, but rare. June-Oct.

Entoloma cuneatum resembles *E. cetratum*, from which it differs in having a darker pileus with yellow papilla, and 4-spored, clamped basidia.

70. Entoloma lanuginosipes Noordel. in Persoonia 10: 248. – Fig. 123.

Nolanea crassipes Velen., Ceské Houby: 627. 1921, non *Entoloma crassipes* Petch, 1924.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 499-501, fig. 33. 1980.

Pileus 20-35 mm, conical then expanding, finally applanate, usually with small papilla, rarely with more or less depressed centre, with straight margin, strongly hygrophanous, when moist pale honey-coloured or yellow-brown (Mu. 10 YR 7/6, 6/4), slightly darker at centre, translucently striate up to centre, pallescent on drying to pale yellow or pinkish yellow (2.5 Y 8/2-4), strongly sericeous. Lamellae, L = 25-35, l = 1-3 (-5), moderately distant; flesh-coloured pink (7.5 YR 7-6/4), with more or less irregular, concolorous edge. Stipe 80-90 × 2-3 mm, cylindrical or compressed, slightly broadened towards base, pale yellow (10 YR 7/8; 2.5 Y 8/6), silvery striate, entirely minutely pruinose, white tomentose at base. Context pallid, relatively firm in stipe, brittle in pileus. Smell weak, subfarinaceous when cut. Taste weak or farinaceous.

Spores 10.0-12.5 × 7.5-9.0 (-10.0) µm, Q = (1.1-) 1.2-1.5 (-1.7), $\bar{Q}$ = 1.4, 6-7-angled in side-view. Basidia 30-58 × 9-17 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, 2.5-8 (-10) µm wide, cylindrical hyphae. Pigment pale, membranal and intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or subgregarious in frondose and coniferous forest. Very rare (Gietelo). Also known from Germany and Czechoslovakia. April-Oct.

Entoloma lanuginosipes is recognized by the pale colours, pruinose stipe, and 4-spored, clamped basidia.

71. Entoloma occultopigmentatum Arnolds & Noordel. in Persoonia 10: 292. 1979. – Fig. 124.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 92c. 1981.

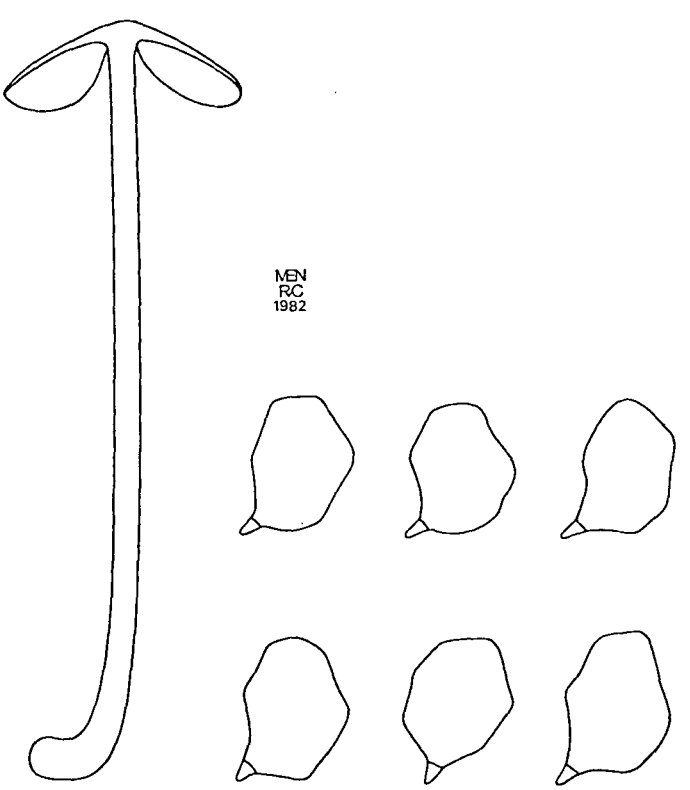

Fig. 123. *Entoloma lanuginosipes.*

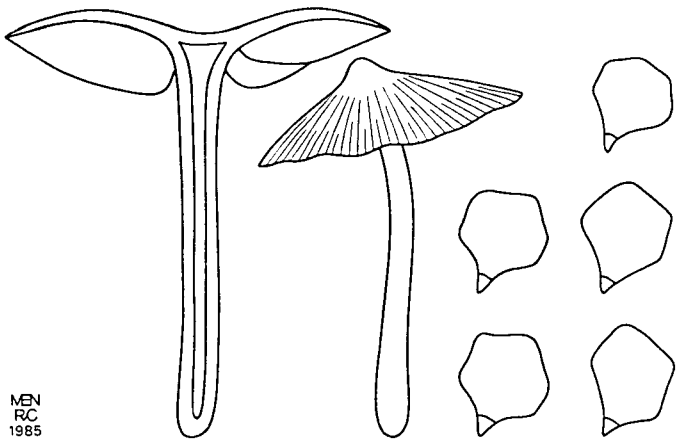

Fig. 124. *Entoloma occultopigmentatum.*

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 18-19, fig. 14. 1981; Noordel. in Persoonia 10: 501-502. 1980.

Pileus 25-56 mm, conico-convex then expanding with or without blunt papilla, rarely slightly depressed at centre, with slightly involute or straight margin, hygrophanous, when moist rather dark brown (Mu. 10 YR 2/2, 3/2; 5 YR 2/2) paler towards margin, translucently striate up to half of radius, strongly pallescent on drying to ochraceous-greyish brown (10 YR 6/4, 6/3, 7/2, 7/3), innately fibrillose, shiny. Lamellae, L = 25-60, l = 1-14, moderately distant to rather crowded, broadly adnate to deeply emarginate, segmentiform to rather broadly ventricose, up to 9 mm broad, pale, sordid grey, then pink with brown tinge (7.5 YR 6/4, 5/4, finally 4/4) with entire or slightly irregular, concolorous edge. Stipe 30-100 × 2.5-8 (-11) mm, cylindrical or compressed, sometimes gradually broadened towards base, pale to moderately dark grey-brown (10 YR 7/4, 6/4, 5/2, 4/3, 4/2), strongly silvery striate lengthwise, white tomentose at base. Context thin and relatively firm in pileus, brittle in stipe, concolorous with surface. Smell strongly farinaceous. Taste strongly farinaceous.

Spores 7.5-9.5 × (6.5-) 7.0-8.0 (-8.5) µm, Q = 1.0-1.25, $\bar{Q}$ = 1.1, (4-)5-6-angled in side-view. Basidia 28-41 × 8.5-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis made up of 3-7 (-11) µm wide cylindrical hyphae with pale brown coloured walls. Pigment pale, diffuse, intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium, in other tissues rare or lacking.

HABITAT & DISTR. – Gregarious in moist grassland (*Scirpetum sylvatici*) or on extensively grazed meadows. Very rare (Vries; Schoorl.). Also known from W.Germany. Sept.-Oct.

Entoloma occultopigmentatum is a large grassland species which resembles a large *E. sericeum* on account of the dark brown colours, farinaceous smell and isodiametrical spores. The distribution of the pigment in the pileus, however, is strikingly different.

72. Entoloma calthionis Arnolds & Noordel. in Persoonia 10: 287. 1979. – Fig. 125.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 89c. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 4-5, fig. 2. 1981; Noordel. in Persoonia 10: 502. 1980.

Pileus (10-)12-28 mm, obtusely conical to convex or flattened, with or without small umbo, hygrophanous, when moist moderately pale brown with orange tinge with distinctly darker grey-brown striae and centre, deeply translucently striate up to centre, pallescent on drying along radial streaks to pale ochraceous grey, shiny, minutely radially wrinkled. Lamellae, L = 22-27, l = 1-3 (-5), free, rather distant, broadly ventricose, pale then moderately dark flesh-coloured pink without grey tinges, with entire, concolorous edge. Stipe 22-47 × 1.5-3.5 mm, cylindrical, at base usually slightly broadened, narrowly fistulose, greyish yellow to brownish yellow, minutely silvery striate lengthwise, minutely pruinose at apex, at base slightly white tomentose. Context thin, fibrillose-brittle, concolorous with surface. Smell weak, not farinaceous. Taste weak, not farinaceous.

Spores (8.5-) 9.0-10.5 (-11.5) × 7.0-8.5 (-9.0) µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25, acutely 5-6-angled in side-view with dihedral base. Basidia 30-38 × 9.5-11.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis made up of cylindrical hyphae, 2-5 µm wide. Pigment pale brown, intracellular in pileipellis and pileitrama. Clamp-connections abundant in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – Subgregarious in unmanured hayfield (*Calthion palustris*) on wet, mesotrophic, peaty soil. Only known from the type-locality (Vries: Taarlo). May.

Entoloma calthionis resembles *E. cetratum* from which it differs, however, in colour, absence of a distinct subpellis in the pileus, and 4-spored, clamped basidia.

73. Entoloma ventricosum Arnolds & Noordel. in Persoonia 10: 298. 1979. – Fig. 126.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 93c. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 20-21, fig. 16. 1981; Noordel. in Persoonia 10: 502-503. 1980.

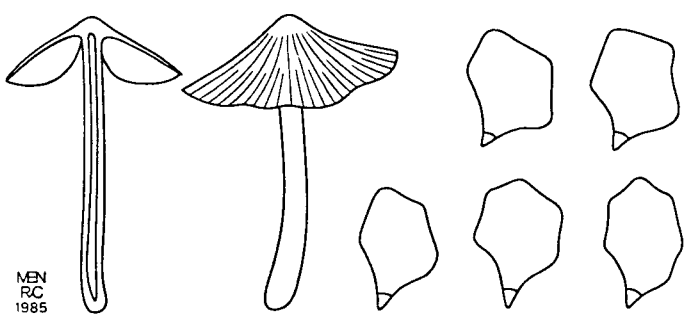

Fig. 125. *Entoloma calthionis.*

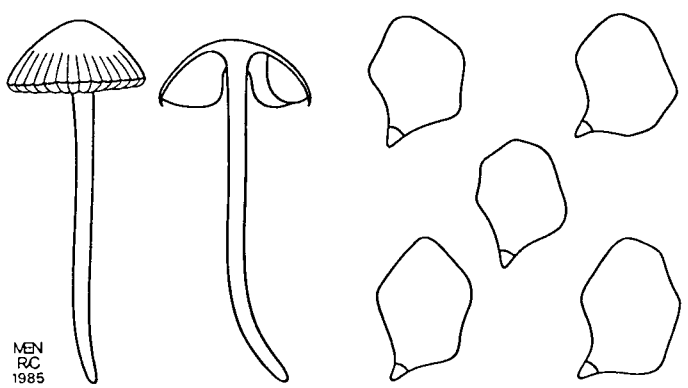

Fig. 126. *Entoloma ventricosum.*

Pileus 13-24 mm, bluntly conico-convex to flattened with weak umbo and slightly inflexed margin, slightly hygrophanous, when moist grey-brown at centre, with pale grey-brown, sometimes sharply delimitated marginal zone, often with slight ochraceous tinge, translucently striate up to centre with dark brown striae, pallescent on drying with radial streaks to very pale ochracreous grey, glabrous. Lamellae, L = 15-18, l = 1-3, rather distant, somewhat thickish, strongly ventricose, transvenose, pale greyish pink then dark brown-pink (K. & W. 6C5), with flesh-coloured edge (6B4). Stipe 30-48 × 2-3.5 mm, cylindrical often slightly flexuose, solid then narrowly fistulose, pale ochraceous grey-brown to rather dark grey-brown (5C5, 6C5, 6E6), smooth, minutely striate lengthwise, on drying more distinctly striate, white tomentose at base. Context very thin in pileus, fibrillose-brittle, concolorous with surface, except pallid inner part of stipe. Smell none. Taste not distinctive.

Spores (8.5-) 9.0-11.0 (-11.5) × 7.0-8.5 µm, Q = 1.15-1.4, $\overline{Q}$ = 1.25, acutely 5-6-angled in side-view. Basidia (28-)30-40 × 9-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of narrow, cylindrical hyphae, 4-8 µm wide; subpellis not distinct. Pigment pale brown, intracellular in pileipellis and pileitrama. Clamp-connections abundant in hymenium, absent in trama.

HABITAT & DISTR. – Solitary or in small groups in poorly manured meadows on fairly dry, weakly acid, humus-rich sand. Very rare (Rolde). Also known from one locality in France. May and Sept.

Entoloma ventricosum belongs to the complex of *E. cetratum* in which it is unique because of the small spores, greyish colour, thickish, transvenose lamellae, and 4-spored, clamped basidia.

74. Entoloma infula (Fr.) Noordel. in Persoonia 10: 503. 1980. – Fig. 127.

Agaricus infula Fr., Spicilegium: 8. 1836; *Nolanea infula* (Fr.) Gillet, Hyménomycètes: 421. 1876; *Rhodophyllus infula* (Fr.) Quél., Enchir. Fung.: 64. 1886.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 90a, d. 1981.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 503-505, fig. 37. 1980.

Pileus 10-45 mm, conical then conico-campanulate, expanding with age to convex finally flattened, with strongly undulating margin, usually with pronounced papilla, hygrophanous, when moist ochraceous or greyish brown to sepia (K. & W. 6D6, 6C5, 6C6, 6E6) translucently striate up to half of radius or more, sometimes zonate, pallescent on drying to ochraceous grey (5C5/C4), glabrous or minutely radially rugulose, shiny. Lamellae, L = 18-30, l = (1-) 3-7, crowded, narrowly adnate to almost free, ventricose, white then pink without any trace of grey or brown with entire, concolorous edge. Stipe 17-78 × 1.5-3 mm, cylindrical sometimes broadened towards base, concolorous with or slightly paler than pileus (6C3, C5, D5, or between D4 and C4), pruinose at apex, glabrous and polished or innately fibrillose lengthwise, not striate, at base white tomentose. Context membranaceous, usually rather firm, concolorous with surface in cortex, inner parts pallid. Smell absent or faint. Taste indistinct.

Spores 7.0-9.5 (-10.0) × 6.0-7.0 µm, Q = 1.15-1.5, $\overline{Q}$ = 1.3, (4-)5-7-angled in side-view. Basidia 25-40 × 7.5-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, (2.5-)4-11 µm wide hyphae; subpellis usually well-differentiated, made up of inflated elements. Pigment minutely incrusting hyphae of pileipellis and in addition pale brown, intracellular in pileipellis and subpellis. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or in small groups in poorly manured grassland, usually on weakly acid soil poor in humus, but also found on

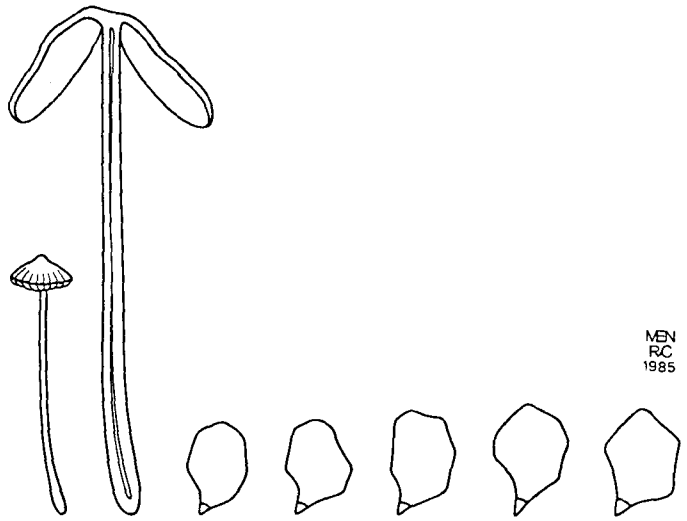

Fig. 127. *Entoloma infula.*

basic soil in xerophytic grassland. Rare. Widespread in north-western Europe in similar habitats. July-Oct.

Entoloma infula is characterised by its conical pileus, glabrous, cartilagineous stipe, fairly small spores and slightly incrusted hyphal walls, *E. solstitiale* is very close but has distinct intracellular pigment, and *E. chlorinosum* differs in having a strong, nitrous smell.

75. Entoloma solstitiale (Fr.) Noordel. in Persoonia 10: 505. 1980. – Fig. 128.

Agaricus solstitialis Fr., Epicr.: 152. 1838; *Leptonia solstitialis* (Fr.) Gillet, Hyménomycètes: 416. 1876; *Rhodophyllus solstitialis* (Fr.) Quél., Enchir. Fung: 60. 1886; *Nolanea solstitialis* (Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 179. 1960.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 90c. 1981.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 505-506, fig. 38. 1980.

Pileus 10-24 mm, (acutely) conical only slightly expanding with age, often with abrupt papilla, with margin slightly involute at first then

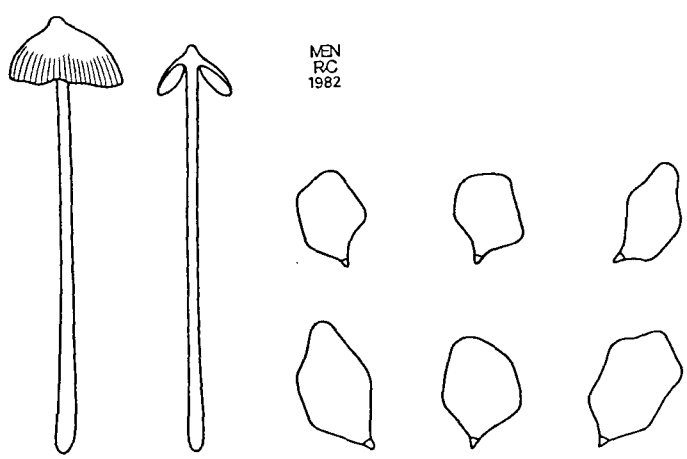

Fig. 128. *Entoloma solstitiale.*

straight, hygrophanous, when moist moderately dark brown, sometimes with ochraceous tinge (K. & W. 6D6-6E6; Mu. 10 YR 5/4, 5/6), darker in centre (10 YR 3/4), slightly paler at margin, translucently striate up to three-quarters of radius, pallescent on drying to greyish brown or greyish yellow (6D5; 10 YR 7/3 or 2.5 Y 7/2, 8/2), strongly radially fibrillose. Lamellae, L = 30-35, l = (1-) 3-9, fairly crowded, deeply emarginate to almost free, ventricose, pallid then salmon-pink without grey or brown tinges (6B5, 7B5; 7.5 YR 8/4, 7/4) with entire, concolorous edge. Stipe 27-60 × 1-2 mm, slender, cylindrical, sometimes slightly broadened at base, solid, then narrowly fistulose, greyish or blackish brown, distinctly more grey than pileus (6E4; 10 YR 2/2, 3/2), paler at apex, glabrous, polished or with some innate fibrils, not striate, white tomentose at base. Context firm-subcartilagineous, concolorous with surface; inner parts paler. Smell indistinct. Taste mild.

Spores 7.5-9.5 × (5.0-) 5.5-7.0 µm, Q = (1.0-) 1.2-1.6, $\bar{Q}$ = 1.35-1.4, (4-)5-6-angled in side-view. Basidia 26-34 × 6.5-12 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, 3-9.5 µm wide, cylindrical hyphae; subpellis only weakly differentiated. Pigment brown, intracellular in subpellis and upper pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or in small groups in poorly manured grassland, preferably on mesotrophic, slightly acid or distinctly basic soil. Very rare (Diepenveen; Wilp). Widespread in north-western Europe but rare. Aug.-Oct.

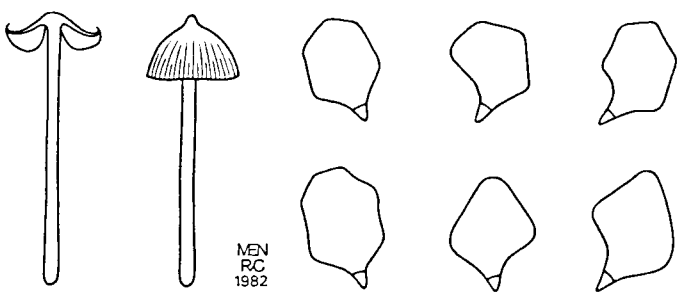

Fig. 129. *Entoloma chlorinosum.*

76. Entoloma chlorinosum Arnolds & Noordel. in Persoonia 10: 287. 1979. – Fig. 129.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 90b. 1981.

SEL. DESCR. & FIGS. – Courtecuisse in Doc. mycol. 12(48): 47-51. 1982; Noordel. in Persoonia 10: 507, fig. 36. 1980.

Pileus 7-14 mm, acutely conical or hemispherical with small, abrupt papilla, expanding to conico-campanulate, finally convex with small conical papilla with straight margin becoming reflexed with age, hygrophanous, when moist (dark) yellowish brown or reddish brown (K. & W. 5C7; Mu. 10 YR 3/3, 4/3, 4/4) slightly paler towards margin, translucently striate up to three-quarters of radius, pallescent on drying to pale yellowish brown (5B5; 10 YR 5/4, 6/4) shiny. Lamellae, L = 12-24, l = 0-1(-3), moderately distant, almost free, thin, ventricose, white, then pink without brown or grey tinges with entire, concolorous edge. Stipe 28-40 × 0.5-1.5 mm, cylindrical, pale to moderately dark yellowish brown (5B5, 5D5; 10 YR 4/3, 4/4), glabrous, polished, white tomentose at base. Context thin, membranaceous-brittle in pileus, firm, rigid in stipe, concolorous with surface. Smell strongly nitrous (like chlorine). Taste mild or like soap.

Spores (7.0-) 7.5-9.0 × 5.0-7.0 µm, Q = 1.2-1.5, $\bar{Q}$ = 1.3, 5-6(-7)-angled in side-view. Basidia 24-35 × 7.5-10 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2-8 µm wide, cylindrical hyphae. Pigment intracellular. Clamp-connections present in hymenium.

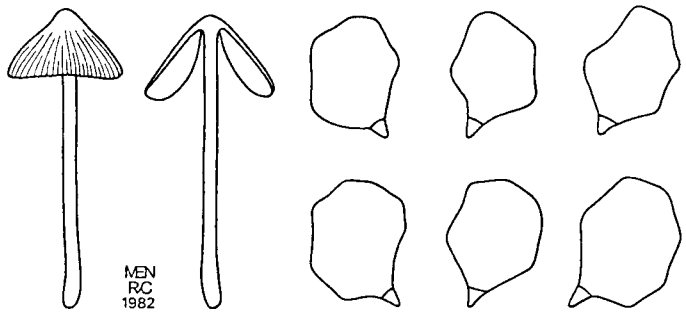

Fig. 130. *Entoloma verecundum.*

HABITAT & DISTR. – In small groups in grassland. Very rare (Vlagtwedde; Anloo). Also known from Sweden, France and Italy. Sept.-Oct.

The nitrous smell is distinctive for this small *Nolanea.*

77. Entoloma verecundum (Fr.) Noordel. in Persoonia 10: 507. 1980. – Fig. 130.

Agaricus rubellus subsp. *verecundus* Fr., Spicilegium: 6. 1836; *Agaricus verecundus* (Fr.) Fr., Epicr.: 158. 1838; *Nolanea verecunda* (Fr.) Gillet, Hyménomycètes: 422. 1876; *Rhodophyllus verecundus* (Fr.) Quél., Enchir. Fung.: 64. 1886.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 507-508, fig. 39. 1980.

Pileus 17-22 mm, conical then expanding to conico-convex with straight margin, hygrophanous, when moist pinkish brown (Mu. 7.5 YR 5/4) paler at margin (7.5 YR 6-7/4), translucently striate up to centre, strongly pallescent on drying to ochraceous pink, smooth, shiny. Lamellae, L = 25, l = 1-5, moderately distant, almost free, ventricose, up to 6 mm broad, white, then pink (7.5 YR 7/2), with entire, concolorous edge. Stipe 25-30 × 1.5-2 mm, cylindrical, straight, yellow (2.5 Y 7/4), glabrous, polished. Context thin-membranaceous, rather tough, pallid. Smell absent. Taste not known.

Spores 9.5-11.0 (-11.5) × 7.0-8.0 µm, Q = 1.1-1.5, $\bar{Q}$ = 1.3, 5-7-angled in side-view. Basidia 28-35 × 11-14 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2.5-11 µm wide, cylindrical hyphae. Pigment pale brownish, intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – In small groups in extensively grazed dune-grassland with *Salix repens.* Very rare (Terschelling). Distribution in north-western Europe unknown. Nov.

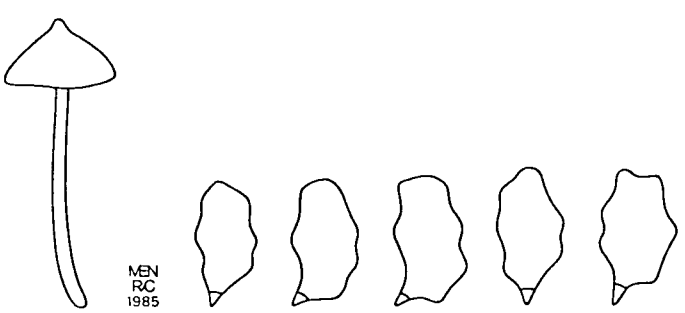

Fig. 131. *Entoloma triste.*

78. Entoloma triste (Velen.) Noordel. in Persoonia 10: 254. 1979. – Fig. 131.

Nolanea tristis Velen., Ceské Houby: 630. 1921.

SEL. DESCR. – Noordel. in Persoonia 10: 509. 1980.

Pileus 10-20 mm, conical finally expanding to convex with small papilla, hygrophanous, when moist blackish brown, not striate or very obscurely so at margin only, pallescent on drying to moderately dark brown, radially fibrillose, shiny. Lamellae, distant, greyish-ochraceous with pink tinge. Stipe 20 × 1.5 mm, horn brown at apex, darker towards base, paler than pileus, white tomentose at base. Smell absent. Taste not known.

Spores 10.5-12.0 (-14.0) × (7.0-) 7.5-9.0 µm, Q = 1.2-1.6, $\bar{Q}$ = 1.35, 6-8-angled in side-view. Basidia 25-38 × 12.5-14.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, 4-10 µm wide hyphae. Pigment abundant, brown, intracellular in pilepellis. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or in small groups in grassland or on peaty soil, in the Netherlands found in *Calluna* heath with *Sphagnum* on dry, acid, sandy soil. Very rare (Nieuw Ginneken). Also known from Denmark and Czechoslovakia. May-Sept.

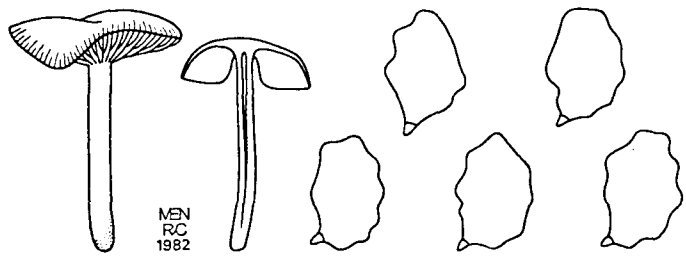

Fig. 132. *Entoloma undulatosporum.*

79. Entoloma undulatosporum Arnolds & Noordel. in Persoonia 10: 295. 1979. – Fig. 132.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 295-296, figs. 27-29. 1979; Noordel. in Persoonia 10: 509-510. 1980.

Pileus 15-23 mm, convex then expanding, without papilla, with straight margin, hygrophanous, when moist blackish brown (K. & W. 5F6) with slightly paler margin, translucently striate at margin only, pallescent on drying from centre towards grey-brown (5D4), shiny, very finely radially rugulose. Lamellae moderately distant, narrowly adnate, rather thick, ventricose, up to 5 mm broad, pale grey-brown (5D4) with incarnate-grey entire edge. Stipe 22-27 × 1.8-2.8 mm, relatively short, cylindrical, paler and more brown than pileus (5D5), glabrous, slightly white tomentose at base. Context thin in pileus, relatively firm, brittle in stipe. Smell farinaceous. Taste farinaceous.

Spores (7.5-) 8.0-11.0 (-12.0) × 6.0-7.0 (-7.5) µm, Q = (1.25-) 1.3-1.6 (-1.7), $\bar{Q}$ = 1.35-1.45, irregularly 6-9-angled in side-view almost gibbose, thin-walled. Basidia 25-32 × 9.5-11.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a poorly developed cutis of 3.5-15 µm wide cylindrical hyphae. Pigment dark brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in hymenium, rare in other tissues.

HABITAT & DISTR. – Solitary or in small groups in poorly manured meadow and in *Quercus-Fraxinus* forest both on humus-rich, sandy soil. Very rare (Axel; Beilen). May-Sept.

80. Entoloma velenovskyi Noordel. in Persoonia 10: 258. 1979. – Fig. 133.

Nolanea conica Velen., Ceské Houby: 623. 1921, non *Entoloma conicum* (Peck) Hesler, 1967. – *Entoloma velenovskyi* var. *longicystidiatum* Arnolds & Noordel. in Persoonia 10: 296. 1979.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 296-298, figs. 30-33. 1979 (as *E. velenovskyi* var. *longicystidiatum*); Einh. in Ber. bayer. bot. Ges. 52: 191. 1981; Noordel. in Persoonia 10: 510-511, fig. 41. 1980; Noordel. in Nord. J. Bot. 2: 157. 1982.

Pileus 10-15 mm, acutely conical or campanulate, always with pronounced papilla, only slightly expanding with age to conico-convex or convex, with straight, rarely slightly inflexed margin, weakly to strongly hygrophanous, when moist moderately to very dark grey-brown (Mu. 7.5 YR 6/2, 5/2; K. & W. 6E5) paler towards margin, slightly translucently striate at margin, rarely distinctly striate up to half of radius, slightly to distinctly pallescent on drying to grey-brown or ochraceous grey (e.g. 6D4), glabrous or radially fibrillose, shiny. Lamellae moderately distant, adnexed, deeply emarginate to (almost) free, ventricose, sometimes thickish, white then clay-pink (5 YR 7/3, 6/3; 5C5, D5) with concolorous or slightly paler to almost white edge. Stipe 15-60 × 1-3 mm, cylindrical, straight or flexuose, pale grey-brown or yellow-brown, glabrous, polished, at base sometimes slightly tomentose. Context thin, membranaceous, concolorous with surface. Smell none. Taste not known.

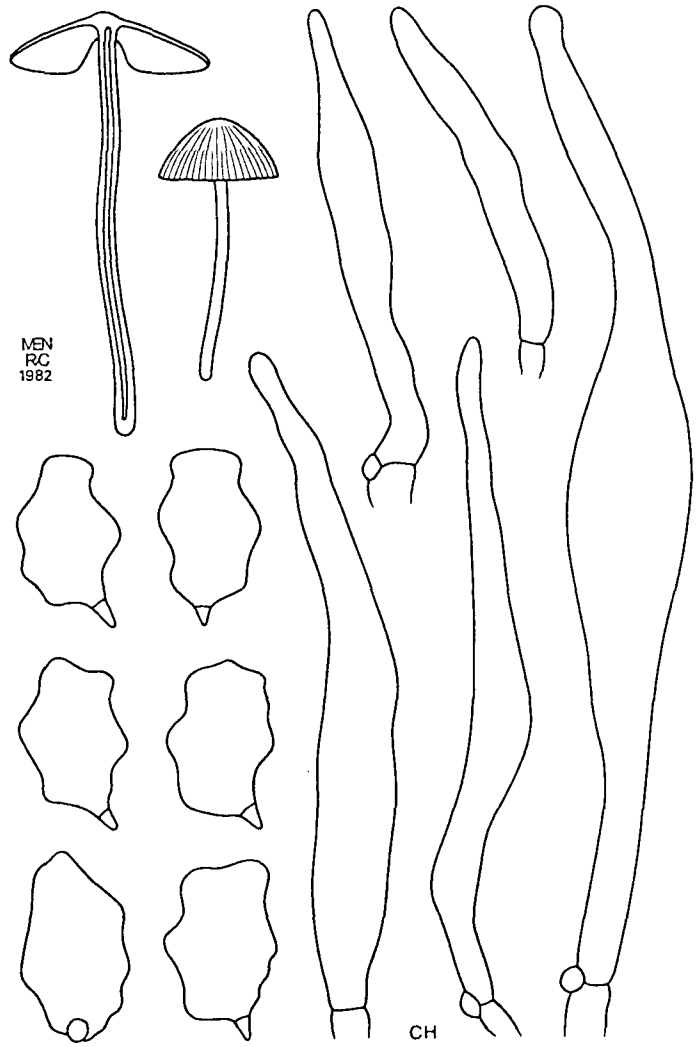

Fig. 133. *Entoloma velenovskyi.*

Spores 10.0-14.0 (-16.0) × (7.0-) 7.5-11.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.3-1.5, irregularly 5-9-angled in side-view. Basidia 28-43 × 9-14 µm, 4-, rarely also 2-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 50-120(-150) × (6-)7-20 (basal part) × 2-5 (apex) µm, fusoid-lageniform, numerous. Pileipellis a cutis made up of radially arranged, up to 12 µm wide cylindrical hyphae. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium, rare or absent in other tissues.

HABITAT & DISTR. – Solitary or in small groups in grassland on moist, rather humus-rich soil. Very rare (Drunen; Westerbork). Widespread but rare in north-western and central Europe. July-Oct.

Since the publication of *Entoloma velenovskyi* var. *longicystidiatum* observations on additional collections revealed that there is no sharp limit between this and the typical variety.

81. Entoloma cryptocystidiatum Arnolds & Noordel. in Persoonia 10: 287. 1979. – Fig. 134.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Persoonia 10: 287-288, figs. 5-10. 1979; Noordel. in Persoonia 10: 511-512. 1980.

Pileus 20-32 mm, conico-convex with margin narrowly involute at first then straight, strongly hygrophanous, when moist rather pale grey-brown (K. & W. 5D4) with slightly darker centre and slightly paler margin, translucently striate up to centre, on drying pallescent to silvery white with ochraceous tinge, shiny. Lamellae, L = 21-23, l = 3-5, crowded, free, ventricose, 2.5-4 µm broad, pale brown-grey (5D4-5C3) without pink tinge, with concolorous, entire edge. Stipe 47-53 × 1.5-2.5 mm, slender, cylindrical, fistulose, brittle, pale grey-brown, silvery striate lengthwise. Context in pileus thin, brown-grey in pileus and stipe. Smell weak, fungoid. Taste indistinct.

Spores 8.5-10.0 × 7.5-8.5 µm, Q = 1.1-1.3, $\bar{Q}$ = 1.2, 5-6-angled in side-view. Basidia 29-39 × (8-) 11.5-12.5 µm. Lamella edge heterogeneous. Cheilocystidia (8.0-)15.5-38(-42) × 5-8 µm, subcylindrical, often subcapitate, sometimes with thickened, refringent apex, scattered among basidia. Pileipellis a cutis of radially arranged, 3.5-6 µm wide, cylindrical hyphae. Pigment intracellular in pileipellis and pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – In small groups in non-manured hayfield, on rather wet, eutrophic soil (*Calthion palustris*). Very rare (Vries). Distribution in rest of Europe unknown; one collection seen from Austria.

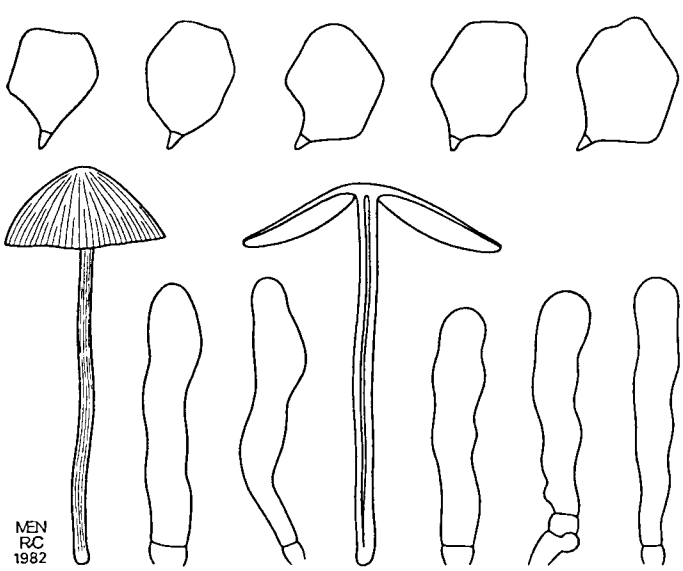

Fig. 134. *Entoloma cryptocystidiatum.*

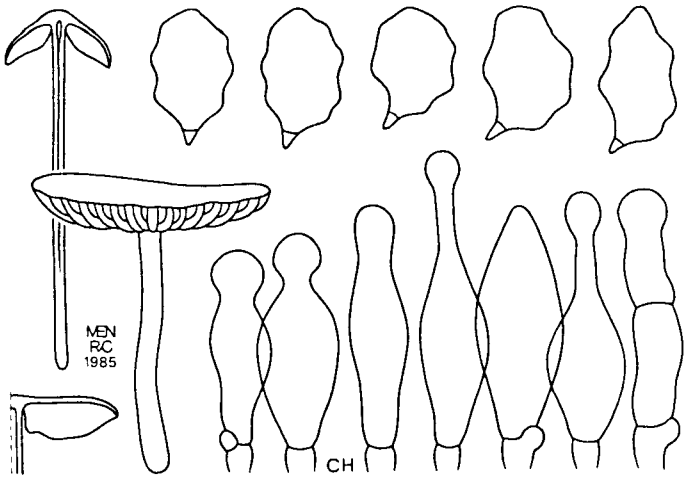

Fig. 135. *Entoloma inutile.*

Entoloma cryptocystidiatum is distinctive on account of its cylindrical-subcapitate cystidia and intracellular pigment. *Entoloma hebes*, *E. kuehnerianum*, and *E. hirtipes* have similar cystidia, but distinctly incrusting pigments and larger, more heterodiametrical spores.

82. Entoloma inutile (Britz.) Noordel. in Persoonia 10: 512. 1980. – Fig. 135.

Agaricus inutilis Britz. in Ber. naturhist. Ver. Augsburg 30: 16. 1890; *Nolanea inutilis* (Britz.) Sacc. & Trav., Syll. Fung. 20: 199. 1911; *Rhodophyllus inutilis* (Britz.) Romagn. in Rev. Mycol. 1: 160. 1937.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 93e. 1981; Romagn. in Rev. Mycol. 1: pl. 12, fig. 2. 1937.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 512-513, fig. 40. 1980.

Pileus 5-30 mm, convex then applanate with or without small papilla rarely slightly depressed, with margin straight, often undulating with age, hygrophanous, when moist moderately dark grey-brown to blackish brown (K. & W. 5D4, 5D5, 6F6), slightly paler towards margin, translucently striate up to two-thirds of radius, pallescent on drying to brown, glabrous or minutely villose, especially at centre, shiny. Lamellae, L = 25-32, l = 1-3, moderately crowded, adnate, emarginate or almost free, ventricose, up to 5 mm broad, pale to rather dark greyish or brownish pink (7D4/E4; Mu. 5 YR 5/4) with irregularly, concolorous or slightly paler edge. Stipe 14-40 × 1-4 mm, cylindrical, pale to moderately dark brown (5B2, 5C3), moderately to strongly silvery striate lengthwise, pruinose at apex, downwards glabrous. Context thin, concolorous with surface in pileus, pale in stipe. Smell indistinct. Taste indistinct.

Spores 9.0-11.5(-12.5) × (6.5-)7.0-8.0 (-9.0) µm, Q = (1.15-) 1.3-1.5, $\bar{Q}$ = 1.3-1.4, nodulose-angular in side-view. Basidia 24-32 × 9.5-11.5 µm, 4-, rarely also 2-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 25-52 (-80) × 6-14.5 (-17) × 2.5-7 µm, lecythiform or subcylindrical and subcapitate to clavate with conical apex, numerous, mixed with basidia. Pileipellis a cutis of radially arranged, cylindrical hyphae, 3.5-14 µm wide, sometimes with tufts of ascending cylindrical to clavate terminal elements up to 17 µm wide. Pigment abundant, brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in hymenium, also observed in covering layers.

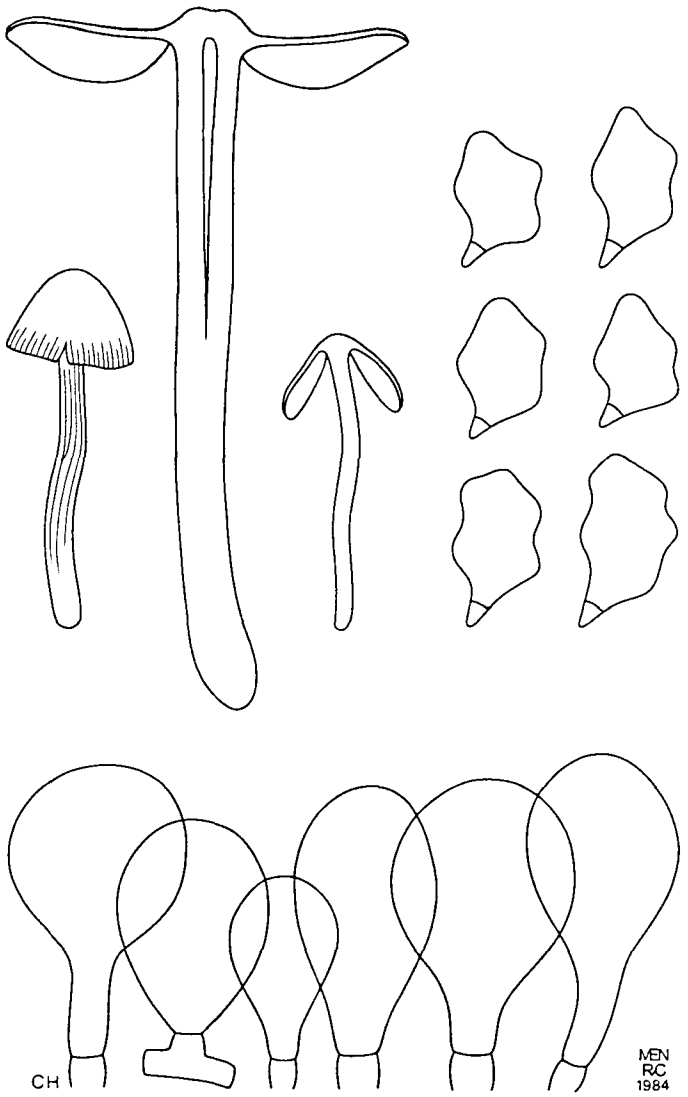

Fig. 136. *Entoloma globuliferum.*

HABITAT & DISTR. – In small groups on *Calluna*-heaths on peaty, acid soil and in poor mossy *Quercus*-forest (*Dicrano-Quercetum*) in coastal dunes. Rare. Widespread in Europe. Oct.-Nov.

Entoloma inutile may resemble *E. clandestinum* because of its dark colour and relatively distant lamellae, but can easily be distinguished by its cheilocystidia and nodulose-angular spores. Other species of *Entoloma* with similar cheilocystidia such as *E. jubatum* and related species differ in a great number of characters such as habit, surface of pileis, structure of pileipellis, and size and shape of spores.

83. Entoloma globuliferum Noordel. in Persoonia 10: 513. 1980. – Fig. 136.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 513-514, fig. 42. 1980.

Pileus 17-45 mm, conical to conico-campanulate then expanding to convex finally flattened, with obtuse papilla, with margin involute, with marginal zone irregularly undulating with age, hygrophanous, very dark sepia-brown when moist, paler at margin (centre Mu. 10 YR 3/3, 4/3, margin 10 YR 5/4, 6/4), translucently striate at margin, pallescent on drying to pale brown (10 YR 6/3, 7/3), brilliantly shiny when moist, innately radially fibrillose, when dry. Lamellae, L = 40-50, l = 1-3, crowded, almost free, ventricose, pale brown then brown-pink (10 YR 6/3, then 7.5 YR 6/4-5/4), with irregularly eroded, concolorous edge. Stipe 40-85 × 2.5-6 mm, cylindrical often slightly broadened towards base, sometimes compressed, sepia or horn-brown (10 YR 6/4, 5/4), sometimes slightly pruinose at apex, downwards glabrous, innately silvery striate, tomentose at base. Context rather firm-tough, particularly in pileus. Smell farinaceous. Taste strong, very unpleasant-rancid.

Spores 9.0-11.5 (-12.5) × 7.0-8.0 µm, Q = 1.3-1.6, $\bar{Q}$ = 1.4, asymmetrical, 5-6-angled in side-view with pronounced angles. Basidia 28-44 × 10.5-14 µm, 2- and 4-spored, clampless. Lamella edge heterogeneous. Cheilocystidia 17-40 × 12-24 µm, sphaeropedunculate to broadly clavate, sometimes with hyaline, slightly thickened walls, scattered among basidia. Pleurocystidia similar to cheilocystidia, abundant near lamella edge. Pileipellis a cutis of 2.5-6 µm wide cylindrical hyphae with scattered ascending terminal elements up to 15 µm wide. Pigment abundant, brown, intracellular in pileipellis and upper pileitrama. Clamp-connections absent from all tissues.

HABITAT & DISTR. – Subgregarious in dune-meadow on humus-rich sandy soil together with *Salix repens*. Very rare (Goedereede). Not known from other places so far. Oct.

84. Entoloma pleopodium (Bull. ex DC.: Fr.) Noordel. in Persoonia 12: 459. 1985. – Fig. 137.

Agaricus pleopodius Bull. ex DC. in DC. & Lam., Fl. franç. 2: 194. 1805; *Agaricus pleopodius* Bull. ex DC.: Fr., Syst. mycol. 1: 207. 1821; *Nolanea pleopodia* (Bull. ex DC.: Fr.) Gillet, Hyménomycètes: 420. 1876; *Rhodophyllus pleopodius* (Bull. ex DC.: Fr.) Quél., Enchir. Fung.: 64. 1886. – *Agaricus icterinus* Fr.: Fr., Syst. mycol. 1: 207. 1821; *Nolanea icterina* (Fr.: Fr.) Kumm., Führ. Pilzk.: 95. 1871; *Rhodophyllus icterinus* (Fr.: Fr.) Quél., Enchir. Fung.: 64. 1886; *Hyporrhodius icterinus* (Fr.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 613. 1889.

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 78A. 1937 (as *R. icterinus*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 516-518, fig. 44. 1980 (as *E. icterinum*).

VERN. NAME. – Citroengele satijnzwam.

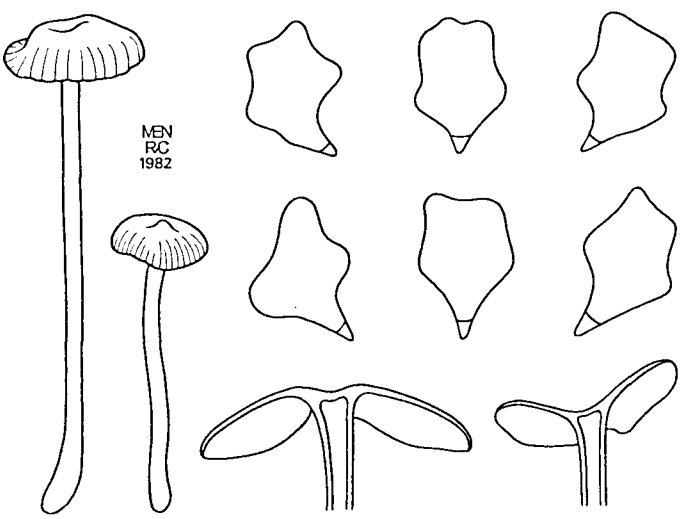

Fig. 137. *Entoloma pleopodium.*

Pileus 10-35 mm, campanulate or paraboloid, often truncate, expanding to convex, finally applanate to concave, often with depressed or subpapillate centre, with involute or straight margin, with marginal zone often sulcate to undulating when old, hygrophanous, when moist pale to moderately dark yellow, olivaceous yellow or lemon-yellow, at centre often darker and more brown, paler towards margin (Mu. 5 YR 7/6, 6/6, 6/4; 2.5 Y 7/6, 6/6, 6/4, 5/4; centre 5 Y 5/6; 10 YR 5/4, margin 2.5 Y 8/6) translucently striate up to half of radius, pallescent on drying to pale yellow or olivaceous yellow (5 Y 8/6, 8/4; K. & W. 2A5/6), smooth when moist, radially fibrillose on drying, sometimes subsquamulose at centre. Lamellae, L = 20-30, l = 0-3, moderately distant, adnate or emarginate, sometimes broadly adnate with small decurrent tooth, segmentiform to ventricose, up to 6.5 mm broad, white then pale yellow finally pink, often with slight brown tinge when old (5 Y 8/2; 2.5 Y 8/6, 8/4; 10 YR 8/6, 8/4; 7.5 YR 8/4, 7/6), with entire to subdentate, concolorous edge. Stipe 20-80 × 2-4 (-5) mm, cylindrical, often slightly broadened towards base, pale yellowish or greyish brown at apex, downwards more flesh-coloured or pinkish brown, at base often with purplish tinge, more rarely entirely yellowish-olivaceous and concolorous with pileus (10 YR 8/4, 8/6, 7/4, 7/6 base 7.5 YR 7/6, 6/6, 5/6, rarely 5 Y 6/4 or 2.5 Y 6/4), minutely pruinose to flocculose at apex, downwards glabrous or minutely striate with scattered silvery fibrils, white tomentose at base. Context subcartilagineous or brittle, yellowish-olivaceous in pileus, pallid in centre of stipe. Smell strongly aromatical like that of amylacetate, fruit, *Entoloma ameides*, *Hebeloma sacchariolens* or *Incoybe pyriodora*, rarely indistinct. Taste weak or nasty.

Spores (8.0-) 8.5-11.0 (-11.5) × (6.5-) 7.0-8.0 (-9.0) µm, Q = (1.15-) 1.2-1.5, $\bar{Q}$ = 1.35, 5-6-angled in side-view. Basidia 32-52 × 9-16 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 4-17 µm wide cylindrical hyphae with scattered clavate terminal elements up to 25 µm wide. Pigment intracellular in pileipellis. Clamp-connections present in hymenium.

HABITAT & DISTR. – Solitary or subgregarious, usually terrestrial on humus-rich, nitrogen-rich soil, particularly in gardens, parks and deciduous forest, but also found on bare, clayey soil. Common. Widespread in Europe. July-Nov.

The smell of *Entoloma pleopodium* is rather variable. Variants with a strong aromatical smell are found besides variants without a special odour. Therefore no taxonomic value has been attached to them.

85. Entoloma chlorophyllum Noordel. in Persoonia 10: 518. 1980. – Fig. 138.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 10: 518-520, fig. 43. 1980.

Pileus 15-27 mm, truncately conical or bluntly campanulate, with slightly depressed centre, sometimes with a small papilla within, with slightly involute margin, hygrophanous, when moist olivaceous-greenish (Mu. 5 Y 6/6) with slightly darker centre, not translucently striate, slightly pallescent on drying, minutely radially fibrillose, white pruinose at centre. Lamellae, L = about 20, l = 1-3, distant, adnate with decurrent tooth, thickish, ventricose, pale olivaceous green then pinkish, with entire, concolorous edge. Stipe up to 50 × 2-4 mm, cylindrical with bulbous base up to 6 mm broad, olivaceous brown at apex, downwards brown, flocculose at apex, downwards covered with silvery-white striation, often twisted, white tomentose at base. Context dark olivaceous when moist, pallescent on drying. Smell none. Taste not known.

Spores (8.5-) 9.5-10.5 × 7.0-8.0 (-8.5) µm, Q = 1.2-1.4, $\bar{Q}$ = 1.3, 5-6-angled in side-view with rather pronounced angles. Basidia 35-50 × 10-14 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 50-85(-150) × 10-17.5 µm, cylindrical to flexuose, often narrowly lageniform, with rounded or subcapitate apex, scattered among basidia. Pileipellis a cutis of 6-20 µm wide, cylindrical hyphae with clavate, repent or slightly ascending, up to 25 µm wide terminal elements. Pigment pale yellow, intracellular and membranal, not incrusting. Clamp-connections present in hymenium.

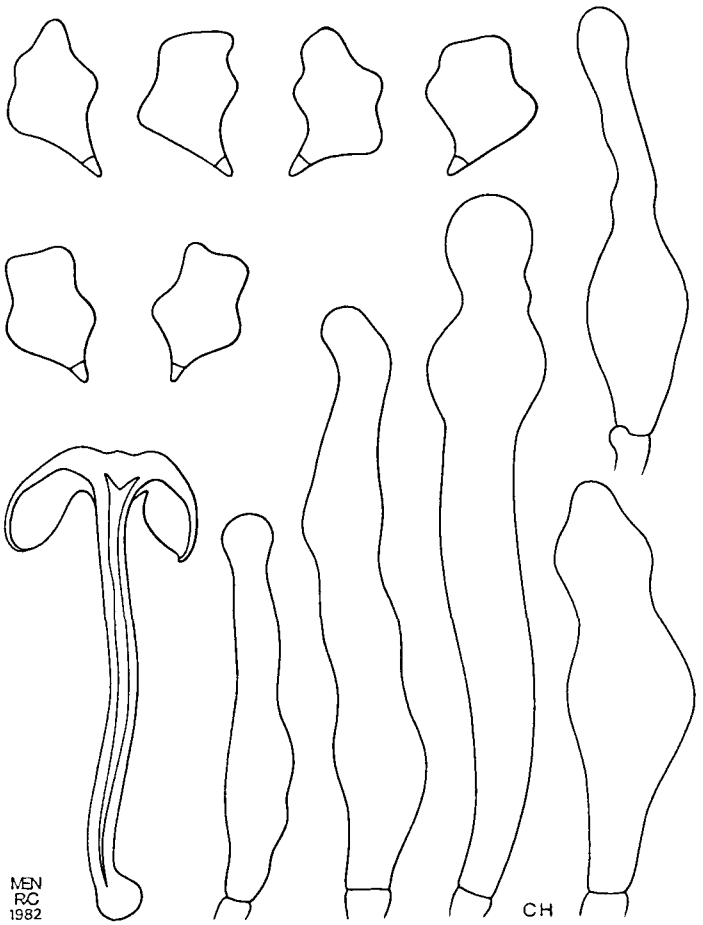

Fig. 138. *Entoloma chlorophyllum*.

HABITAT & DISTR. – Subgregarious on humus in garden. Very rare. Only known from the type-locality (Wijster). Oct.

Entoloma chlorophyllum comes close to *E. pleopodium* from which it differs in the initially green lamellae and presence of cheilocystidia.

Subgen. TRICHOPILUS (Romagn.) Noordel.

SEL. LIT. – Larg., Gen. Leptonia Pac. Coast United States: 121-128. 1977.

Habit tricholomatoid; pileus umbonate, rarely applanate, not hygrophanous, radially fibrillose to squamulose; pileipellis a cutis with transitions to a trichoderm, made up of up to 25 µm wide, inflated hyphae; hymenophoral trama made up of long, fusoid elements up to 450 µm long; cheilocystidia present, lageniform, lecythiform or tibiiform; pigment intracellular.

86. Entoloma jubatum (Fr.: Fr.) P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp.: 263. 1879. – Fig. 139.

Agaricus jubatus Fr.: Fr., Syst. mycol. 1: 196. 1821; *Rhodophyllus*

jubatus (Fr.: Fr.) Quél., Enchir. Fung.: 58. 1886; *Leptonia jubata* (Fr.: Fr.) Larg. in Northwest Sci. 43: 52. 1974.

EXCL. – *Rhodophyllus jubatus* sensu Konr. & M., Ic. sel. Fung. 2: pl. 193. 1932 (= *E. elodes*). – *Entoloma jubatum* sensu Cooke, Ill. Brit. Fungi: pl. 333 (317). 1884 (= *E. porphyrophaeum*).

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 95b. 1981; Cetto, Funghi Vero 4: pl. 1425. 1983; J.Lange, Fl. agar. dan. 2: pl. 72B. 1937.

SEL. DESCR. & FIGS. – J.Favre, Assoc. fong. Hauts-Marais: 47-49, fig. 12, pl. 1, fig. 3-5. 1948.

VERN. NAME. – Fijnschubbige satijnzwam.

Pileus 20-50 mm, conical, then expanding to conico-convex, finally convex, rarely flattened, usually with pronounced umbo, with slightly involute, then straight margin, with undulating marginal zone with age, not hygrophanous, not translucently striate when moist, dark grey-brown or brown (Mu. 10 YR 4/2, 4/3, 3/2; 7.5 YR 3/2), strongly radially fibrillose with adpressed or loose-lying fibrils, at centre often tomentose-subsquamulose, sometimes with micaceous patches. Lamellae, L = 25-30, l = 1-5, moderately distant, narrowly adnate to deeply emarginate or free, ventricose, already when young dark brown to chocolate brown, later on with pink tinge (7.5 YR 5/4-4/2), with irregular, concolorous edge. Stipe 45-80 × 3-6 mm, cylindrical or broadened at base (up to 8 mm), dark brown fibrillose-striate on paler, more yellowish brown background (fibrils 10 YR 4/3, background 6/4-7/4), fibrils sometimes agglutinated to scurfy floccules, especially in upper part, white tomentose at base, solid or fistulose. Context fibrilose-brittle, pale grey or white. Smell none. Taste not distinctive or slightly astringent to almost rancid.

Spores 8.0-10.0 (-11.0) × 6.0-8.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.3-1.4, 6-8-angled in side-view. Basidia 4-spored, 25-45 × 10-14 µm, clamped.

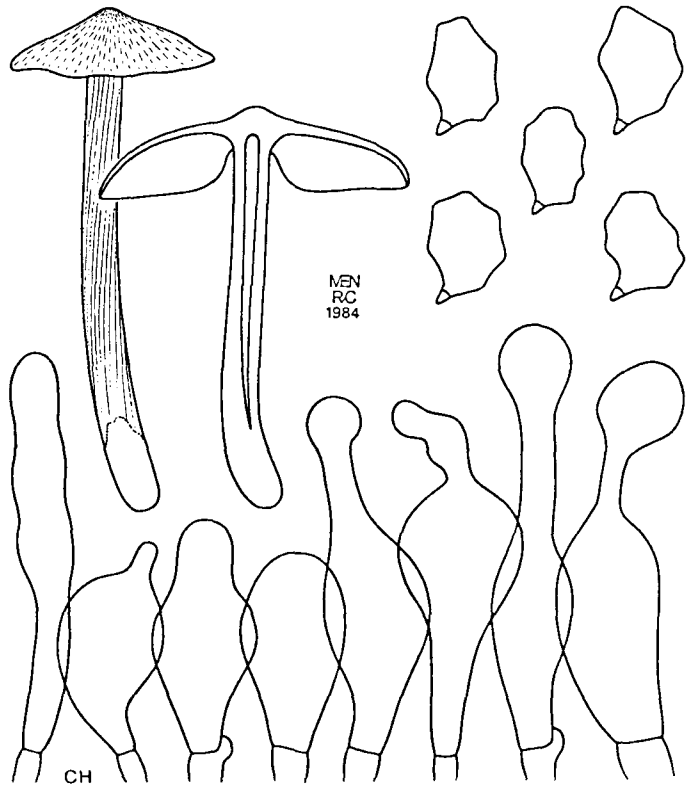

Fig. 139. *Entoloma jubatum*.

Lamella edge heterogeneous. Cheilocystidia 25-60 × 6-15 µm, usually lecythiform with distinct capitulum (6-14 µm) and narrow neck (2.5-6 µm), more rarely lageniform, usually very numerous, but almost always mixed with basidia. Pileipellis a cutis with transition to a trichoderm, made up of cylindrical to inflated hyphae, with clavate-cylindrical terminal elements, 10-28 (-35) µm wide. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in hymenium, elsewhere rare or lacking.

HABITAT & DISTR. – Solitary in small groups in unmanured hayfields on dry, clacareous soils, in heaths with *Calluna vulgaris* and *Empetrum nigrum* on dry, acid soil, among mosses in dune-grasslands, also near *Betula* in dune-forest. Rare. Widespread in N. and W.Europe, locally common where its habitat occurs. July-Nov.

Entoloma jubatum is distinguished within the subgenus *Trichopilus* because of the dark grey-brown colour, lack of smell and distinctly capitate, never apiculate or mucronate cheilocystidia.

87. Entoloma porphyrophaeum (Fr.) P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp. 1: 259. 1879. – Fig. 140.

Agaricus porphyrophaeus Fr., Monogr. Hymenomyc. Sueciae 1: 473. 1857; *Rhodophyllus porphyrophaeus* (Fr.) J.Lange in Dansk bot. Ark. 2(11): 28. 1921; *Leptonia porphyrophaea* (Fr.) Larg., Gen. Leptonia Pac. Coast United States: 122. 1977.

MISAPPL. – *Entoloma jubatum* sensu Cooke, Ill. Brit. Fungi: pl. 333(317). 1884.

EXCL. – *Entoloma porphyrophaeum* sensu Konr. & M., Ic. sel. Fung. 2: pl. 190, fig. 1. 1932 (= *E. elodes*).

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 95. 1981; Dähncke & Dähncke, 700 Pilze: 249. 1979; J.Lange, Fl. agar. dan. 2: pl. 73D. 1937; R.Phillips, Mushr. other Fungi: 116. 1981.

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 33-34, fig. 25. 1981; J.Favre, Cat. descr. Champ. sup. Zone subalpine: 457-458, fig. 41. 1960.

VERN. NAME. – Porfiersatijnzwam.

Pileus 40-145 mm, conical, then slowly expanding, usually with pronounced umbo, finally often entirely expanded with broad umbo, with involute margin at first, later on more or less straight, with often strongly undulating and/or splitting marginal zone when old, not hygrophanous, not translucently striate, when young lilaceous brown or reddish brown with lilaceous or purple sheen (Mu. 7.5 YR 4/2, 5/2 to 5 YR 4/3, 5/3), slightly paler towards margin, with age losing the lilaceous purple tinge, then brownish (like 10 YR 5/3), innately radially fibrillose or very minutely radially rugulose with micaceous patches, almost tomentose or subsquamulose when dry. Lamellae, L = 40-60, l = 3-7, deeply emarginate to free, ventricose, up to 20 mm broad, white or cream, then pinkish or salmon, finally brown-pink, with irregularly dentate concolorous edge. Stipe 40-160 × 5-18 mm, cylindrical, more often fusiform, sometimes broadened at base, rather strongly reddish-porphyraceous fibrillose to squamulose on paler background, pallid, almost white at base, solid. Context in pileus concolorous with surface in cortex, inner part pale; in stipe cortex concolorous with surface, inner part whitish. Smell none or slightly sweetish. Taste mild or nasty, more rarely nutty or sweetish.

Spores 8.0-12.0 × (5.5-) 6.0-8.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.35-1.5, irregularly many-angled in side-view. Basidia 32-60 × 9-13 µm, 4-spored, clamped. Lamella edge heterogeneous, rarely entirely sterile. Cheilocystidia 20-60 × 7-20 µm, lageniform to lecythiform with broad base and rostrate to distinctly capitate (3-12 µm), rarely moniliform neck (2.5-7 µm), usually mixed with basidia. Pileipellis a transition between a cutis and a trichoderm, made up of cylindrical to inflated, up

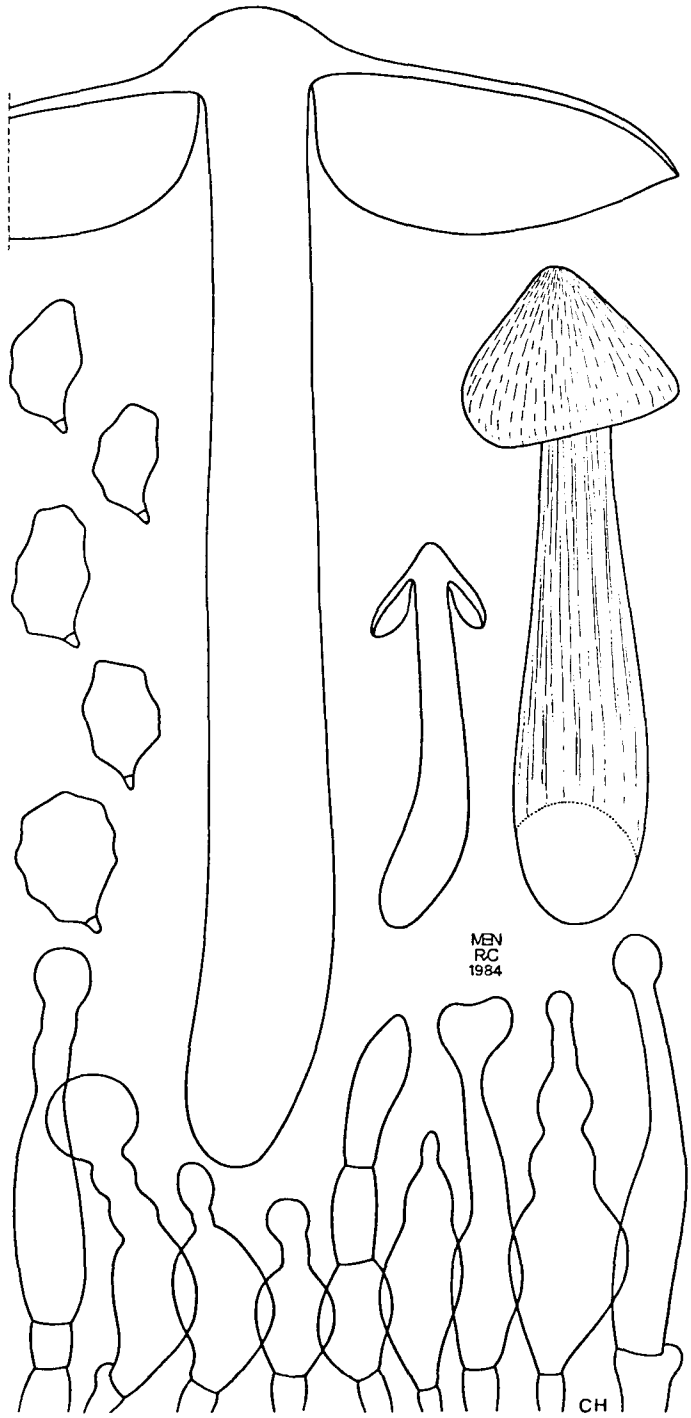

Fig. 140. *Entoloma porphyrophaeum.*

to 25 µm wide hyphae. Pigment brownish-purplish, intracellular in pileipellis. Clamp-connections present in hymenium and covering layers.

HABITAT & DISTR. – Solitary or in small groups in unmanured grassland on wet to rather dry, sandy or clayey, acid or basic soil. Rare. Widespread in W. and N.Europe. Aug.-Oct.

88. Entoloma elodes (Fr.: Fr.) Kumm., Führ. Pilzk.: 98. 1871. – Fig. 141.

Agaricus elodes Fr.: Fr., Syst. mycol. 1: 196. 1821; *Hyporrhodius elodes* (Fr.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 617. 1889; *Rhodophyllus elodes* (Fr.: Fr.) J.Favre, Assoc. fong. Hauts-Marais: 46. 1948.

MISAPPL. – *Rhodophyllus jubatus* sensu Konr. & M., Ic. sel. Fung. 2: pl. 193. 1932; *Rhodophyllus porphyrophaeus* sensu Konr. & M., Ic. sel. Fung. 2: pl. 190. 1932.

SEL. ICON. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: pl. 94c. 1981; Konr. & M., Ic. sel. Fung. 2: pl. 190, fig. 1. 1932 (as *R. porphyrophaeus*), and pl. 193. 1932 (as *R. jubatus*).

SEL. DESCR. & FIGS. – Arnolds & Noordel. in Fung. rar. Ic. col. 12: 21-32, fig. 24. 1981; J.Favre, Assoc. fong. Hauts-Marais: 46-47. 1948; Neuh. in Z.Pilzk. 1: 58. 1922.

VERN. NAME. – Veenmossatijnzwam.

Pileus 25-37 mm, obtusely conical to convex, soon expanding, finally applanate, with or without depressed centre, but usually umbonate, with involute margin at least when young, weakly hygrophanous, when moist (dark) sepiaceous grey, sometimes with yellow or reddish-purplish tinge (Mu. 10 YR 3/2, 3/3, 4/4; 7.5 YR 3/2; 5 YR (2/2) 3/2), not or only slightly pallescent on drying, not translucently striate, entirely micaceous to radially fibrillose-tomentose, glabrescent with age. Lamellae, L = 25-60, l = 1-7, moderately distant, adnate or slightly emarginate, segmentiform to broadly ventricose, white, then pink, finally tinged brown (7.5 YR 8/2, 8/4, 7/4, 6/4, 5/4), with slightly irregular, concolorous edge. Stipe 25-70 × 3-7 mm, cylindrical or compressed, sometimes broadened at base, white to pale or rather dark greyish brown or red-brown, always paler than pileus, silvery striate lengthwise, often twisted, sometimes pruinose at apex, downwards glabrous, solid or fistulose. Context brittle, concolorous with or paler than surface. Smell strongly farinaceous. Taste strongly farinaceous.

Spores (8.0-) 8.5-11.5 (-12.5) × (6.0-) 7.0-8.5 (-9.5) µm, Q = 1.15-1.5, $\bar{Q}$ = 1.3, irregularly 5-8-angled in side-view. Basidia 25-42 × 9.5-14 µm, 4-spored, clamped. Lamella edge sterile or (mostly) heterogeneous. Cheilocystidia 24-57 × 7-20 (-25) µm, clavate to lageniform, rarely subcapitate (3-9 µm), numerous to scattered, usually mixed with basidia. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged cylindrical hyphae, with up to 17 µm wide, cylindrical to clavate terminal elements. Pigment brown, intracellular in pileipellis. Clamp-connections numerous in hymenium and pileipellis.

HABITAT & DISTR. – In groups in living *Sphagnum* or on peaty soil. Rare. Widespread, but probably rare in peatbogs in the lowlands of W.Europe and S.Scandinavia. Aug.-Oct.

Entoloma elodes can easily be distinguished from the closely related *E. jubatum* and *E. porphyrophaeum* by colour, expanding pileus, strongly farinaceous smell and habitat in living *Sphagnum*. *Entoloma fuscomarginatum* differs in having a brown lamella edge.

89. Entoloma fuscomarginatum P.D.Orton in Trans. Br. mycol. Soc. 43: 228. 1960. – Fig. 142.

Rhodophyllus fuscomarginatus (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 3. Aufl.: 153. 1967.

SEL. DESCR. & FIGS. – Noordel. in Coolia 27: 61-63, fig. 2. 1984; P.D.Orton in Trans. Br. mycol. Soc. 43: 228-229, figs. 18, 19, 269, 411. 1960.

Pileus 15-60 mm, conico-campanulate, soon expanding to applanate, usually with pronounced, rarely weak umbo, with involute margin at first, weakly hygrophanous, when moist not translucently striate, sepia or reddish brown (Mu. 7.5 YR 5/4, 4/4) with slightly red purplish tinge, slightly pallescent on drying along radial streaks, innately radially fibrillose with some loose fibrils, almost smooth. Lamellae, L = about

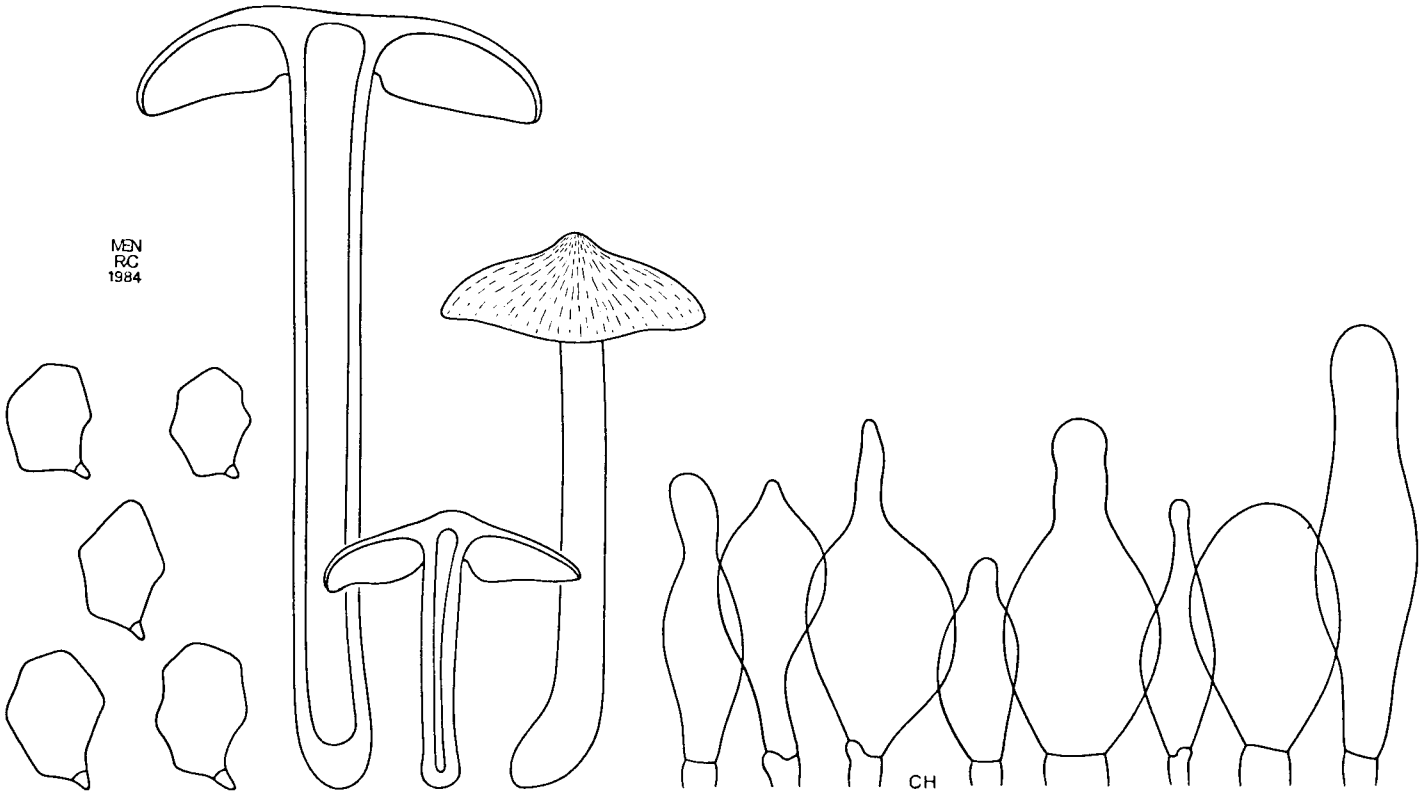

Fig. 141. *Entoloma elodes.*

50, l = 3-5-7, moderately crowded, free or adnexed, ventricose, pale pink (7.5 YR 8/2, 8/4) with minutely denticulate, brown edge. Stipe 25-60 × 2-7 mm, cylindrical, broadened towards base (up to 11 mm), entirely coarsely fibrillose with purplish brown fibrils on pale, almost white background (general appearance about 7.5 YR 6/4), in upper half with scattered fibrillose floccules, solid or fistulose. Context concolorous with surface, very brittle. Smell strongly farinaceous or reminiscent of coconut. Taste strongly farinaceous.

Spores 9.0-12.0 × 7.0-8.0 µm, Q = 1.2-1.5, $\bar{Q}$ = 1.4, 5-7-angled in side-view with blunt base. Basidia 35-50 × 8-12.5 µm, 4-spored, clamped. Lamella edge entirely sterile. Cheilocystidia 25-70 × 7.5-30 µm, lageniform to tibiiform, often distinctly capitate (2.5-7 µm), with brown intracellular pigment. Pileipellis a cutis with some ascending hyphae, made up of radially arranged, cylindrical to inflated hyphae up to 20 µm wide. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections present in hymenium and covering layers.

HABITAT & DISTR. – The only Netherlands' collection found on slightly acid sandy soil among *Empetrum nigrum* in old dunes. In Scotland frequently found in marshes and peatbogs, often in *Sphagnum*. Very rare (Terschelling: Grieltjeplak). Sept.-Nov.

As *Entoloma fuscomarginatum* has been found only once in the Netherlands, the description above is supplemented by observations on several collections from Scotland, where this mushroom occurs rather frequently in peaty or marshy areas. There are slight differences between the Netherlands' and the Scottish material: in Scotland, the basidiocarps usually have a dull brown colour with slight purple sheen and are rather strongly hygrophanous. Moreover, in the Scottish collections, the smell is always distinctly farinaceous, whereas the Netherlands' collection had a curious smell like a mixture of a weakly farinaceous component with a coconut-like one.

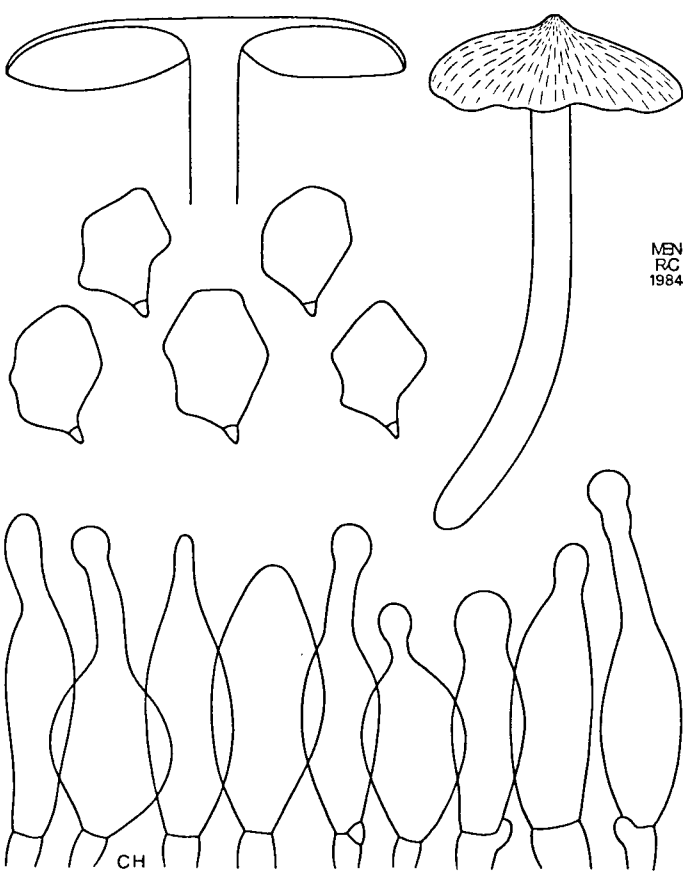

Fig. 142. *Entoloma fuscomarginatum.*

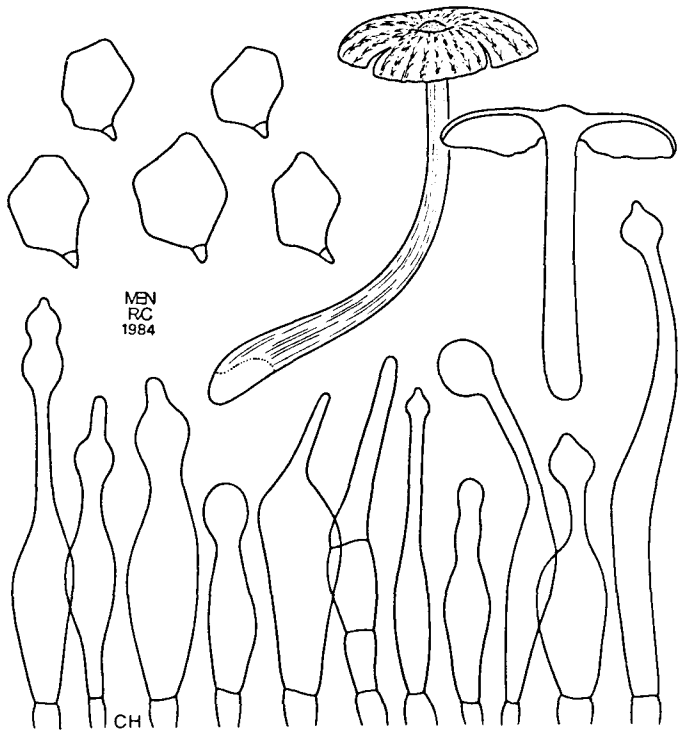

Fig. 143. *Entoloma scabiosum.*

90. Entoloma scabiosum (Fr.) Quél. in C.R. Ass. franç. Av. Sci. (Grenoble, 1885) 14: 445. 1886 (Champ. Jura Vosges 14). – Fig. 143.

Agaricus scabiosus Fr., Spicilegium: 3. 1836; *Rhodophyllus scabiosus* (Fr.) Quél., Enchir. Fung.: 58. 1886.

SEL. DESCR. & FIGS. – Kits in Persoonia 8: 460-466, figs. 1-4, 6-8. 1976.

Pileus 20-80 mm, conical at first, soon expanding to convex or irregularly applanate, usually with low, broad umbo, with slightly involute then straight margin, not hygrophanous, not translucently striate, coarsely radially fibrillose-squamulose with dark reddish brown or blackish brown fibrils on pale background, showing context of pileus between the fibrils (fibrils Mu. 10 YR 2/2, 3/2; 7.5 YR 4/2), at centre often densely tomentose or squamulose. Lamellae, L = 40-50, l = 3-7, rather crowded, deeply emarginate to (almost) free, segmentiform to ventricose, often distinctly transvenose, grey, then pinkish grey, finally brownish pink with fimbriate, white or concolorous edge. Stipe 30-75 (-110) × 2-6 mm, often distinctly broadened towards base (3-12 mm), (reddish) brown, paler than pileus with darker fibrils striate lengthwise, at base whitish tomentose, solid or fistulose. Context white to pale brown, very brittle in pileus and stipe. Smell indistinct. Taste indistinct.

Spores 7.0-8.0(-9.5) × 5.5-7.0 µm, Q = 1.1-1.4, $\overline{Q}$ = 1.2-1.3, 5-6-angled in side-view. Basidia 30-60 × 8-12 µm, 4-spored, clampless. Lamella edge heterogeneous to almost sterile. Cheilocystidia 25-65 × 2.5-20 (broadest part), × 2.5-10 (apex) µm, lecythiform to tibiiform, capitulum frequently with small conical protuberance, very numerous, but usually mixed with basidia. Pileipellis a cutis with transitions to a trichoderm, made up of 10-35 µm wide broadly fusoid terminal elements. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections absent from all tissues.

HABITAT & DISTR. – Solitary or in small groups; terrestrial in humus of deciduous forests on (humus-rich) clayey or sandy soil. Rare. Recently also collected in Belgium and Denmark. Sept.-Oct.

Entoloma scabiosum is a remarkable fungus with its strongly radially fibrillose-squamulose pileus and lecythiform to tibiiform cheilocystidia with appendiculate capitulum. It is the only clampless species in subgenus *Trichopilus.*

Subgen. **INOCEPHALUS** Noordel.

Habit mycenoid or tricholomatoid; pileus not or weakly hygrophanous, usually papillate, radially fibrillose to squamulose, velutinous or slightly to distinctly radially rimose; lamellae free or narrowly adnate, sometimes adnate but never decurrent; pileipellis a trichoderm or a transition between a cutis and a trichoderm made up of inflated hyphae; pigment intracellular, rarely also incrusting; clamp-connections usually present.

Sect. **Phlebophora** Noordel.

Pileus typically radially rimose to venose; cheilocystidia present, subcylindrical to lageniform; pigment intracellular, sometimes incrusting; clamp-connections present.

91. Entoloma kitsii Noordel. in Persoonia 12: 76. 1983. – Fig. 144.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 76-78, fig. 1. 1983.

Pileus about 45 mm, plano-convex with strongly undulating margin, with small papilla, not hygrophanous, translucently striate at margin only, dark bronze brown (Mu. 7.5 YR 4/2), paler at margin (7.5 YR 4/4), almost black at centre, minutely radially venose from margin to centre, minutely tomentose at centre. Lamellae, L = 25, l = 1-3, moderately crowded, free or narrowly adnate, venrtricose, pale brown with pink tinge then sordid pink-brown (7.5 YR 7/4-6/4), with concolorous, fimbriate edge. Stipe 50 × 3.5 mm, cylindrical, only slightly broadened towards base, reddish brown (5 YR 3/1 at base, upwards 5 YR 4/2) with grey tinge, at apex minutely striatulate-sulcate, finely white pruinose,

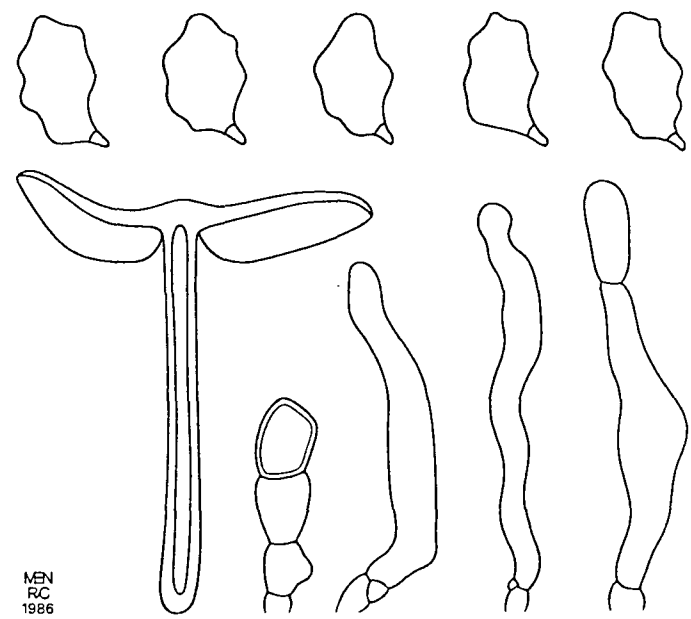

Fig. 144. *Entoloma kitsii.*

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fistulose. Context concolorous with surface. Smell weakly farinaceous. Taste strongly farinaceous.

Spores (8.5-) 9.5-11.0 × 6.0-7.0 µm, Q = 1.25-1.9, $\bar{Q}$ = 1.55, 5-8-angled in side-view with dihedral base. Basidia 25-42 × 9-15 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 37-127 × 4.5-8 (-9) µm, cylindrical and flexuose, sometimes subcapitate. Pileipellis a trichoderm of inflated or cylindrical hyphae with clavate terminal elements, 50-120 × 10-25 µm. Pigment brown, intracellular in pileipellis, (coarsely) incrusting in pileitrama. Brilliant granules absent. Clamp-connections abundant in hymenium.

HABITAT & DISTR. – Solitary, on humus-rich sandy soil in mixed forest of *Quercus* and *Pinus* in old coastal dunes. Very rare (Bloemendaal: Leyduin). Oct.

Entoloma kitsii is a very remarkable species with its dark, radially venose pileus and large cheilocystidia.

Sect. **Erophila** (Romagn.) Noordel.

Basidiocarps fleshy, more or less tricholomatoid; cheilocystidia absent or present, and then mixed with basidia and never capitate; clamp-connections present.

92. Entoloma plebejum (Kalchbr.) Noordel. in Persoonia 12: 462. 1985. – Fig. 145.

Agaricus plebejus Kalchbr., Ic. sel. Hymenomyc. Hungariae: 22. 1874; *Entoloma erophilum* var. *plebejum* (Kalchbr.) Sacc., Syll. Fung. 5: 681. 1887. – *Agaricus erophilus* Fr., Hymenomyc. eur.: 190. 1874; *Entoloma erophilum* (Fr.) P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp. 1: 257. 1879; *Rhodophyllus erophilus* (Fr.) Quél., Enchir. Fung.: 57. 1886. – *Entoloma erophilum* var. *pyrenaicum* Quél. in C.R. Ass. franç. Av. Sci. (Blois, 1884) 13: 279. 1885 (Champ. Jura Vosges 13); *Entoloma pyrenaicum* (Quél.) Sacc., Syll. Fung. 5: 682. 1887.

Pileus 11-40 mm, conico-campanulate to conico-hemispherical then expanding to convex, finally applanate with weak to distinct, conical umbo, sometimes within a slight central depression, with straight, sometimes reflexed margin, with marginal zone sometimes undulating with age, not hygrophanous, not translucently striate, dark grey-brown, more or less uniformly coloured or with darker to almost black centre and margin relatively pale (Mu. 10 YR 4/1, 4/2, 5/2; 7.5 YR 3/2, 4/2, 5/2, towards margin 10 YR 5/2, 6/3, 6/2), entirely fibrillose-velutinous when young, then radially fibrillose to almost costate with micaceous patches, at centre often velutinous, shiny, in old specimens often radially splitting from margin to half of radius. Lamellae, L = 25-40, l = 1-3, moderately distant, almost free to narrowly adnate, triangular then ventricose, up to 12 mm broad, frequently transvenose, grey then grey-pink (10 YR 6/2, 7/2, 5/2, 5/3) with slightly to coarsely eroded, concolorous or slightly paler edge. Stipe 25-78 × 2-6 mm, cylindrical or broadened towards base (up to 8 mm), pale grey to grey-brown or almost white, in general much paler than pileus (e.g. 10 YR 7/2, 7/3), entirely lanate-fibrillose when young, then innately fibrillose-striate with longitudinal fibrils, at apex often white pruinose, solid then narrowly fistulose. Context dark grey-brown in cortex of pileus and above attachment of lamellae, in stipe pale in inner parts, rather fibrous and brittle. Smell spontaneously weak, but distinctly herbaceous-subfarinaceous when cut. Taste farinaceous.

Spores (9.0-)10.5-14.5(-17.0) × 7.0-11.0 µm, Q = 1.1-1.7, $\bar{Q}$ = 1.3-1.6, irregularly many-angled almost nodulose in side-view. Basidia 31-65 × 10-16 µm, 4-, rarely also 2-spored, clamped. Lamella edge fertile or rarely heterogeneous. Cheilocystidia, if present, 35-100 × 5-20 × 2-9 µm, subcylindrical, usually attenuate towards apex, very sparse.

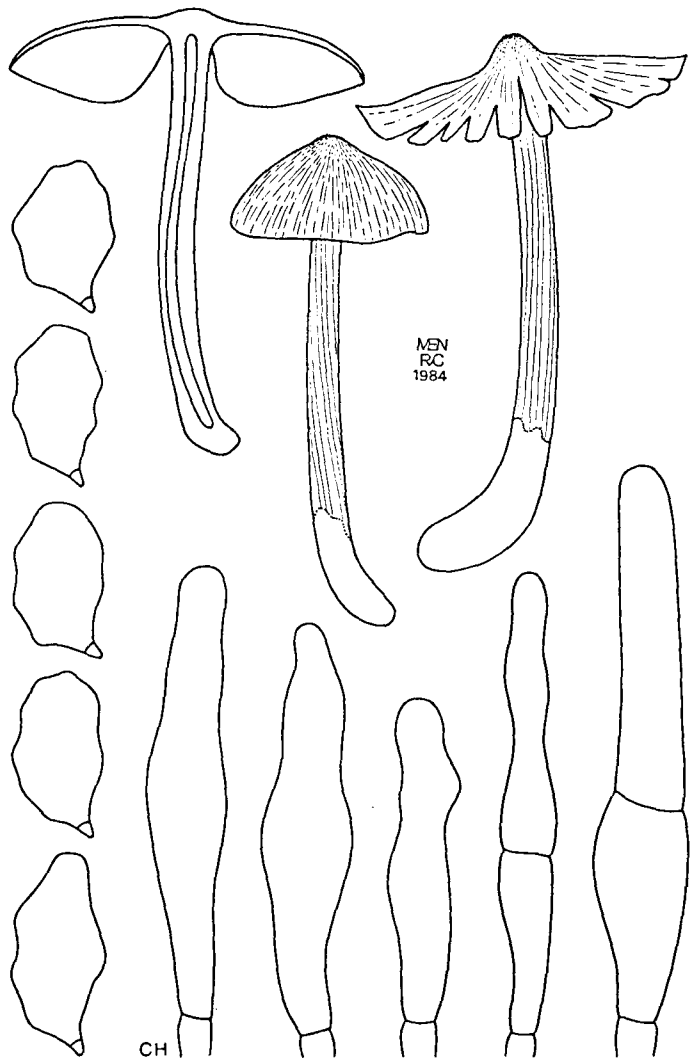

Fig. 145. *Entoloma plebejum*.

Pileipellis a trichoderm at centre, towards margin transition between a trichoderm and a cutis, made up of fusiform cells, 57-125 × 15-23 µm. Pigment brown, intracellular in pileipellis. Brilliant granules present in pileitrama. Clamp-connections present in hymenium, rare in other tissues.

HABITAT & DISTR. – Terrestrial on clayey soil in frondose forests, also in humus-rich sand in coastal dunes. Not uncommon. Widespread in W.Europe but, judging by the lack of good descriptions, a rare species. Jan.-July, probably strictly vernal.

Among the vernal species of *Entoloma*, *E. plebejum* is easily recognized by its conical, strongly fibrillose-felted pileus, reminiscent of a species of *Inocybe*, and the dark grey colours. It differs from the autumnal *E. resutum* and *E. plebeioides* in having larger, more irregularly nodulose-angular spores, and darker colours. *Entoloma jubatum*, which has a superficial macroscopical resemblance to *E. plebejum*, differs among other things in lecythiform cheilocystidia and smaller, differently shaped spores.

93. Entoloma plebeioides (S.Schulz.) Noordel. in Persoonia 12: 462. 1985. – Fig. 146.

Agaricus plebeioides S.Schulz. in Verh. zool. bot. Ges. Wien 26: 428.

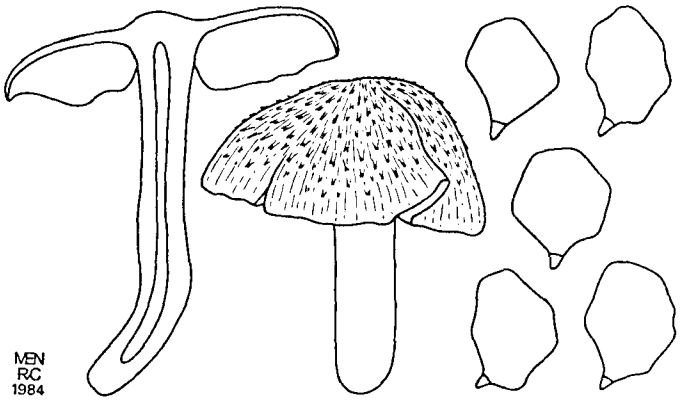

Fig. 146. *Entoloma plebeioides.*

1876. – *Entoloma holophaeum* Bres. & Schulz. in Hedwigia 24: 428. 1885.

Pileus 20-57 mm, irregularly conico-campanulate, then expanding to convex with slightly depressed or subumbonate centre, with straight margin, with strongly undulating marginal zone, not hygrophanous, not striate, very dark grey-brown (Mu. 10 YR 3/2, 4/2), only slightly paler towards margin (10 YR 5/2) when young entirely lanate-squamulose with appressed to slightly uplifted squamules, becoming fibrillose-subsquamulose with micaceous patches towards margin, finally almost costate with centre remaining squamulose. Lamellae, L = 22-30, l = 3-5-9, fairly crowded, broadly adnate to (deeply) emarginate, segmentiform to subventricose, up to 5 mm broad, sometimes transvenose, pale greyish cream, then grey-pink, finally rather dark grey-brown with pink tinge (10 YR 8/3, 7/3, 7/2, 6/3) slightly paler towards subentire to distinctly dentate edge. Stipe 25-58 × 3-9 mm, cylindrical, sometimes broadened towards base, pale to rather dark grey-brown, subconcolorous with pileus, fibrillose-striate lengthwise, solid to narrowly fistulose. Context rather dark brown-grey in cortex of pileus and stipe, paler in inner parts. Smell none. Taste unpleasant, not distinctly farinaceous or rancid.

Spores 8.0-12.0 × 7.0-8.5 µm, Q = 1.15-1.3, $\bar{Q}$ = 1.25, 5-7-angled in side-view with rather pronounced angles. Basidia 32-52 × 9.5-16 µm, 4- rarely also 2-spored, clamped. Lamella edge fertile. Cheilocystidia absent. Pileipellis a trichoderm at centre, towards margin a transition between a trichoderm and a cutis, made up of radially arranged cylindrical to inflated 8-16 µm wide hyphnae, with strongly inflated terminal elements 35-130 × 9-21 µm. Pigment intracellular in pileipellis. Brilliant granules absent. Clamp-connections absent.

HABITAT & DISTR. – In small groups in the grass of very old dune-areas on humus-rich sandy soil and in humus of frondose forest (*Fraxinus*) among grasses on a path. Very rare (Voorschoten: Ter Horst; Goeree: Westduinen). Distribution outside the Netherlands unknown. Sept.-Nov.

Entoloma plebeioides is a very rare species with dark brown, fibrillose-squamulose pileus and stipe. The spores are smaller than in the vernal species *E. plebejum.*

94. Entoloma resutum (Fr.) Quél. in Bull. Soc. bot. Fr. 23: 326. 1877 (Champ. Jura Vosges 4). – Fig. 147.

Agaricus resutus Fr., Epicr.: 145. 1838; *Rhodophyllus jubatus* var. *resutus* (Fr.) Quél., Enchir. Fung.: 58. 1886; *Rhodophyllus resutus* (Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 205. 1953 (not valid, basionym not mentioned).

SEL. DESCR. & FIGS. – Noordel. in Coolia 27: 60-61. 1984.

Pileus 10-30 mm, conical, then irregularly expanding with small papilla, with straight margin, not hygrophanous, not translucently striate, dark grey-brown (Mu. 10 YR 3/2, 3/3, 3/4, 4/3), not or only slightly paler towards margin, shiny radially fibrillose, with aeriferous fibrils, more or less lanate, then radially fibrillose, finally splitting up in radial rows of fibrillose squamules, showing paler trama in between the fibrils. Lamellae, L = 28-36, l = 1-5, rather distant, thickish, narrowly adnate, ventricose, dark grey, then grey-brown with pink tinge paler towards subentire to irregularly denticulate edge. Stipe 18-32 × 3-6 mm, cylindrical to compressed, sometimes twisted, with slightly to distinctly broadened base, (grey-)brown, paler than pileus, innately fibrillose appearing almost polished (like a species of *Leptonia*), rarely with some scattered fibrils substriate, solid or fistulose. Context concolorous with surface in cortex, pale and fibrous in inner parts. Smell none to weakly farinaceous. Taste distinctly farinaceous-rancid.

Spores 8.0-11.0 × 6.0-8.0 µm, Q = 1.25-1.6, $\bar{Q}$ = 1.35, 5-7-angled in side-view. Basidia 27-40 × 8-11 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm at centre, towards margin a transition between a trichoderm and a cutis, made up of radially arranged, 10-23 µm wide, inflated hyphae. Pigment brown, intracellular in pileipellis. Brilliant granules absent. Clamp-connections present in hymenium, elsewhere rare or absent.

HABITAT & DISTR. – In small groups among grasses near *Salix repens* in young coastal sand dunes. Very rare (Terschelling: Dazenplak). Distribution outside the Netherlands unknown. Nov.

Entoloma resutum is a distinctive species because of its dark, fibrillose-subsquamulose pileus and glabrous, polished stipe. *E. plebeioides* differs in having a darker, strongly fibrillose-striate stipe, and in lacking a distinct smell and taste.

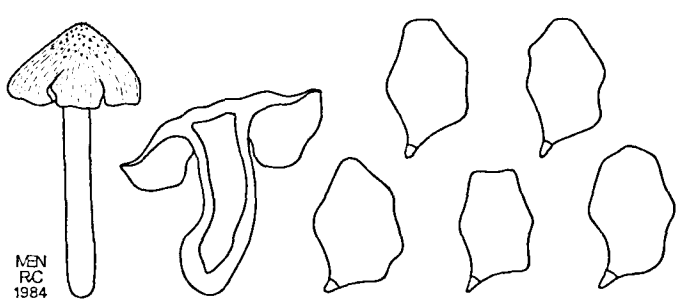

Fig. 147. *Entoloma resutum.*

Subgen. **ALBOLEPTONIA** (Larg. & Benedict) Noordel.

SEL. LIT. – Larg. & Benedict in Mycologia 62: 437-452. 1970.

Basidiocarps white, ochraceous or pale brown; pileipellis a cutis, sometimes with transitions to a trichoderm, made up of cylindrical to inflated hyphae up to 20 µm wide; pileitrama and hymenophoral trama made up of short elements; pigment, if present, intracellular; clamp-connections usually present.

Sect. **Candida** (Romagn.) Noordel.

Clamp-connections always present; pileipellis a cutis to a trichoderm of cylindrical to inflated hyphae without modified terminal elements.

95. Entoloma sericellum (Fr.: Fr.) Kumm., Führ. Pilzk.: 97. 1871. – Fig. 148.

Agaricus sericellus Fr.: Fr., Syst. mycol. 1: 196. 1821; *Rhodophyllus sericellus* (Fr.: Fr.) Quél., Enchir. Fung.: 61. 1886; *Hyporrhodius sericellus* (Fr.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 616. 1889; *Leptonia sericella* (Fr.: Fr.) Barbier in Bull. trimest. Soc. mycol. Fr. 27: 178. 1904; *Eccilia sericella* (Fr.: Fr.) Sing. in Collect. bot. 1: 218. 1947; *Alboleptonia sericella* (Fr.: Fr.) Larg. & Benedict in Mycologia 62: 446. 1970. – *Agaricus sericellus* var. *lutescens* Fr., Ic. sel. Hymenomyc. 1: 106. 1867; *Alboleptonia sericella* var. *lutescens* (Fr.) Larg. & Benedict in Mycologia 62: 446. 1970. – *Entoloma sericellum* var. *decurrens* Boud., Ic. mycol.: 49. 1904; *Leptonia sericella* var. *decurrens* (Boud.) Rea, Brit. Basidiomyc.: 347. 1922. – *Agaricus carneoalbus* With., Arr. Brit. Pl., Ed. 3, 4: 170. 1796; *Eccilia carneoalba* (With.) Quél. in Bull. Soc. bot. Fr. 26: 49. ('1879') 1880; *Rhodophyllus carneoalbus* (With.) Quél., Mém. Soc. Emul. Montbéliard, sér. II, 5: 345. 1873 (Champ. Jura Vosges 2). – *Agaricus molluscus* Lasch in Linnaea 3: 398. 1828; *Eccillia molluscus* (Lasch) D.Reid in Trans. Br. mycol. Soc. 41: 433. 1958. – *Eccilia molliusculus* ('Lasch') Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 345. 1873 (Champ. Jura Vosges 2); *Rhodophyllus molliusculus* ('Lasch') Romagn. in Bull. mens. Soc. linn. Lyon 8: 204. 1939. – *Leptonia aurea* Velen., Ceské Houby: 218. 1921.

MISAPPL. – *Rhodophyllus kervernii* sensu Romagn. in Kühn. & Romagn., Fl. anal. Champ. sup.: 181. 1953.

EXCL. – *Eccilia molluscus* sensu D.Reid in Trans. Br. mycol. Soc. 41: 433. 1958 (= *E. cephalotrichum*); *Rhodophyllus molliusculus* sensu Romagn. in Bull. mens. Soc. linn. Lyon 8: 204. 1939 (= *E. cephalotrichum*).

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 77E, 79B (as *R. carneoalbus*) 1937; R.Phillips, Mushr. other Fungi: 116. 1981 (as *L. serrulata*, corrected in Dutch translation!); Ryman & Holmåsen, Svampar: 380. 1984.

SEL. DESCR. & FIGS. – J.Favre, Assoc. fong. Hauts-Marais: 54-55, fig. 17. 1948; Mal. & Bert., Fl. Champ. sup. Maroc 1: 572. 1970.

VERN. NAME. – Sneeuwvloksatijnzwam.

Pileus 5-40 mm, hemispherical or campanulate, then convex with blunt or slightly depressed, rarely subpapillate centre, with involute margin when young, not distinctly hygrophanous, not translucently striate, white or whitish, often with yellow, ochraceous or pinkish tinge at centre, sometimes entirely lemon-yellow or ochraceous, especially when old (Mu. 2.5 Y 8/4-6, 10 YR 8/6), entirely felted, then radially fibrillose often showing context between the fibrils, sometimes splitting up in small triangular squamules especially at centre, at margin often sulcate, glabrescent with age. Lamellae, L = 20-35, l = 3-5, moderately distant to distant, broadly adnate often with small decurrent tooth, sometimes distinctly decurrent or slightly emarginate, arcuate then segmentiform or ventricose, up to 5 mm broad, white then purely pink with entire, concolorous edge. Stipe 20-60 × 2-4 mm, cylindrical or compressed, white or slightly tinged yellow, glabrous, hyaline, sometimes minutely pruinose, especially at apex, or minutely fibrillose-striate. Context thin-membranaceous in pileus, fibrillose in stipe, white. Smell none or weakly nauseating. Taste indistinct.

Spores 8.0-11.5 (-12.5) × 6.0-9.0 (-9.5) µm, Q = 1.1-1.4, $\bar{Q}$ = 1.25, 5-8-angled in side-view. Basidia 25-45 × 8-11.5 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 25-70 × 3-10 µm, cylindrical or lageniform, numerous to sparse. Pileipellis a cutis with transitions to a trichoderm, made up of 12-20 µm wide, cylindrical to inflated hyphae with clavate terminal elements up to 35 µm wide. Pigment absent or pale yellowish brown, intracellular in upper layer of pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in groups in grassland on moist, loamy or sandy soil in poorly manured (semi-)natural vegetations such as dune-meadows, but also at roadsides, and in heathlike grassland, rarely also found among humus in deciduous forest on rich, probably calcareous soil. Common. Widespread all over Europe and boreal N.America from lowlands up to alpine zone. Aug.-Oct.

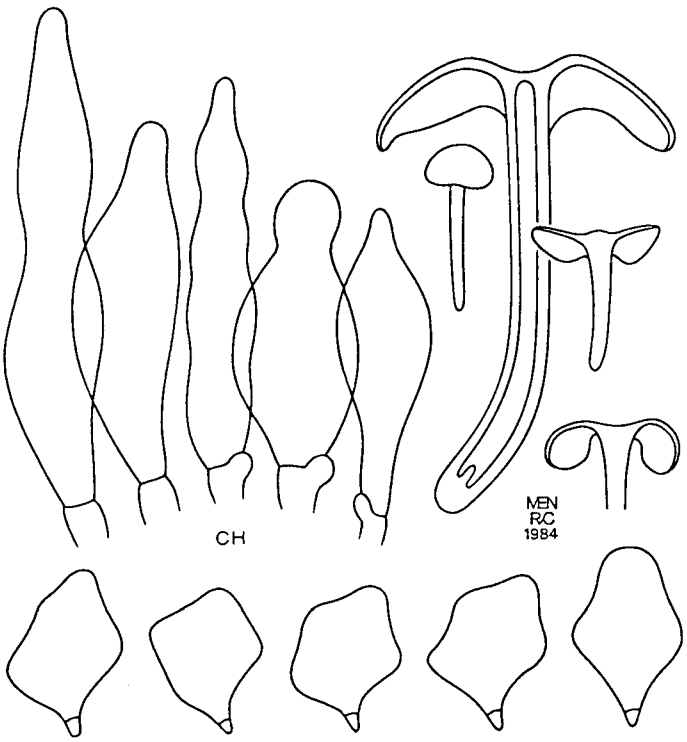

Fig. 148. *Entoloma sericellum*.

Entoloma sericellum is an easily recognized fungus with its pale basidiocarps and large cheilocystidia. The pileus usually has yellow tinges, especially at the centre, and often the stipe is also yellowish. White forms are rare, as is a pure yellow-ocre form. The latter probably represents *Rhodophyllus kervernii* sensu Romagn. The real *Entoloma kervernii*, however, is a species of subgen. *Leptonia* sect. *Cyanula*. It differs from *E. sericellum* among other things in having an entirely ochraceous, squamulose pileus, a white, fibrillose-striate stipe, an entirely sterile lamella edge with cylindrical and flexuose cheilocystidia, and clampless hyphae.

Entoloma olorinum and *E. percandidum* differ in having a deeply translucently striate pileus and a fertile lamella edge without cheilocystidia.

96. Entoloma olorinum (Romagn. & Favre) Noordel. in Persoonia 10: 260. 1979. – Fig. 149.

Rhodophyllus olorinus Romagn. & Favre in Rev. Mycol. 3: 75. 1938.

SEL. DESCR. & FIGS. – Romagn. & Favre in Rev. Mycol. 3: 60-62, fig. 1. 1938.

Pileus 15-30 mm, conico-convex, then expanding to convex or applanate, not too distinctly depressed at centre with slightly involute or straight margin, hygrophanous, when moist translucently striate up to half of radius, creamy white to pale yellowish pink or isabella (Mu. 2.5 Y 7/4, 8/4), especially at centre, pallescent on drying, glabrous, radially fibrillose, sometimes zonate when dry, shiny. Lamellae, L = 15-22, l = (1-)3-5(-9), distant, adnate to deeply emarginate or with decurrent

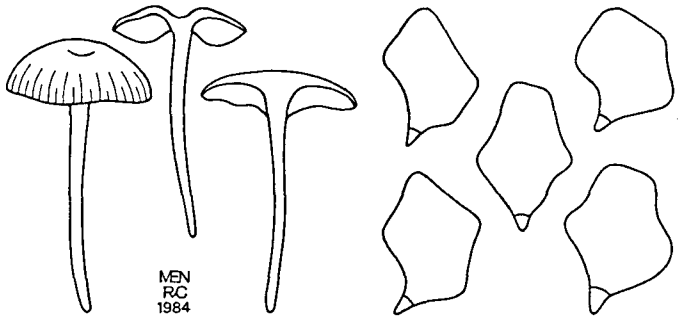

Fig. 149. *Entoloma olorinum.*

tooth, white, then pink with entire, concolorous edge. Stipe 20-55 × 1.5-3 mm, cylindrical or tapering downwards, white to cream or slightly pinkish-yellowish at base, hyalinous, glabrous or with fine, adpressed silvery striation, sometimes white pruinose at apex, usually narrowly fistulose. Context very thin, white-hyaline. Smell none. Taste none.

Spores 8.0-11.5 × 6.0-8.0 µm, Q = 1.1-1.7, $\bar{Q}$ = 1.35, 5-6-angled in side-view. Basidia 30-47 × 10-12.5 µm, 4-, rarely also 2-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of entangled cylindrical hyphae 10-15 µm wide, more like a trichoderm at centre with ascending cylindrico-clavate up to 25 µm wide terminal elements. Pigment almost absent, pale intracellular. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups in xerophytic grassland rich in moss on somewhat acid soil, also found on mossy trunk of *Salix* in swamp-forest on clayey soil. Rare. Probably rare all over W.Europe. Known from Belgium and France. June-Oct.

Entoloma olorinum is distinguished from *E. sericellum* by its translucently striate glabrous pileus and fertile lamella edge.

Sect. **Cephalotricha** Noordel.

Pileipellis a cutis of cylindrical hyphae with capitate terminal elements ('pileocystidia'); clamp-connections absent.

97. Entoloma cephalotrichum (P.D.Orton) Noordel. in Persoonia 10: 260. 1979. – Fig. 150.

Leptonia cephalotricha P.D.Orton in Trans. Br. mycol. Soc. 43: 291. 1960.

MISAPPL. – *Eccilia molliuscula* sensu Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 345. 1873 (Champ. Jura Vosges 2), non *A. molluscus* Lasch, 1828.

SEL. ICON. – Schavey in Sterbeeckia 9: 3. 1974 (as *R. molliusculus*).

SEL. DESCR. & FIGS. – P.D.Orton in Trans. Br. mycol. Soc. 43: 291-292. 1960; Romagn. in Bull. mens. Soc. linn. Lyon 8: 204-206. 1939 (as *R. molliusculus*).

VERN. NAME. – Hagelwitte satijnzwam.

Pileus 2-14 mm, convex then applanate, sometimes faintly depressed or with weak papilla, with involute margin, slightly hygrophanous, when moist translucently striate at margin, white to pale beige, becoming non-translucent, brilliantly white on drying, glabrous. Lamellae, L = 16-20, l = 1-3, distant, broadly adnate-emarginate or with decurrent tooth, triangular-segmentiform, sometimes transvenose, white then pink with eroded, concolorous edge. Stipe 10-30 × 0.5-2 mm, cylindrical, rarely compressed, white to pale grey or creamy yellow (Mu. 10 YR 8/6; 2.5 Y 8/6, 8/4, 8/2), smooth to weakly fibrillose-striate lengthwise, pruinose at apex. Context very thin, white or hyaline, brittle. Smell strongly farinaceous. Taste farinaceous.

Spores 8.0-12.5 × 6.0-7.0 (-7.5) µm, Q = 1.1-2.0, $\bar{Q}$ = 1.3-1.7, 5- to many-angled in side-view. Basidia 25-40 × 8-16 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 10-27 µm wide cylindrical hyphae with scattered cylindrical, capitate 5-7 µm wide hairs with round, 8-10 µm wide capitulum. Pigment none or very pale intracellular in upper layer of pileus. Caulocystidia at apex of stipe cylindrical 2-6 µm wide with very distinct, large, 8-12 µm wide capitulum. Clamp-connections absent.

HABITAT & DISTR. – In small groups, terrestrial, often on bare soil, on clay or peat, in parks and at roadsides, frequently on nitrogen-rich places. Fairly common. Widely distributed in W.Europe. Aug.-Oct.

Subgenus **LEPTONIA** (Fr.) Noordel.

SEL. LIT. – Larg., Gen. Leptonia Pac. Coast United States. 1977. – Noordel. in Beih. Nova Hedwigia 91. 1987.

Habit collybioid, rarely omphalioid or tricholomatoid; pileus usually depressed; not or weakly hygrophanous, fibrillose to squamulose; pileipellis a trichoderm, sometimes with transitions to a cutis or a hymeniderm, made up of inflated 10-40 µm wide elements; pigment intracellular, rarely also incrusting; clamp-connections present or absent.

Sect. **Leptonia** Noordel.

Habit tricholomatoid, mycenoid or collybioid; pileipellis a trichoderm or a transition between a cutis and a trichoderm, made up of septate cylindrical to inflated hyphae; pigment intracellular, sometimes in addition slightly incrusting; clamp-connections present in hymenium, frequently also in pileipellis and pileitrama.

98. Entoloma carbonicola Noordel. in Persoonia 11: 454. 1982. – Fig. 151.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 454-455, fig. 1. 1982.

Pileus about 18 mm, conico-convex with acute papilla, not hygrophanous, not translucently striate, grey with slight violaceous tinge, radially

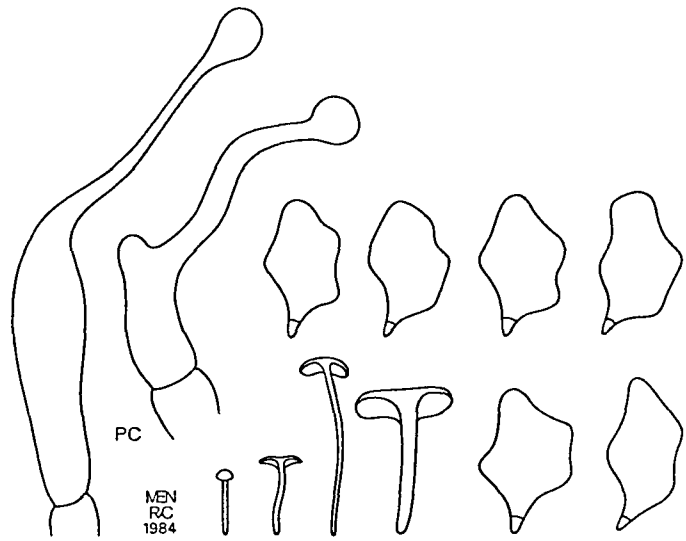

Fig. 150. *Entoloma cephalotrichum.*

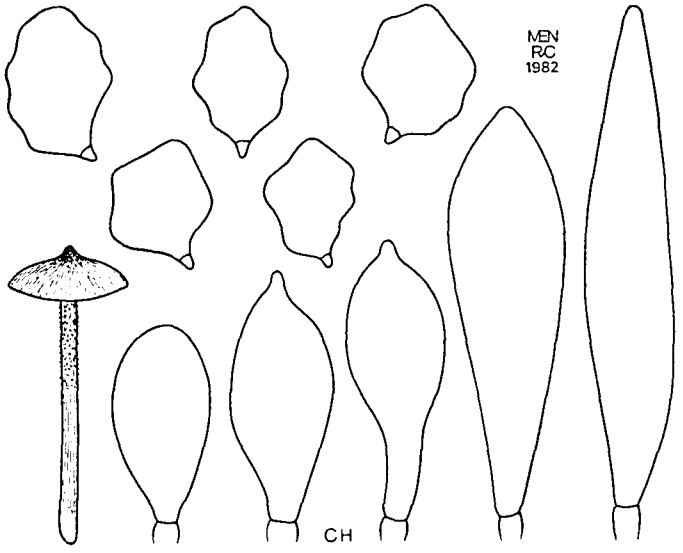

Fig. 151. *Entoloma carbonicola.*

fibrillose, somewhat shiny. Lamellae, L = 22, l = 3, moderately crowded, ventricose up to 3 mm broad, pink with concolorous edge. Stipe 3-5 × 3 mm, cylindrical, grey with dark grey fibrils, almost squamulose, solid. Context thin, membranaceous, concolorous with surface in pileus. Smell not known, probably indistinct. Taste not known.

Spores 9.0-11.0 (-12.0) × 7.0-8.5 µm, Q = 1.1-1.5, $\bar{Q}$ = 1.3, 5-8-angled in side-view. Basidia 22-37 × 9-11.5 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 24-52 × 10-17 µm, broadly clavate to fusiform with rounded, acute or mucronate apex, numerous, but mixed with basidia. Pileipellis a transition between a cutis and a trichoderm, made up of cylindrical to inflated 7-21 µm wide hyphae. Pigment brown, intracellular in pileipellis. Brilliant granules sparsely present in pileitrama.

HABITAT & DISTR. – Solitary on burnt peaty soil. Very rare; known only from the type-locality (Ospel: Grote Peel). Aug.

Entoloma carbonicola is a distinctive species with its acute, violaceous grey pileus, its grey fibrillose-squamulose stipe, and its cheilocystidia.

99. Entoloma hispidulum (M.Lange) Noordel. in Nord. J. Bot. 2: 159. 1982. – Fig. 152.

Rhodophyllus hispidulus M.Lange in Friesia 3: 210. 1946. – *Leptonia inocybeoides* P.D.Orton in Trans. Br. mycol. Soc. 43: 296. 1960.

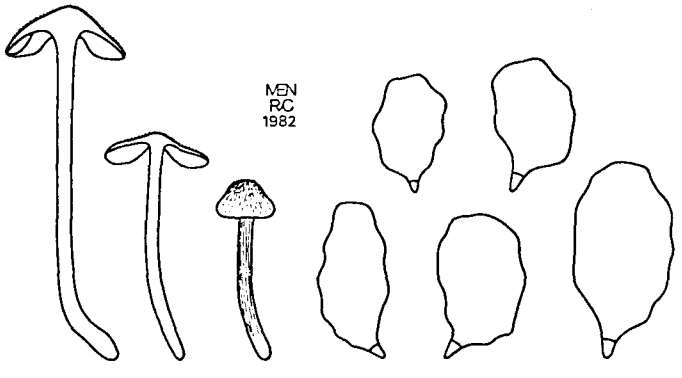

Fig. 152. *Entoloma hispidulum.*

SEL. ICON. – Arnolds, Ecol. Coenol. Grassl. Heathl. Drenthe, Netherlands 3: pl. 4b. ('1982') 1983.

SEL. DESCR. & FIGS. – Noordel. in Nord. J. Bot. 2: 159, fig. 16. 1982; Noordel. in Persoonia 11: 455-457, fig. 2. 1982; P.D.Orton in Trans. br. mycol. Soc. 43: 296. 1960 (as *L. inocybeoides*).

Pileus 5-20 mm, conico-convex, only slightly expanding, with margin slightly involute, then straight, not hygrophanous, not striate, grey-brown (Mu. 10 YR 6/4, 5/4, 4/2, 3/2) with darker centre, densely fibrillose-squamulose; centre often distinctly marked by clustered, uplifted squamules. Lamellae, L = 14-26, l = 1-3, (moderately) distant, free or narrowly adnate, sometimes emarginate, narrowly ventricose, rarely transvenose, sometimes thickish, white or pale grey, then pink, when old often with brown or grey tinge, with concolorous, entire edge. Stipe 15-55 × 1-3 mm, cylindrical, paler than pileus, yellowish or greyish brown (10 YR 7/3, 7/4, 6/4, 5/2 rarely 4/2) densely silvery striate lengthwise, at apex often slightly pruinose, white tomentose at base, sometimes with reddish tinge, solid. Context thin, membranaceous in pileus, concolorous with surface. Smell none. Taste mild.

Spores 9.5-12.0 (-14.0) × 6.5-8.5 µm, Q = 1.3-1.7 (-1.9), $\bar{Q}$ = 1.45, irregularly nodulose-angular, probably with dihedral base. Basidia 27-55 × 7-15 µm, 4- (rarely also 2-)spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a transition between a cutis and a trichoderm, made up of radially arranged, repent or slightly ascending clavate to fusiform, up to 35 µm wide elements. Pigment abundant, brown, intracellular in pileipellis, in addition in some collections minutely incrusting the hyphae of pileipellis and upper pileitrama. Clamp-connections abundant in hymenium and pileipellis.

HABITAT & DISTR. – Solitary or in small groups, terrestrial in grassland on humus-rich, sandy soil, on *Calluna* heaths, sometimes found on peaty soil or in slightly calcareous coastal dunes. Rare. Also known to occur in Great Britain and Denmark. Aug.-Nov.

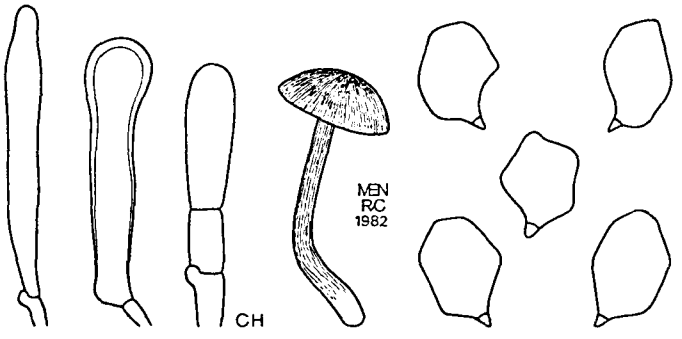

Fig. 153. *Entoloma euchroum.*

100. Entoloma euchroum (Pers.: Fr.) Donk in Bull. bot. Gdns Buitenz., ser. III, 18: 157. 1949. – Fig. 153.

Agaricus euchrous Pers., Syn. meth. Fung.: 343. 1801; *Agaricus euchrous* Pers.: Fr., Syst. mycol. 1: 203. 1821; *Leptonia euchroa* (Pers.: Fr.) Kumm., Führ. Pilzk.: 96. 1871; *Rhodophyllus euchrous* (Pers.: Fr.) Quél., Enchir. Fung.: 60. 1886; *Hyporrhodius euchrous* (Pers.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 615. 1889.

SEL. ICON. – H.Jahn, Pilze Holz: pl. 185. 1979; J.Lange, Fl. agar. dan. 2: pl. 79A. 1937; R.Phillips, Mushr. other Fungi: 116. 1981; Romagn. in Bull. trimest. Soc. mycol. Fr. 97, atl. pl. 225. 1981.

SEL. DESCR. & FIGS. – Horak, Syn. Gen. Agar.: 343. 1968; Noordel. in Persoonia 11: 457. 1982.

VERN. NAME. – Violette satijnzwam.

Pileus 9-40 mm, hemispherical or conico-convex, then expanding, usually with more or less applanate centre, rarely slightly umbilicate or with weak papilla, with slightly involute margin when young, later more or less straight, not hygrophanous, not translucently striate or very obscurely so at margin only, blue violaceous, often with brownish-sepiaceous tinge, particularly at centre with age, entirely flocculose-squamulose with slightly darker squamules on paler background (K. & W. 17E3, 19E3 with tinges like Mu. 10 YR 4/3, background more like 17D2-18D2). Lamellae, L = 20-40, l = 1-3, moderately crowded, adnate often with decurrent tooth, segmentiform to ventricose, pinkish grey-beige with distinct violaceous tinge to dark violaceous brown with pink tinge, sometimes with brown colour at base and near the fimbriate edge. Stipe 20-60 × 1.5-5 mm, cylindrical, sometimes compressed with bulbous base, concolorous with pileus, pale to dark violaceous, covered with loose, darker fibrils, sometimes with sepia tinge near base, at apex flocculose-squamules, sometimes white tomentose at base, solid or fistulose. Context concolorous with surface. Smell sweet, like that of soap or violet, fugaceous. Taste soapy.

Spores (8.0-) 9.5-11.5 × 6.0-8.0 µm, Q = 1.1-1.4, $\overline{Q}$ = 1.3, 5-7-angled in side-view. Basidia 27-45 × 9-12 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 22-47 × 6-12 µm, narrowly cylindrical to broadly clavate or obpyriform, thin-walled, colourless or with slightly thickened, brownish wall, particularly at apex, scarce to abundant, always mixed with basidia. Pileipellis a trichoderm of cylindrical, 7-19 µm wide, septate hyphae. Pigment violaceous, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in hymenium and covering layers.

HABITAT & DISTR. – Solitary or in small groups on dead and living deciduous wood (*Quercus*, *Alnus*, *Sorbus*, *Corylus*, *Fraxinus*) exceptionally on coniferous trees (*Chamaecyparus*). Fairly common. Common throughout W.Europe. Sept.-Oct.

Entoloma euchroum is easily recognized because of the violaceous colours in the basidiocarp and the lignicolous habitat. It can be distinguished from other species of sect. *Leptonia* with a lignicolous habitat by the violaceous lamellae.

101. Entoloma dichroum (Pers.: Fr.) Kumm., Führ. Pilzk.: 97. 1871. – Fig. 154.

Agaricus dichrous Pers., Syn. meth. Fung.: 343. 1801; *Agaricus dichrous* Pers.: Fr., Syst. mycol. 1: 202. 1821; *Rhodophyllus dichrous* (Pers.: Fr.) Quél., Enchir. Fung.: 58. 1886.

EXCL. – *Agaricus dichrous* sensu Fr., Summa Veg. Scandinaviae 2: 287. 1849; Ic. sel. Hymenomyc. 1: 105, pl. 92, fig. 3. 1867; *Entoloma dichroum* sensu Bres., Iconogr. mycol. 12: pl. 554. 1929; sensu Konr. & M., Ic. sel. Fung. 2: pl. 190, fig. 2. 1932; *Rhodophyllus dichrous* sensu J.Lange, Fl. agar. dan. 2: 93, pl. 72A. 1937 (= *Entoloma tjallingiorum* Noordel.).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 462-463, fig. 6. 1982.

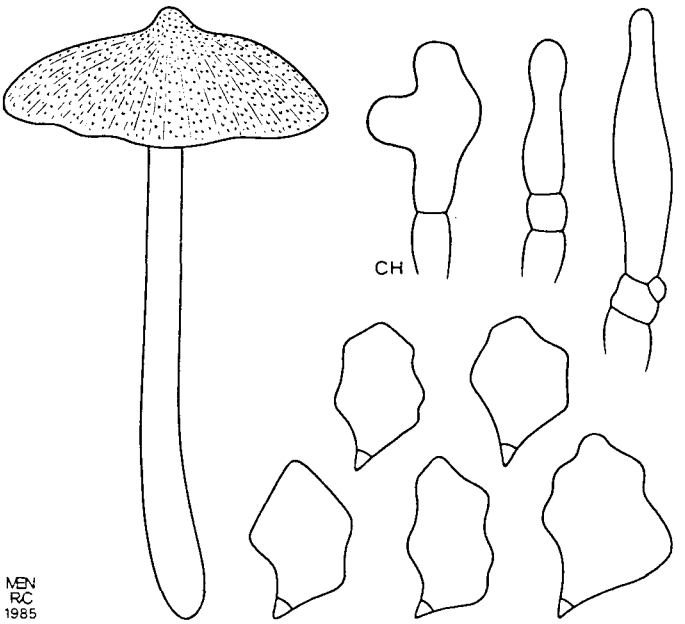

Fig. 154. *Entoloma dichroum*.

Pileus 7-55 mm, conical, then convex, finally plano-convex with or without papilla, never depressed, not hygrophanous, not translucently striate, dark violaceous (brown) then sepia or pinkish brown with purple tinge (K. & W. 12F3, 13F3-4(2) then more like Mu. 10 YR 3/3, 3/4 or 7.5 YR 4/2), entirely squamulose, when young fibrillose with subsquamulose centre, or granules. Lamellae, L = about 25, l = 1-3, moderately crowded, narrowly adnate or emarginate, triangular then ventricose, white then pink, finally pinkish brown (up to 7.5 YR 6/4, 5/4) with entire, concolorous edge. Stipe 20-60 × 2-5 mm, cylindrical, slightly broadened towards base, very dark grey-blue (19F3-4, 20F4-5) to violaceous blue, usually distinctly different from colour of pileus, glabrous, at base white tomentose, solid or narrowly fistulose. Context concolorous with surface, paler in inner part. Smell none or slightly spermatic. Taste not known.

Spores 9.0-12.0 × 7.0-10.0 µm, Q = 1.1-1.65, $\overline{Q}$ = 1.4, 6- to many-angled in side-view with rather pronounced sharp angles, slightly thick-walled. Basidia 27-50 × 7-15 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 20-42 × 5-16 (-25) µm, irregularly cylindrical to flexuose, sometimes septate, mixed with basidia. Pileipellis a transition between cutis and trichoderm, made up of radially arranged, up to 20 µm wide cylindrical to inflated hyphae with clavate terminal elements, 35-100 × 20-42 µm. Pigment abundant, brownish, intracellular in pileipellis and upper pileitrama. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Solitary or in small groups, terrestrial in mixed forest. Very rare (Egmond; Bennekom). Rare in W. and C.Europe. Aug.-Nov.

Entoloma dichroum is taken here in the restricted sense of Persoon and Noordel. non Fries (see synonymy). Characteristic are the smooth stipe, strongly angular spores and exclusively intracellular pigment. *Entoloma tjallingiorum* (= *dichroum* sensu Fries) differs in colour, habit, flocculose-squamulose stipe, thin-walled, obtusely angled spores, and incrusting pigment in pileitrama. *Entoloma callichroum* Horak & Noordel. differs among other things in having a pinkish-violaceous pileus.

102. Entoloma allochroum Noordel. in Persoonia 11: 463. 1982. – Fig. 155.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 463-465, fig. 7. 1982.

Pileus 28-32 mm, about 10-12 mm high, expanded conical with slightly inflexed margin, subumbonate, hardly hygrophanous, translucently at margin only, with a slightly lilaceous, fairly dark grey-brown velutinous covering broken up in minute granular greyish brown floccules on rather pale pinkish grey background (covering Mu. 7.5 YR 3/2, 4/2, 5/2, background 7.5 YR 6/4 to 10 YR 5/3). Lamellae fairly crowded,

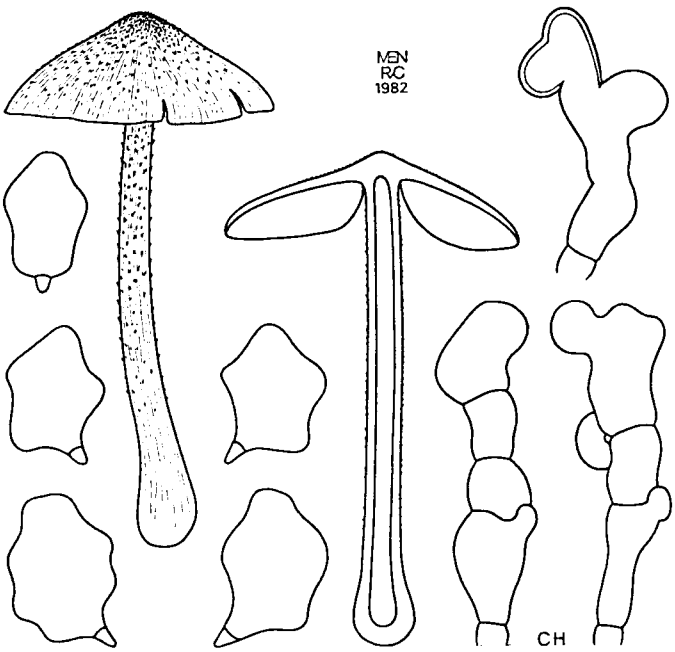

Fig. 155. *Entoloma allochroum*.

adnexed to free, moderately broad, 5-6 mm, slightly ventricose, pale brownish-pinkish sordid cream (7.5 YR 8/2 to 7/4) with slightly irregular, concolorous edge. Stipe 53-60 × 3.5-4.5 mm, cylindrical with subclavate, 7-10 mm broad base, pale violaceous with dark purple violaceous fibrillose covering and darker minutely fibrillose squamules, especially in upper half, with sordid white tomentum at base. Context hyaline pale brownish grey in pileus, paler in stipe-apex with pale sordid wax-yellow tinge in base of stipe. Smell not distinctive. Taste not distinctive.

Spores 9.5-12.5 × 7.0-9.5 µm, Q = 1.15-1.5, $\bar{Q}$ = 1.35, 6-9-angled in side-view with rather pronounced angles, slightly thick-walled. Basidia 34-54 × 9.5-11.5 µm, (2-)4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 30-55 × 5-10 µm, irregularly cylindrical to flexuose, septate, often slightly thick-walled, scattered among basidia. Pileipellis a cutis with transitions to a trichoderm of cylindrical up to 40 µm wide septate hyphae. Pigment brownish, intracellular in pileipellis, frequently also incrusting some hyphae of pileipellis and upper pileitrama. Clamp-connections abundant in hymenium and covering layers.

HABITAT & DISTR. – Solitary, terrestrial in garden. Very rare (Aerdenhout and The Hague). Aug.

Entoloma allochroum is distinguished from *E. dichroum* by colour, pigmentation of pileipellis, and surface of stipe; from *E. tjallingiorum* it is distinguished also by colours and strongly angular spores.

103. Entoloma tjallingiorum Noordel. in Persoonia 11: 465. 1982. – Fig. 156.

MISAPPL. – *Agaricus dichrous* sensu Fr., Summa Veg. Scandinaviae 2: 287. 1849; Ic. sel. Hymenomyc. 1: 105, pl. 92, fig. 3. 1867; *Entoloma dichroum* sensu Bres., Iconogr. mycol. 12: pl. 554. 1929; sensu Konr. & M., Ic. sel. Fung. 2: pl. 190, fig. 2. 1932; *Rhodophyllus dichrous* sensu J.Lange, Fl. agar. dan. 2; pl. 72A. 1937; Romagn. in Bull. trimest. Soc. mycol. Fr. 92: 299-301. 1976. – *Agaricus placidus* sensu Fr., Ic. sel. Hymenomyc. 1: 109, pl. 97, fig. 1. 1867.

SEL. ICON. – Ryman & Holmåsen, Svampar: 381. 1984.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 465-467, fig. 8. 1982.

VERN. NAME. – Stippelsteelsatijnzwam.

Pileus 20-50 mm, conico-convex or truncately conico-convex with or without weak umbo or with slightly umbilicate centre, with involute margin when young, later on more or less straight, not hygrophanous, not striate, grey-brown with or without blue patches or blue tinge especially near margin, coarsely radially fibrillose-squamulose or lanate all over. Lamellae subdistant, normally thick or slightly thickish, sometimes transvenose, segmentiform to ventricose up to 7 mm broad, white, then sordid pink, sometimes tinged blue, especially near subentire edge. Stipe 34-100 × 2.5-7 mm, cylindrical, often broadened towards base (up to 10 mm), dark blue-grey or indigo at apex, downwards more greyish or violaceous blue, with blackish blue fibrillose-squamulose covering, especially in upper part, at base sordid white tomentose, solid or fistulose. Context beige with violaceous blue tinge in pileus and cortex of stipe, often more greyish in centre of stipe. Smell not distinctive. Taste somewhat bitterish.

Spores 9.0-11.0 (-11.5) × 6.0-7.5 (-8.0) µm, Q = 1.2-1.7, $\bar{Q}$ = 1.5, thin-walled, weakly angled. Basidia 27-43 × 8-12 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 20-55 × 6-13 µm, cylindrical to clavate or irregularly flexuose to lageniform, scattered among basidia. Pileipellis a transition between a cutis and a trichoderm, made up of radially arranged, 7-24 µm wide hyphae with equally thick or slightly inflated up to 25 µm wide terminal elements. Pigment brownish, intracellular in pileipellis and also incrusting the hyphae of pileipellis and upper pileitrama. Clamp-connections abundant in all tissues studied.

HABITAT & DISTR. – In small groups or solitary, terrestrial or on rotton wood in *Quercus*-forest. Very rare (Bloemendaal: Koningshof). June-Nov.

Entoloma tjallingiorum is a very rare but widespread species. The description given above is based on material from various parts of north-western Europe (see also Persoonia 12: 467. 1982). For a discussion on related taxa, see *E. dichroum* and *E. allochroum*.

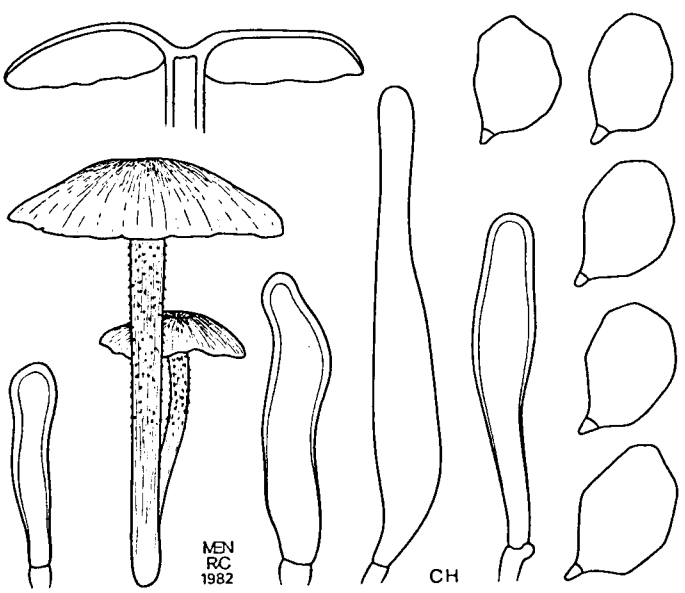

Fig. 156. *Entoloma tjallingiorum*.

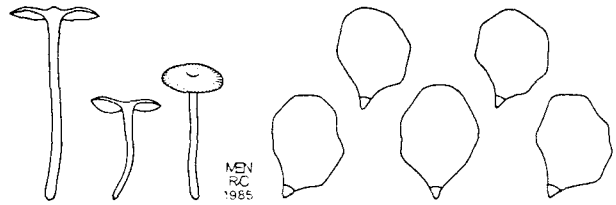

Fig. 157. *Entoloma juniperinum*.

104. Entoloma juniperinum Barkman & Noordel. in Persoonia 13: 123. 1986. – Fig. 157.

SEL. DESCR. & FIGS. – Barkman & Noordel. in Persoonia 13: 123-125, fig. 1. 1986.

Pileus 5-20 mm, convex then applanate with weakly depressed centre or with small, distinct papilla, with deflexed or straight margin, weakly hygrophanous, when moist dark grey-brown especially at centre, sometimes, especially when young, with blue tinge, translucently striate up to two-thirds of radius, slightly pallescent on drying, almost smooth to radially fibrillose, at centre usually with minute squamules. Lamellae, L = 10-25, l = 1-5 (-7), moderately distant, adnate, sometimes slightly emarginate or with decurrent tooth, segmentiform, rarely ventricose up to 6 mm broad, sometimes transvenose, white to grey, then pink, finally pinkish grey with entire, concolorous edge. Stipe 20-45 × 1-2 mm, cylindrical, sometimes slightly to distinctly swollen at base, steel-blue or blue, sometimes more brown with age, glabrous, polished. Context thin, with about the same colour as the surface of pileus and stipe. Smell not distinctive. Taste often distinctly farinaceous.

Spores 8.0-10.0 (-11.0) × 6.0-8.0 µm, Q = 1.05-1.25 (-1.3), $\bar{Q}$ = 1.1-1.2, subisodiametrical, 5-7-angled in side-view. Basidia (18-) 22-35 × 7.5-11 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged, septate, 4-15 (-20) µm wide cylindrical or slightly inflated hyphae with cylindrical terminal elements up to 22 µm wide. Pigment brown, intracellular in pileipellis and upper pileitrama. Clamp-connections present.

HABITAT & DISTR. – Among mosses, needles and grasses preferably in *Juniperus*-heaths on relatively rich, calcareous soils. Very rare (Bemelen: Bemelerberg). Widespread in Denmark, where it is fairly common in Jylland, also recorded from the German Federal Republic. Aug.-Nov.

Entoloma juniperinum is a fairly distinctive member of sect. *Leptonia* on account of the small basidiocarps and small, almost isodiametrical spores.

Entoloma juniperinum is a fairly distinctive member of sect. *Leptonia* on account of the small basidiocarps and small, almost isodiametrical spores.

105. Entoloma lepidissimum (Svrček) Noordel. in Persoonia 11: 460. 1982. – Fig. 158.

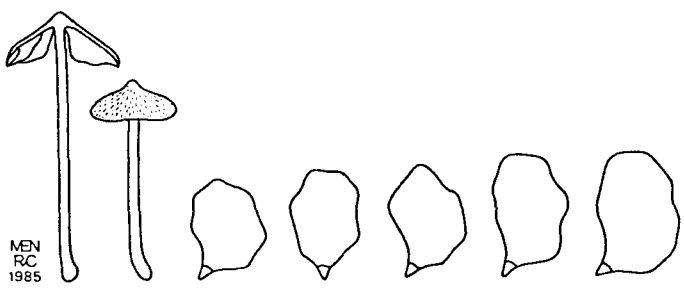

Fig. 158. *Entoloma lepidissimum*.

Leptonia lepidissima Svrček in Ceská Mykol. 18: 205. 1964; *Rhodophyllus lepidissimus* (Svrček) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 203. 1978.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 11: 460-461, fig. 5. 1982.

Pileus 5-10 mm, conical to convex with small papilla, with straight margin, not hygrophanous, slightly translucently striate at margin only, deep blue (K. & W. 21F8), radially fibrillose. Lamellae, L = 20, l = 0-3, distant, adnate, ventricose, pale blue then pinkish grey with concolorous, entire edge. Stipe 25 × 1-2 mm, cylindrical, blue, concolorous with pileus, glabrous, polished. Context thin, concolorous with surface. Smell none. Taste not known.

Spores 7.5-11.0 × 6.0-8.0 µm, Q = 1.2-1.5, $\bar{Q}$ = 1.35, 6-8-angled in side-view. Basidia 25-48 × 8-11.5 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent (see note). Pileipellis a cutis with transitions to a trichoderm, made up of 5-15 µm wide, inflated hyphae. Pigment blue, intracellular in pileipellis. Clamp-connections present.

HABITAT & DISTR. – Terrestrial in moss along path in coniferous forest on slightly calcareous soil. Also known from deciduous forest and grassland. Very rare (O.Flevoland: Roggebotszand). Also known from W. and E.Germany, Czechoslovakia, Austria, Norway and France, but apparently rare. July-Oct.

The Netherlands' collection is poor in specimens and did not show cheilocystidia. Some extralimital collections, however, have scattered cylindrical cheilocystidia, 25-50 × 6-15 µm. The colour of the lamellae is variable also, viz. from almost purely white to distinctly blue when young.

Sect. Griseorubida (Romagn.) Noordel.

Pileus truncately conical to convex with depressed centre; pileipellis a cutis to a trichoderm of 10-30 µm wide inflated hyphae; clamp-connections present; cheilocystidia, if present, large, fusiform to lageniform.

106. Entoloma griseorubidum (Kühner ex) Noordel. in Persoonia 12: 196. 1984. – Fig. 159.

Rhodophyllus griseorubidus Kühner in Kühn. & Romagn., Fl. anal. Champ. sup.: 201. 1953 (not valid, no Latin diagn.).

MISAPPL. – *Eccilia griseorubella* sensu Konr. & M., Ic. sel. Fung. 2: pl. 185, fig. 1. 1928.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 196-198, fig. 1. 1984.

Pileus 20-32 mm, convex with depressed to umbilicate centre, with involute margin, not or weakly hygrophanous, not or only slightly translucently striate at margin, grey-brown (Mu. 10 YR 3/2-4/2), innately radially fibrillose, at centre tomentose or rugulose. Lamellae, L = 18-36, l = 1-3, moderately distant, adnate to subdecurrent, segmentiform, then ventricose, white, then pink with fimbriate, concolorous edge. Stipe 40-60 × 2-5 mm, cylindrical or attenuated towards base, concolorous with or slightly paler than pileus, flocculose to fibrillose at apex, downwards fibrillose-striate, white tomentose at base, solid or narrowly fistulose. Context concolorous with surface, paler in inner parts. Smell none. Taste not distinctive.

Spores 10.0-14.0 × 8.0-11.5 µm, Q = 1.1-1.5, $\bar{Q}$ = 1.2-1.3, irregularly rectangular to broadly ellipsoid, 5-9-angled in side-view. Basidia 27-55 × 8.5-14 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 35-110 × 7.5-23 µm, lageniform with long, tapering

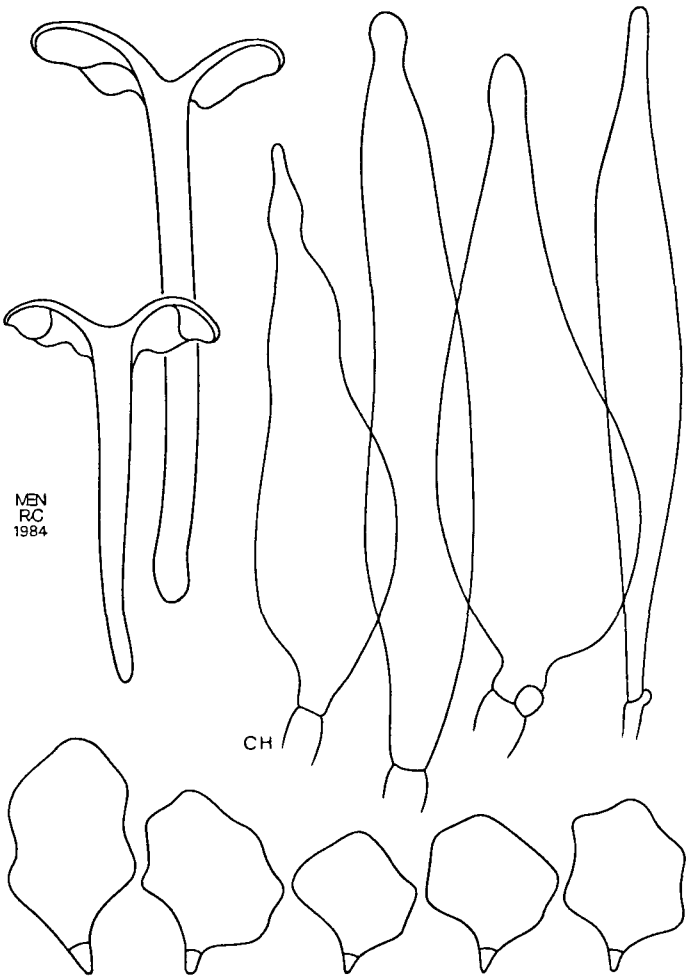

Fig. 159. *Entoloma griseorubidum.*

neck 3.5-6 µm wide, sometimes with acute apex, always numerous, but mixed with basidia. Pileipellis a cutis at margin, more like a trichoderm at centre, made up of radially arranged inflated 10-25 µm wide hyphae. Pigment intracellular in pileipellis. Clamp-connections present in hymenium.

HABITAT & DISTR. – Terrestrial in deciduous and coniferous forest. Very rare (Groningen: Helpman). Rare in Europe. July-Sept. (Jan.).

Entoloma griseorubidum is a highly distinctive species with its clamped basidia, large cheilocystidia and pileipellis with broad hyphae. It is extremely rare in the Netherlands, and has been collected only once. The description above is supplemented by observations on extralimital material.

107. Entoloma calaminare Noordel. in Persoonia 12: 198. 1984. – Fig. 160.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 198-200, fig. 2. 1984.

Pileus 17-18 mm, conico-convex, truncate with slightly depressed centre, with straight margin, not hygrophanous, not striate, pale grey ochraceous, strongly radially fibrillose, shiny. Lamellae, L = 18-20, l = 1-3, fairly distant, adnate to emarginate with small decurrent tooth, triangular, then ventricose, grey then grey-pink with entire, concolorous edge. Stipe 25-50 × 1-2 mm, cylindrical or slightly broadened at base, pale brown with slight grey tinge, glabrous, polished, at base white tomentose, solid. Context thin, concolorous with surface, very brittle. Smell none. Taste not distinctive.

Spores 10.0-14.0 × 7.0-9.0 µm, Q = 1.2-1.6, $\bar{Q}$ = 1.4, irregularly nodulose-angular on side-view. Basidia 27-43 × 10.5-14 µm, 4-spored, clamped. Lamella edge heterogeneous or almost sterile. Cheilocystidia 27-58 × 16-29 µm, broadly fusiform to lageniform, numerous. Pileipellis a cutis with scattered trichodermal bundles of clavate elements up to 12 (-15) µm wide. Pigment brown, intracellular in pileipellis. Clamp-connections abundant in hymenium.

HABITAT & DISTR. – In small groups on roots of grasses in poorly manured grassland on clay along river. Very rare (Vaals: Cottessen). Sept.

108. Entoloma cocles (Fr.) Noordel. in Persoonia 11: 149. 1981. – Fig. 161.

Agaricus cocles Fr., Epicr.: 158. 1838; *Rhodophyllus cocles* (Fr.) Quél., Enchir. Fung.: 65. 1886; *Nolanea cocles* (Fr.) Sacc., Syll. Fung. 5: 728. 1887.

SEL. ICON. – Rick., Blätterpilze: pl. 73, fig. d. 1910.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges.: 47: 34, fig. 3. 1976.

Pileus 10-20 mm, conical, only slightly expanding with age, with or without depressed centre, with straight sometimes crenulate margin, hygrophanous, when moist translucently striate up to centre, at centre and on striae very dark brown-grey to almost black (Mu. 10 YR 3/2), towards margin and between striae (slightly) paler (10 YR 4/4), minutely innately radially fibrillose to almost glabrous, shiny. Lamellae, L = 15-30, l = 0-3, moderately distant to distant, narrowly to broadly adnate, segmentiform to ventricose up to 4 mm broad, pale grey, then pink, finally brown-pink (finally almost 5 YR 5/3-4), with minutely fimbriate, concolorous edge. Stipe 20-45 × 1-2 mm, cylindrical, sometimes broadened at base, pale brown, paler than pileus, glabrous, solid. Context thin, almost concolorous with surface in pileus, slightly paler to almost white in inner part of stipe. Smell farinaceous. Taste farinaceous.

Spores 9.5-14.0 (-14.5) × 8.0-10.5 µm, Q = 1.1-1.5, $\bar{Q}$ = 1.35, irregularly 4-9-angled in side-view. Basidia 25-54 × 8.5-13 µm, 4-,

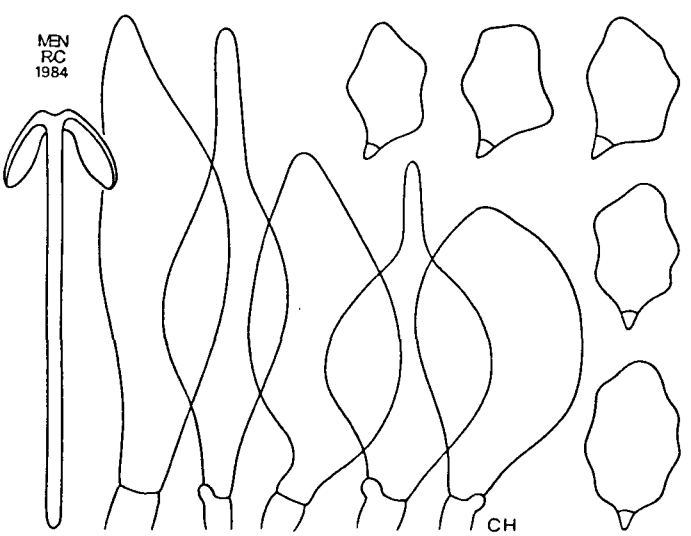

Fig. 160. *Entoloma calaminare.*

rarely also 2-spored, clamped. Lamella edge heterogeneous. Cheilocystidia 35-80 × 7.5-16 µm, (broadly) fusiform to lageniform, rarely lecythiform, neck 2.5-9 µm wide, usually abundant, but mixed with basidia. Pileipellis a cutis, rarely with transitions to a trichoderm, made up of radially arranged, cylindrical to slightly inflated 6-13 µm wide hyphae with scattered tufts of clavate terminal elements up to 17 µm wide. Pigment intracellular in pileipellis and upper pileitrama. Brilliant granules absent. Clamp-connections present.

HABITAT & DISTR. – In poorly manured grassland with *Juniperus* on slightly acidified, but basically calcareous loam (Netherlands), in *Sphagnum*-bogs and subalpine meadows (C.Europe). Very rare (Winterswijk: Willinks Weust). Widespread but rare in W. and C.Europe. Aug.-Nov.

Entoloma cocles is distinguished from all other cystidiate members of sect. *Griseorubida* by its distinctly translucently striate, hygrophanous pileus.

109. Entoloma farinasprellum Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 329. ('1982') 1983. – Fig. 162.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 4a. ('1982') 1983.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 329-331, fig. 145. ('1982') 1983.

Pileus 8-26 mm broad, truncately campanulate or hemispherical, expanding to plano-convex with depressed to umbilicate centre, with margin involute at first, weakly to strongly hygrophanous, when moist translucently striate up to centre, dark grey-brown when young (Mu. 10 YR 4/3, 5/3), then moderately dark brown with darker centre and striation, glabrous, pallescent on drying and strongly radially fibrillose, subsquamulose at centre. Lamellae, L = 15-25, l = 1-3 (-7), distant, variably inserted, from broadly adnate with decurrent tooth to deeply emarginate or almost free, ventricose, pallid, then sordid flesh-colour, with grey tinge, finally rather dark brown-pink, with entire, concolorous or partly brownish edge. Stipe 15-35 × 1-4 mm, cylindrical or slightly broadened at base, grey-brown, usually browner and paler than pileus, slightly pruinose at apex, downwards glabrous, polished, at base white tomentose, solid or fistulose. Context thin, concolorous with surface, fibrillose-brittle in pileus, fibrillose-tough in stipe. Smell strongly farinaceous. Taste strongly farinaceous.

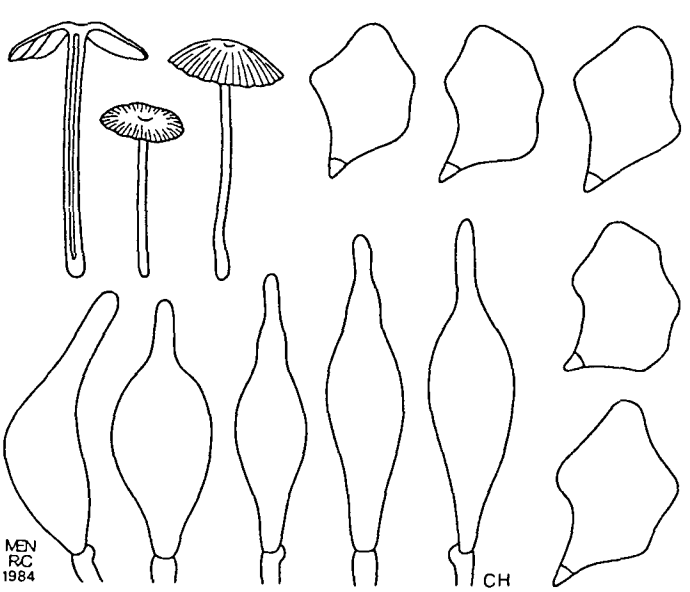

Fig. 161. *Entoloma cocles*.

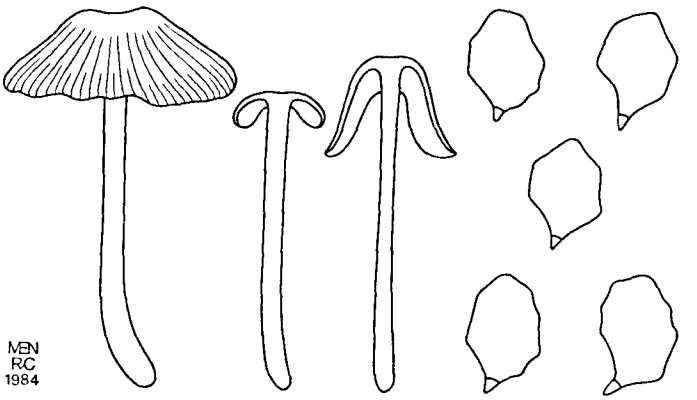

Fig. 162. *Entoloma farinasprellum*.

Spores 7.5-11.0 × 6.0-7.5 (-8.0) µm, Q = 1.15-1.45, $\bar{Q}$ = 1.3, ellipsoid in outline with 6-10 angles. Basidia 24-42 × 9-15 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis at margin, more like a trichoderm at centre, made up of radially arranged, inflated 10-18 µm wide hyphae with clavate up to 25 µm wide terminal elements. Pigment brown, intracellular in pileipellis. Clamp-connections present, abundant in hymenium, scattered in other tissues.

HABITAT & DISTR. – In small groups in dry grassland with rich moss-layer on subneutral, humus soil, and in coastal dunes on sandy soil with scanty vegetation. Very rare (Beilen: Smalbroek; Terschelling: Boschplaat). Sept.-Nov.

Entoloma farinasprellum is placed in sect. *Griseorubida* on account of habit, type of pileipellis and clamped hyphae. It differs from other species in this section by small spores and fertile lamella edge.

Sect. **Cyanula** (Romagn.) Noordel.

Basidiocarps collybioid, more rarely mycenoid or omphalioid; clamp-connections absent; cheilocystidia, if present, of the basidiole-like type or lamella edge entirely sterile made up of terminal elements of trama hyphae; pileipellis at centre of pileus a trichoderm or a hymeniderm of inflated elements.

110. Entoloma serrulatum (Fr.: Fr.) Hesler in Beih. Nova Hedwigia 23: 140. 1967. – Fig. 163.

Agaricus serrulatus Fr.: Fr., Syst. mycol. 1: 204. 1821; *Leptonia serrulata* (Fr.: Fr.) Kumm., Führ. Pilzk.: 96. 1871; *Rhodophyllus serrulatus* (Fr.: Fr.) Quél., Enchir. Fung.: 60. 1886. – *Agaricus atrides* Lasch: Fr., Syst. mycol. 3 (Index): 8. 1832; *Eccilia atrides* (Lasch: Fr.) Kumm., Führ. Pilzk.: 94. 1871; *Rhodophyllus atrides* (Lasch: Fr.) Quél., Enchir. Fung.: 63. 1886; *Leptonia serrulata* var. *atrides* (Lasch: Fr.) Konr. & M., Agaricales 1: 217. 1924. – *Leptonia serrulata* f. *laevipes* Maire in Bull. trimest. Soc. mycol. Fr. 26: 174. 1910.

SEL. ICON. – Konr. & M., Ic. sel. Fung. 2: pl. 184, fig. 1. 1932; Ryman & Holmåsen, Svampar: 382. 1984.

SEL. DESCR. & FIGS. – J.Lange in Dansk bot. Ark. 2(11): 32. 1921; F.Møller, Fungi Faeröes 1: 245, fig. 115. 1945.

VERN. NAME. – Zwartsneesatijnzwam.

Pileus 6-35 mm, hemispherical then conico-convex, expanding to plano-convex, finally applanate with undulating marginal zone, with margin slightly to distinctly involute when young, not hygrophanous, not translucently striate, dark blackish blue, bluish grey or violaceous blue, uniformly coloured, while expanding with age turning violaeous brown as the context becomes visible between the dark blue fibrils (K. & W. 15-21E-F5-2; Mu. 10 YR 5/2, 6/2 + blue), entirely rugulose or tomentose when young, becoming squamulose or squarrulose with age, especially at centre; at margin usually glabrous to radially fibrillose, shiny, especially when dry. Lamellae, L = 20-40, l = (1-) 3-7, moderately crowded, adnate or emarginate, rarely subdecurrent, arcuate, then segmentiform, rarely ventricose, sometimes transvenose, pale to fairly dark blue when young, especially near margin of pileus, then greyish pink with strongly contrasting blackish blue crenulate to denticulate edge. Stipe 20-50 × 1.5-4 mm, cylindrical or compressed with longitudinal groove, rarely with swollen base, concolorous with pileus when young, soon paler and more greenish-olivaceous or brown-grey covered with darker, bluish, adpressed flocculose fibrils, rarely glabrous, at apex white pruinose, white tomentose at base. Context concolorous with surface except for pallid inner part, brittle. Smell none or weakly to strongly aromatic like flowers (violets). Taste none or nasty-rancidulous.

Spores 9.0-11.5 × 6.5-8.0 µm, Q = 1.15-1.6, $\bar{Q}$ = 1.25-1.3, ellipsoid in outline with 5-7 angles in side-view. Basidia 24-53 × 8-15 µm, 4-spored, clampless. Lamella edge entirely sterile. Cheilocystidia 25-100 × 3.5-20 µm, cylindrical to clavate, very abundant, forming a thick sterile band along edge, always with blue intracellular pigment. Pileipellis a cutis to a trichoderm at margin, a trichoderm to a hymeniderm at centre, made up of cylindrical to clavate 8-35 (-40) µm wide terminal cells. Pigment blue, intracellular in pileipellis and upper pileitrama. Brilliant granules rare to abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In groups in poorly manured, semi-natural grassland on moist to relatively dry, sandy, peaty or clayey, acid to basic soil. Fairly common. July-Nov.

Entoloma serrulatum is the most common species of '*Leptonia*' in Europe, and occurs in many types of poorly manured grassland, natural grasslands, etc. from sea-level up into the subalpine zone. It occurs also in N.America, where it frequently grows in forests.

111. Entoloma caesiocinctum (Kühner) Noordel. in Persoonia 11: 470. 1982. – Fig. 164.

Rhodophyllus caesiocinctus Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 4. 1954 (Compl. Fl. anal. 1); *Leptonia caesiocincta* (Kühner) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960. – *Entoloma purpureomarginatum* Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 344. ('1982') 1983.

MISAPPL. – *Leptonia linkii* sensu Bres., Iconogr. mycol. 12: pl. 567. 1929.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 3c. ('1982') 1983 (as *E. purpureomarginatum*); Bres., Iconogr. mycol. 12: pl. 567. 1929 (as *L. linkii*).

SEL. DESCR. & FIGS. – Kühner in Rev. Mycol. 19: 43-46. 1954 (Compl. Fl. anal. 1).

Pileus 8-40 mm, hemispherical, then expanding to convex, finally applanate, slightly to distinctly depressed to umbilicate at centre, sometimes infundibuliform, not hygrophanous, usually slightly to distinctly translucently striate at margin when moist, brown or yellow-brown, sometimes with reddish flush, frequently with blue tinge near margin especially when young (Mu. 7.5 YR and 10 YR 3-5/2-4), radially fibrillose, becoming squamulose at centre. Lamellae, L = 20-36, l = 3-7,

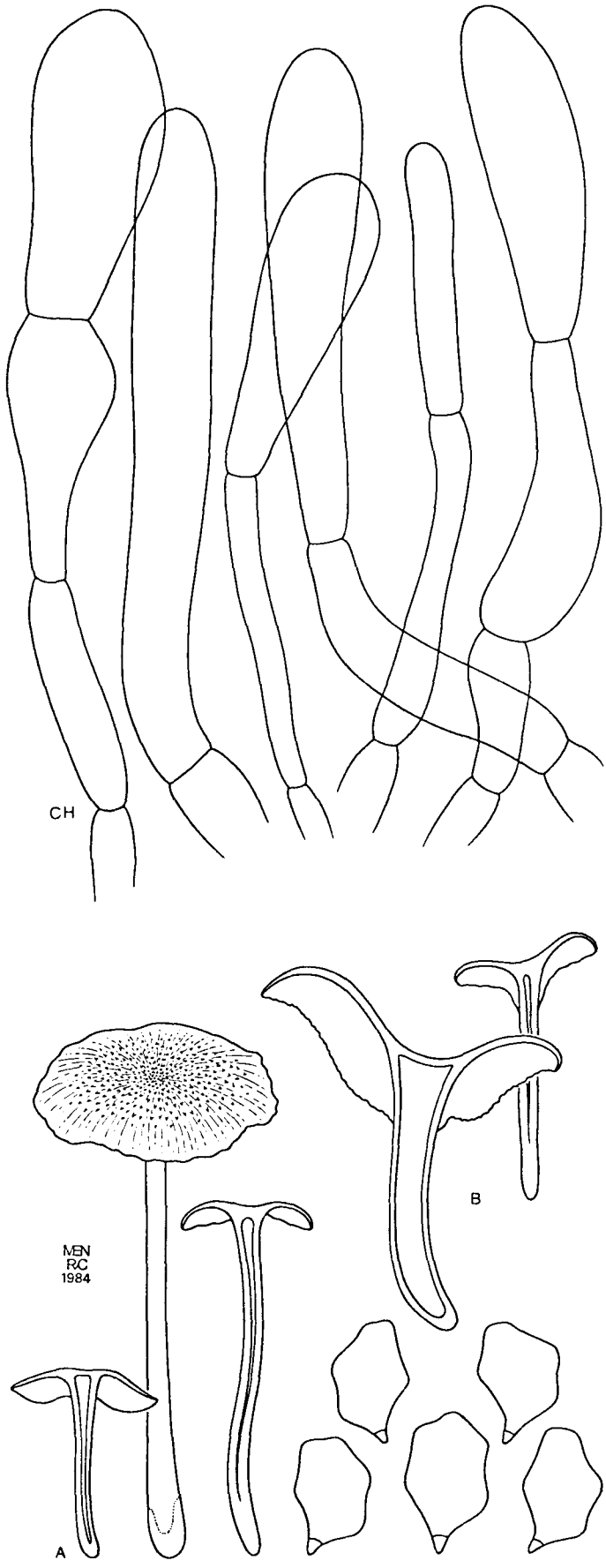

Fig. 163. *Entoloma serrulatum*.

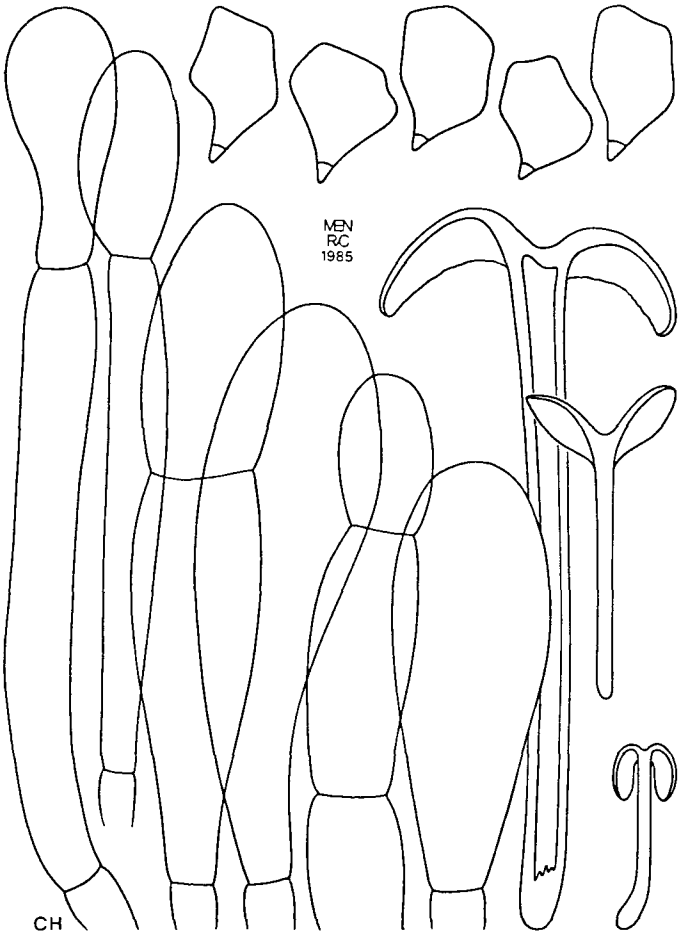

Fig. 164. *Entoloma caesiocinctum.*

moderately crowded, adnate to slightly emarginate, sometimes decurrent, arcuate then segmentiform, pale, rarely with blue tinge near base, then pink with strongly contrasting blackish blue or violaceous brown, fringed to denticulate edge. Stipe 20-60 (-80) × 1.5-5 mm, cylindrical or compressed with groove, sometimes broadened towards base, grey-brown to yellow-brown, with blue tinge especially when young, glabrous and polished, or sometimes blue-black punctate at apex, at base white tomentose, solid or fistulose. Context concolorous with surface, except for pale inner part of fleshy specimens. Smell none or slightly aromatic like flowers. Taste none or slight rancid.

Spores 8.5-11.5 (-12.5) × 6.5-9.0 µm, Q = 1.15-1.5 (-1.8), $\bar{Q}$ = 1.3, ellipsoid in side-view with 5-7 angles and dihedral base. Basidia 23-45 × 7-12.5 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia 20-120 × 7-20 µm, cylindrical and flexuose to narrowly clavate, numerous, forming a thick sterile band along edge. Pileipellis at margin a cutis or a transition between a cutis and a trichoderm, towards centre a trichoderm or a hymeniderm, made up of 14-45 µm wide cylindrical to broadly clavate elements. Pigment brown, intracellular in pileipellis. Brilliant granules present or absent in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In groups in poorly manured, semi-natural grassland, roadsides, etc., on sandy, peaty or clayey soil. Not uncommon. Widespread in N. and W.Europe. July-Nov.

Entoloma caesiocinctum is closely related to *E. serrulatum*, from which it is distinguished by the brown colour of the pileus and the pale lamellae.

112. Entoloma sodale Kühn. & Romagn. ex Noordel. in Int. J. Mycol. Lich. 1: 58. 1982. – Fig. 165.

Rhodophyllus sodalis Kühn. & Romagn. in Rev. Mycol. 19: 35. 1954 (Compl. Fl. anal. 1) (not valid, no Latin diagn.).

MISAPPL. – *Leptonia lampropoda* sensu Bres., Iconogr. mycol. 12: pl. 570, fig. 1. 1929; sensu P.D.Orton in Dennis, Orton & Hora in Trans. Br. mycol. Soc. 43, Suppl.: 105. 1960.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 570, fig. 1. 1929 (as *L. lampropoda*).

SEL. DESCR. & FIGS. – Kühner & Romagn. in Rev. Mycol. 19: 35-37, figs. 7, 9. 1954; Noordel. in Int. J. Mycol. Lich. 1: 58-59, fig. 4. 1982.

Pileus 13-30 mm, campanulate, then convex, finally applanate, usually slightly depressed to distinctly umbilicate at centre, with involute margin when young, not hygrophanous, translucently striate up to half of radius, pale horn-brown with minute grey-brown squamules especially on disc, towards margin fibrillose or subsquamulose, rarely smooth (Mu. 10 YR 6/3, 6/4, 5/4, 7/3, 7/2), becoming opaque, not much paler on drying. Lamellae, L = 25-35, l = 1-3, moderately crowded, adnate to deeply emarginate, segmentiform to ventricose, white to grey then pink, finally brown-pink (K. & W. 6B2; 10 YR 7/3) with entire or pruinose, concolorous edge. Stipe 10-60 × 1-3 (-4) mm, cylindrical, sometimes slightly broadened at apex, pale grey-blue, sometimes fading to brown with age, especially in upper part, at apex sometimes minutely pruinose, downwards glabrous, polished or substriate with scattered fibrils, white tomentose at base; solid or fistulose. Context thin, concolorous with surface. Smell none or weakly farinaceous. Taste none or weakly farinaceous.

Spores 9.5-12.5 (-14.0) × 7.0-8.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.4, ellipsoid in outline with 5-9 angles in side-view. Basidia 24-50 × 7.5-12.5 µm, 4-spored, clampless. Lamella edge sterile or heterogeneous. Cheilocystidia 22-60 × (8-) 12-30 µm, broadly clavate to broadly ellipsoid. Pileipellis a cutis at margin, towards centre a trichoderm, made up of radially arranged cylindrical or inflated 10-22 µm wide hyphae with clavate up to 35 µm wide terminal elements. Pigment brown, intracellular in pileipellis. Brilliant granules present or absent in pileitrama. Clamp-connections absent.

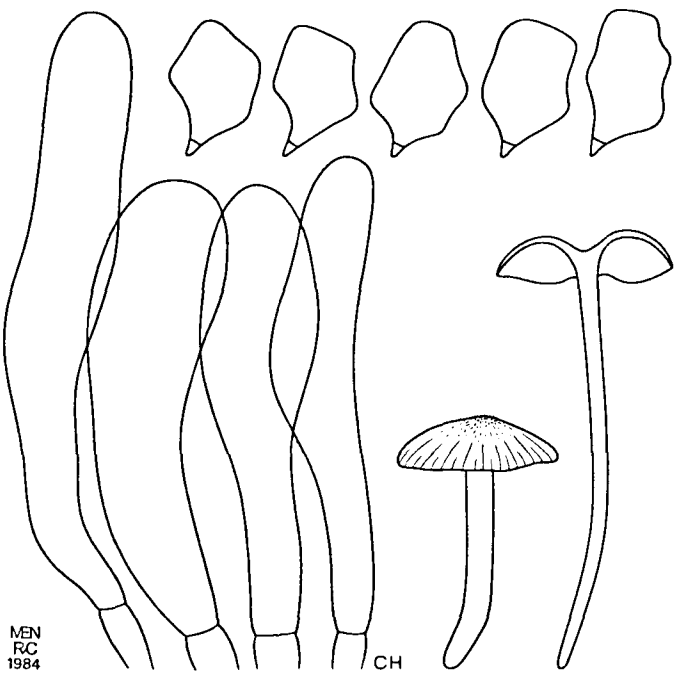

Fig. 165. *Entoloma sodale.*

HABITAT & DISTR. – In small groups in poorly manured grasslands on dunes and on dikes along rivers, uncommon. Widespread in N. and W.Europe. June-Oct.

Entoloma sodale is distinctive on account of its moderately dark brown, translucently striate pileus and broadly clavate to broadly ellipsoid cheilocystidia.

113. Entoloma poliopus (Romagn.) Noordel. in Persoonia 10: 262. 1979.

Rhodophyllus poliopus Romagn. in Kühn. & Romagn. in Rev. Mycol. 19: 8. 1954 (Compl. Fl. anal. 1). – *Rhodophyllus umbellus* J.Favre, Champ. sup. Zone alpine: 70. 1955.

KEY TO THE VARIETIES

1. Spores small, in average length not exceeding 10 µm. var. **parvisporigerum**
1. Spores larger, average length more than 10 µm.
2. Lamella edge brown; stipe deep blue when fresh. . var. **poliopus**
2. Lamella edge concolorous with sides; stipe steel-blue. var. **discolor**

var. **poliopus** – Fig. 166.

SEL. ICON. – J.Favre, Champ. sup. Zone alpine: pl. 5, fig. 2. 1955 (as *R. umbellus*).

SEL. DESCR. & FIGS. – Romagn. in Kühn. & Romagn. in Rev. Mycol. 20: 223-225, fig. 22. 1955 (Compl. Fl. anal. 1); J.Favre, Champ. sup. Zone alpine: 70, fig. 49. 1955 (as *R. umbellus*).

Pileus 10-40 mm, conical or conico-campanulate, then convex with slightly to distinctly depressed centre, with involute margin when young, not hygrophanous, not translucently striate or translucently striate up to half of radius, brown-grey with almost black centre (Mu. 10 YR 2-3/2; 7.5 YR 3/2), paler towards margin, entirely tomentose or minutely squamulose, or fibrillose at margin and minutely squamulose at centre, sometimes glabrescent, dull or shiny. Lamellae, L = 20-30, l = 3-7, moderately crowded, usually deeply emarginate, sometimes almost free, ventricose up to 5 mm broad, pale brown, then pink, with brown, entire edge. Stipe 25-60 × 1-3 (-4) mm, cylindrical or compressed with longitudinal groove, deep blue at first, then fading to blue-brown, glabrous and polished or minutely pruinose at apex, white tomentose at base, solid or narrowly fistulose. Context thin, concolorous with surface in cortex of pileus and stipe; paler in inner parts of pileus and stipe. Smell none or faintly farinaceous. Taste none or slightly farinaceous.

Spores 9.0-13.5 × 6.0-9.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.35, ellipsoid in outline with 5-8 angles in side-view. Basidia 30-55 × 7-10 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia 40-110 × 5-18 µm, cylindrical to clavate with brown intracellular pigment. Pileipellis a cutis at margin, towards centre a trichoderm to a hymeniderm, made up of 7-15 µm wide cylindrical or inflated hyphae with up to 25 µm wide, inflated terminal elements. Pigment brown, intracellular in pileipellis. Brilliant granules usually abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups in poorly manured, seminatural grassland on peaty or sandy soil, especially along big rivers and on coastal dunes. Rare. Widespread in N. and W.Europe, but never common. June-Oct.

var. **discolor** Noordel. in Persoonia 12: 460. 1985.

CHARACTERISTICS. – Differs from var. *poliopus* in the concolorous lamella edge; paler, more grey-blue stipe, and shorter cheilocystidia (20-40 × 6.5-15 µm).

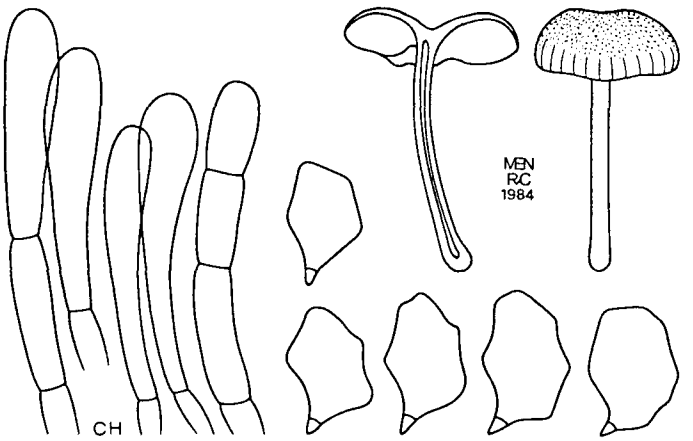

Fig. 166. *Entoloma poliopus* var. *poliopus*.

HABITAT & DISTR. – In grassland on acid and on calcareous soil (e.g. on coastal dunes; *Mesobromion*). Very rare (Noordwijkerhout: Waterleidingduinen; Bemelen: Bemelerberg). Widespread in N. and W.Europe. Known from Norway (in damp *Fraxinus/Corylus* forest), Scotland (moist grassland on slightly calcareous soil), and Germany (*Gentiano-Koelerietum*). July-Nov.

var. **parvisporigerum** Noordel. in Persoonia 12: 460. 1985. – Fig. 167.

CHARACTERISTICS. – Differs from var. *poliopus* and var. *discolor* mainly in having distinctly smaller spores: 8.0-11.0 × 6.0-8.0 µm. The cheilocystidia measure 25-80 × 5-20 µm.

HABITAT & DISTR. – On soil among moss in grassland (e.g.

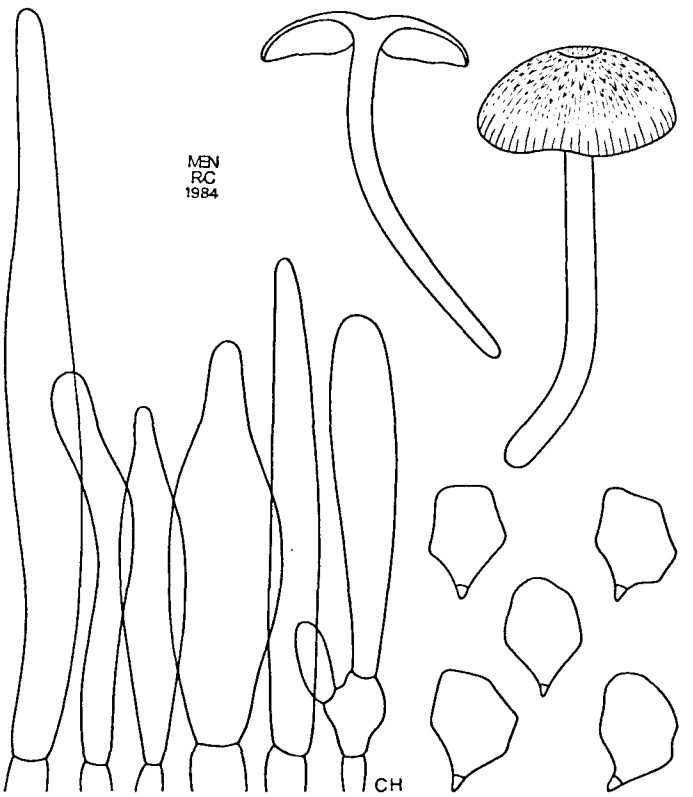

Fig. 167. *Entoloma poliopus* var. *parvisporigerum*.

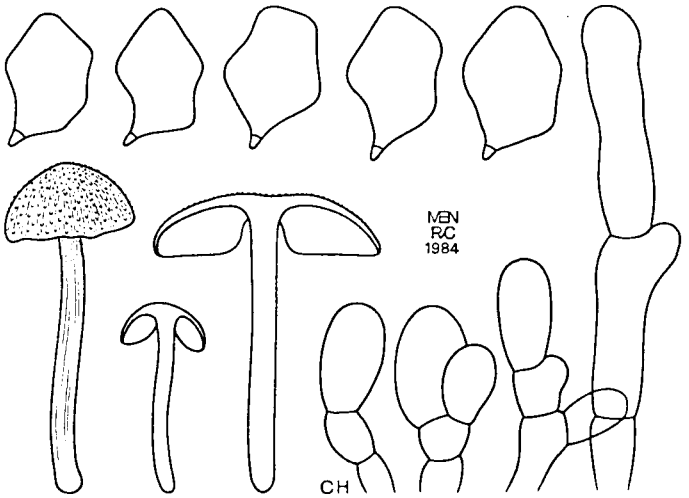

Fig. 168. *Entoloma caeruleoflocculosum.*

Mesobromion), on lawns, paths or open places in deciduous forest, preferably on more or less calcareous soil. Very rare (Helvoirt: Drongelens kanaal; Neercanne: Canner berg; Ermelo: Staverden). Widespread in N. and W.Europe. Known from Norway, Denmark, France, and N.Italy from more or less similar habitats. July-Sept.

114. Entoloma caeruleoflocculosum Noordel. in Persoonia 12: 461. 1985. – Fig. 168.

Pileus 7-18 mm, convex, then applanate, umbilicate with inflexed margin, not hygrophanous, not translucently striate, or very obscurely so at margin only, dark (grey-)brown (Mu. 10 YR 2-3/2, 4/3), only slightly paler at margin, entirely coarsely squamulose. Lamellae, L = 20-35, l = 1-5, rather distant to moderately crowded, adnate or emarginate, segmentiform to narrowly ventricose, sometimes transvenose, cream-colour to pale brownish yellow, then sordid flesh-colour, with entire, concolorous edge. Stipe 20-45 × 1.5-4 mm, cylindrical or broadened at base or at apex, dark ultramarine or indigo (K. & W. 18F3-4), sometimes more grey in lower part, entirely flocculose with concolorous, granulose squamules, especially in upper part and fibrillose-flocculose in lower part. Context thin, brown in cortex of pileus; blue in cortex of stipe. Smell none. Taste not distinctive.

Spores 9.0-13.5 × 6.5-9.0 µm, Q = 1.25-1.75, $\bar{Q}$ = 1.45, ellipsoid in outline with 5-7 angles in side-view. Basidia 25-50 × 10-17 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia 35-85 × 7-12 µm, cylindrical or narrowly clavate, densely clustered. Pileipellis a cutis at margin, more like a trichoderm at centre, made up of up to 17 µm wide, cylindrical elements. Pigment brown, intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In poorly manured, semi-natural grassland on sandy soil on old coastal dunes. Very rare (Goeree: Westduinen; Voorne: Oostvoorne, Nachtegalenbosje; Texel). Also known from Scotland in rather open *Betula* forest. Sept.

Entoloma caeruleoflocculosum comes close to *E. poliopus* and *E. sodale* from which it differs in the not translucently striate, entirely squamulose pileus, and flocculose surface of stipe. *E. anatinum* and *E. viaregale* differ among other things in having a fertile lamella edge.

115. Entoloma lividocyanulum Kühner ex Noordel. in Persoonia 12: 214. 1984. – Fig. 169.

Rhodophyllus lividocyanulus Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 37. 1954 (Compl. Fl. anal. 1) (not valid, no Latin diagn.); *Leptonia lividocyanula* (Kühner) P.D.Orton in Trans. Br. mycol. Soc. 43: 105. 1960 (invalid).

MISAPPL. – *Eccilia griseorubella* sensu Bres., Iconogr. mycol. 12: pl. 594. 1929.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 594. 1929 (as *Eccilia griseorubella*); Dähncke & Dähncke, 700 Pilze: 259. 1979.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 214-215, fig. 10. 1984.

Pileus 10-35 mm, convex, then applanate, (deeply) umbilicate with involute margin when young, not distinctly hygrophanous, translucently striate up to centre, when young sepia, then rather pale yellow-brown with darker brown, granulose-squamulose centre, glabrous or radially fibrillose towards margin. Lamellae, L = 20-36, l = 3-7, moderately crowded, adnate to subdecurrent, triangular, then segmentiform, white then pale pink, with entire, concolorous edge. Stipe 25-60 × 1-3 (-4.5) mm, cylindrical or compressed, moderately dark to pale blue often fading to brown with age, glabrous, polished, sometimes pruinose at apex, at base white tomentose, solid or narrowly fistulose. Context concolorous with surface in pileus, in stipe long retaining the blue colour of the surface. Smell none or slightly herbaceous. Taste indistinct.

Spores (7.0-) 8.0-10.0 (-11.0) × 6.5-7.0 (-8.0) µm, Q = 1.15-1.75, $\bar{Q}$ = 1.3-1.5, ellipsoid in outline with 5-6 angles in side-view. Basidia 25-54 × 6.5-10.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of 7.5-20 µm wide hyphae with cylindrical to clavate up to 30 µm wide terminal cells. Pigment brownish, intracellular in pileipellis. Brilliant granules usually present in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in poorly manured semi-natural grassland on more or less calcareous soil. Very rare (Heythuysen: Grote Moost). Widespread in N., W. and C.Europe from sea-level up into subalpine zone. July-Sept.

Entoloma lividocyanulum is characterised by its pale brown, deeply striate, almost smooth pileus, pale blue stipe, and small spores. *E. huijsmanii* differs in darker colours and larger spores.

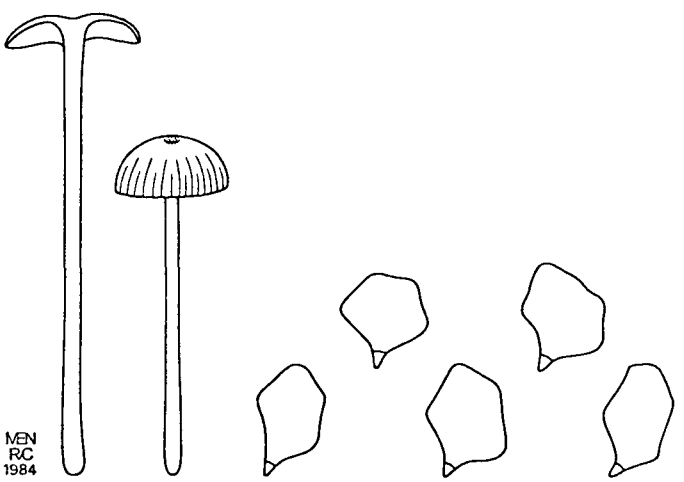

Fig. 169. *Entoloma lividocyanulum.*

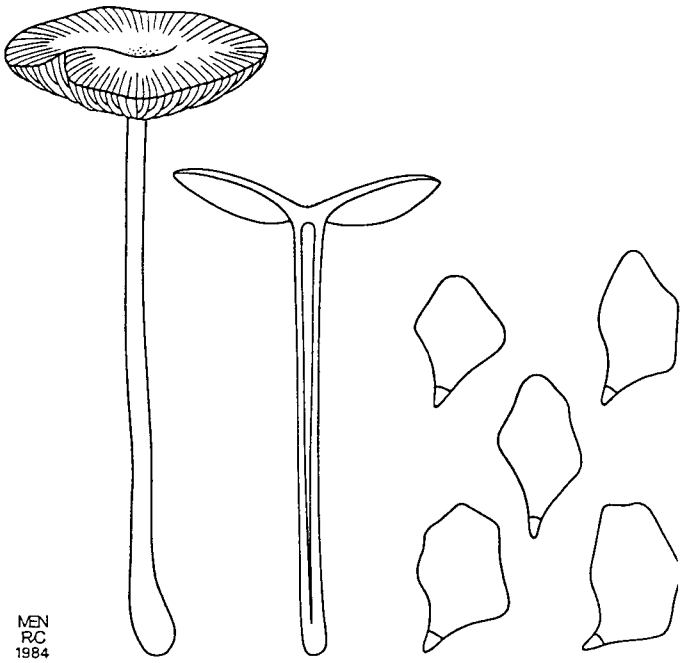

Fig. 170. *Entoloma huijsmanii.*

116. Entoloma huijsmanii Noordel. in Persoonia 12: 212. 1984. – Fig. 170.

MISAPPL. – *Rhodophyllus griseorubellus* sensu J.Lange, Fl. agar. dan. 2: pl. 80F. 1937.

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 80F. 1937 (as *R. griseorubellus*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 212-214, fig. 9. 1984.

Pileus 10-30 (-40) mm, convex, then plano-convex, usually umbilicate, with slightly involute margin when young, weakly hygrophanous, pale to moderately dark brown-grey or horn-brown when moist, translucently striate up to centre, slightly pallescent and opaque on drying, granulose-squamulose at centre, radially fibrillose to almost glabrous at margin. Lamellae, L = about 20, l = 1-5, moderately distant, adnate or almost decurrent, triangular-segmentiform, then (sub-)ventricose, white or very pale grey, then pink with or without faint grey tinge, with entire, concolorous edge. Stipe 25-60 × 1-3 mm, cylindrical or compressed, grey violaceous with slight blue tinge in some specimens (K. & W. 6-7D3-4, 7E4), glabrous and polished or in upper part violaceous pruinose; in lower part with blackish-violaceous fibrils, at base white tomentose-villose, solid or fistulose. Context thin, concolorous with surface in cortex, inner parts pale. Smell indistinctive. Taste weak, mild.

Spores (8.5-) 9.5-13.5 × 6.0-8.5 (-9.0) µm, Q = 1.2-1.7, $\bar{Q}$ = 1.45, ellipsoid in outline with 6-9 angles in side-view. Basidia 25-55 × 8-14 µm, 2- or mixed 2- and 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm at centre, towards margin more like a cutis, made up of radially arranged inflated hyphae with up to 20 µm wide terminal elements. Pigment brown, intracellular in pileipellis. Brilliant granules present or absent in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups in dry grassland and open places in frondose forest. Very rare (Buren: loam pits; Beek: Bijvanck). Also known from Denmark, France and Switzerland. Aug.-Sept.

Entoloma huijsmanii comes close to *E. lividocyanulum* from which it differs in colour and much larger spores.

117. Entoloma anatinum (Lasch: Fr.) Donk in Bull. bot. Gdns Buitenz., ser. III, 18: 158. 1949. – Fig. 171.

Agaricus anatinus Lasch in Linnaea 4: 540. 1829; *Agaricus anatinus* Lasch: Fr., Syst. mycol. 3 (Index): 7. 1832; *Leptonia anatina* (Lasch: Fr.) Kumm., Führ. Pilzk.: 96. 1871; *Rhodophyllus anatinus* (Lasch: Fr.) Quél., Enchir. Fung.: 60. 1886; *Hyporrhodius anatinus* (Lasch: Fr.) Schroet. in Cohn., Krypt.-Fl. Schlesien 3(1): 614. 1889.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 569, fig. 1. 1929.

SEL. DESCR. & FIGS. – P.D.Orton in Trans. Br. mycol. Soc. 43: 290 figs. 118-121, 315. 1960.

Pileus 10-65 mm, conico-convex or truncately conical to truncately campanulate, not or only slightly expanding with age, with depressed or subumbonate centre, with slightly inflexed margin when young, not hygrophanous, not translucently striate, dark sepia, blackish brown or greyish brown to almost black (Mu. 10 YR 3/2, 2/2), densely minutely squarrulose at centre to squamulose at margin, and squamules often arranged in radial rows giving a streaky appearance. Lamellae, L = 20-35, l = 3-7 (-11), rather crowded, narrowly to broadly adnate, subsegmentiform, then ventricose, sordid white, then sordid incarnate, finally brown-pink, with concolorous or slightly brownish, entire edge. Stipe 22-90 × 1.5-5 mm, cylindrical or compressed, sometimes with swollen base, ultramarine-blue to grey-blue, often slightly turning brownish with age, innately silvery fibrillose to flocculose-squamulose especially in upper part; white tomentose at base. Context concolorous with surface in cortex, paler in inner parts. Smell not distinctive. Taste not distinctive.

Spores 9.0-13.5 (-14.5) × (6.5-) 7.0-8.0 (-9.0) µm, Q = 1.2-1.8, $\bar{Q}$ = 1.45, ellipsoid in outline, with 6-9 angles in side-view. Basidia 24-55 × 8-13 µm, 4-spored, clampless. Lamella edge fertile. Cheilocystidia absent. Pileipellis a cutis with transitions to a trichoderm, made up of 15-20 µm wide, cylindrical to inflated hyphae with more or less cylindrical, up to 22 µm wide, terminal elements. Pigment brown, intracellu-

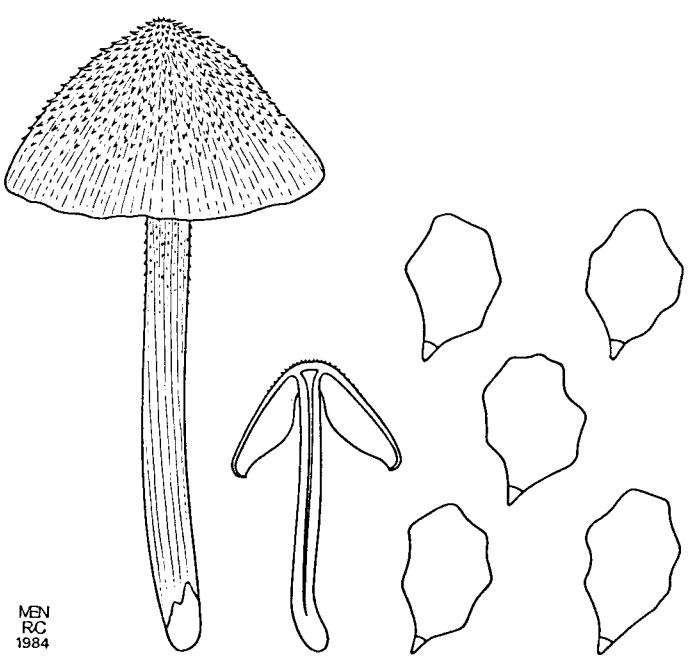

Fig. 171. *Entoloma anatinum.*

lar in pileipellis and upper pileitrama. Brilliant granules present or absent in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in grassland on poor, acid, sandy or peaty soil, also in coastal dunes among grasses and *Salix repens*. Very rare (Oostvoorne: Parnassia valley; Gorssel: 't Amelte). Known to occur in Great Britain, Germany and France, but apparently everywhere very rare. Aug.-Sept.

118. Entoloma griseocyaneum (Fr.: Fr.) Kumm., Führ. Pilzk.: 97. 1871. – Fig. 172.

Agaricus griseocyaneus Fr., Observ. mycol. 2: 96. 1818; *Agaricus griseocyaneus* Fr.: Fr., Syst. mycol. 1: 202. 1821; *Rhodophyllus griseocyaneus* (Fr.: Fr.) Quél., Enchir. Fung.: 58. 1886; *Hyporrhodius griseocyaneus* (Fr.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 3(1): 617. 1889; *Leptonia griseocyanea* (Fr.: Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 552. 1929; J.Lange, Fl. agar. dan. 2: pl. 73C. 1937; Ryman & Holmåsen, Svampar: 382. 1984.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 104, fig. 21, 23. 1969.

Pileus 15-50 mm broad, conical or hemispherical only slightly expanding with age, with slightly involute to straight, finally undulating margin, not hygrophanous, not translucently striate, pale yellow-brown with pink shade or moderately dark sepia to reddish brown (Mu. 7.5 YR-10 YR, 6-4/2-4) entirely puberulous or aeriferously fibrillose when young, then minutely adpressedly squamulose, sometimes with micaceous particles. Lamellae, L = 20-30, l = 3-7, distant, sometimes thickish, deeply emarginate to almost free, ventricose, sometimes transvenose, white then pink with concolorous, entire edge. Stipe 20-60 × 1.5-5 mm, cylindrical or compressed with groove, blue, blue-grey to violaceous blue with dense, white, aeriferous fibrillose covering, white tomentose, sometimes with yellow tinge at base, solid, soon fistulose. Context concolorous with surface, inner parts of fleshy specimens white. Smell none. Taste none.

Spores 9.0-13.5 × 6.5-8.0 (-9.0) µm, Q = 1.15-1.7, $\overline{Q}$ = 1.45, irregularly many-angled in side-view with dihedral base. Basidia 35-52 × 9-13.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm with transitions to a hymeniderm, made up of broadly clavate to broadly ellipsoid, up to 40 µm wide elements.

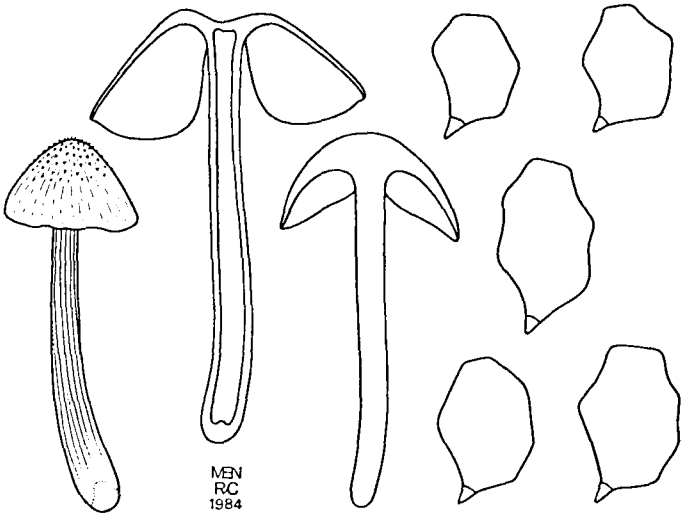

Fig. 172. *Entoloma griseocyaneum*.

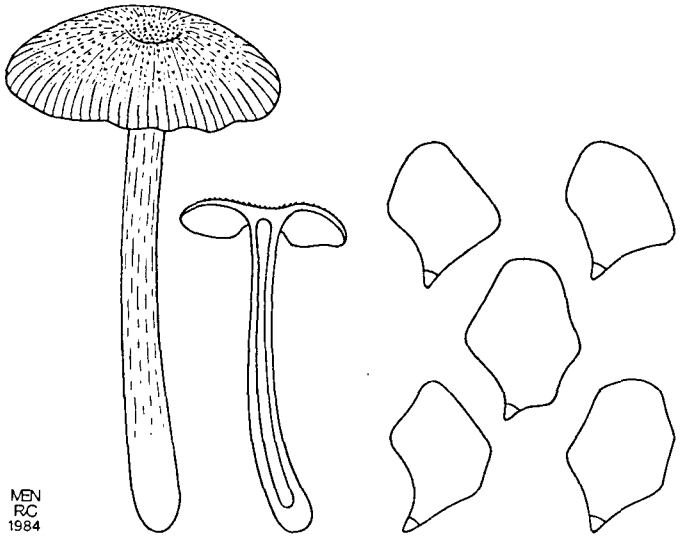

Fig. 173. *Entoloma scabrosum*.

Pigment brown, intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in poorly manured, semi-natural grasslands, on acid and basic soils. Very rare (Bemelen: Bemelerberg). July-Oct.

The description of *Entoloma griseocyaneum* is based on one collection from the Netherlands, supplemented by data from extralimital collections from Scotland, Germany and Finland, where this striking species occurs in meadows often with *Betula*, *Alnus* or *Salix*.

119. Entoloma scabrosum (Fr.) Noordel. in Persoonia 12: 462. 1985. – Fig. 173.

Agaricus scabrosus Fr., Epicr.: 154. 1838; *Rhodophyllus scabrosus* (Fr.) Quél., Enchir. Fung.: 61. 1886; *Leptonia scabrosa* (Fr.) Sacc., Syll. Fung. 5: 715. 1887.

SEL. DESCR. – Romagn. in Bull. trimest. Soc. mycol. Fr. 60: 97-99. 1944.

Pileus 18-60 mm, convex, then applanate with (slightly) depressed centre, with involute margin, distinctly hygrophanous, when moist dark brown (Mu. 7.5 YR 4-5/3-4), with almost black centre, (10 YR 3/2), pallescent on drying to greyish brown, remaining darker at centre, translucently striate at margin, entirely concentrically squamulose, densest at centre. Lamellae, L = 25-35, l = 3-5, moderately distant, emarginate, segmentiform up to 6 mm broad, sometimes transvenose, greyish white, then sordid pink with concolorous, entire edge. Stipe 40-90 × 3-6 mm, cylindrical, usually broadened at base, brown with distinct violaceous tinge especially at centre, becoming brown with age (10 YR 4-5/2-3, 7.5 YR 4-5/2), glabrous, almost polished but with some scattered silvery fibrils lengthwise, becoming more and more fibrillose-striate on drying, white tomentose at base. Context concolorous with surface in cortex, pallid in inner parts of pileus and stipe. Smell fairly strong, herbaceous or almost aromatic, reminiscent of the smell of *Entoloma euchroum*. Taste not tested.

Spores 10.0-12.5(-13.5) × 6.5-9.0 µm, Q = 1.25-1.7, $\overline{Q}$ = 1.4, 5-6 (-7)-angled in side-view. Basidia 24-45 × 11-16.5 µm, 4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm to a plurostratous hymeniderm at centre, made up of cylindrical to clavate

up to 30 µm wide terminal elements, towards margin more like a transition between a cutis and a trichoderm, made up of inflated, up to 18 µm wide elements. Pigment brown, intracellular in pileipellis. Brilliant granules present, but not abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Terrestrial on bare soil in *Alnus* forest. Very rare (Roden: Natuurschoon). Distribution in Europe unknown. Recorded from France, Finland and Sweden. Oct.

Entoloma scabrosum is closely related to *E. anatinum*, from which it differs mainly in colour, shape of the pileus, surface of stipe, and habitat.

120. Entoloma pseudocoelestinum Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 341. ('1982') 1983. – Fig. 174.

MISAPPL. – *Rhodophyllus coelestinus* sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 206. 1953.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 4c. ('1982') 1983.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 341-343, fig. 154. ('1982') 1983.

Pileus 13-26 mm, hemispherical or bluntly conical, then applanate, often depressed at centre, weakly hygrophanous, when moist translucently striate up to half the radius, dark violaceous brown (K. & W. 8E5), then paler violaceous brown or greyish brown with violaceous tinge (9E3, 8E4, 7E5-4, 6E4), always with dark brown or blackish brown centre, finely adpressedly squamulose at centre, more scattered squamulose towards margin, on drying slightly paler, dull. Lamellae, L = 17-25, l = 2-8, moderately crowded, adnate-emarginate or subdecurrent, up to 6 mm broad, white then salmon pink with entire, concolorous edge. Stipe 20-40 × 1.5-2.5 mm, cylindrical, rather pale bluish grey (17E2, 18E2, 19E2, 22E2), at extreme apex finely white pruinose, at base white tomentose, glabrous, shiny. Context very thin (1 mm) in pileus, but relatively firm; in stipe subcartilagineous. Smell indistinct. Taste indistinct.

Spores 8.0-10.0 × 6.5-8.0 µm, Q = 1.1-1.6, $\bar{Q}$ = 1.3, 5-7-angled in side-view. Basidia 24-36 × 8.5-12 µm, (2-)4-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis at margin, a trichoderm at centre, made up of inflated terminal elements, 35-90 × 12-25 µm. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – On humus amongst grasses. Very rare (Drenthe: Westerbork). Also known from France and Sweden. Sept.-Oct.

Entoloma pseudocoelestinum comes close to *E. lividocyanulum* from which it differs in having a darker pileus with distinct (blue-)violaceous

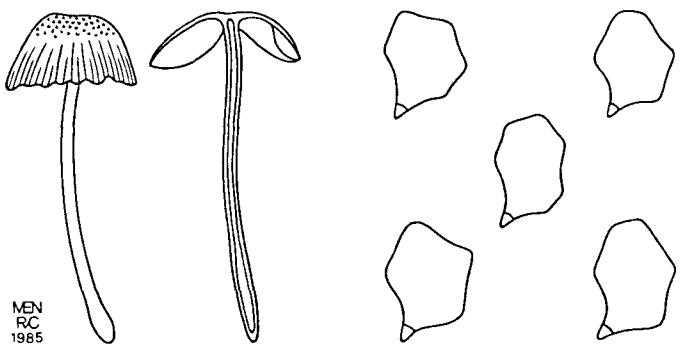

Fig. 174. *Entoloma pseudocoelestinum.*

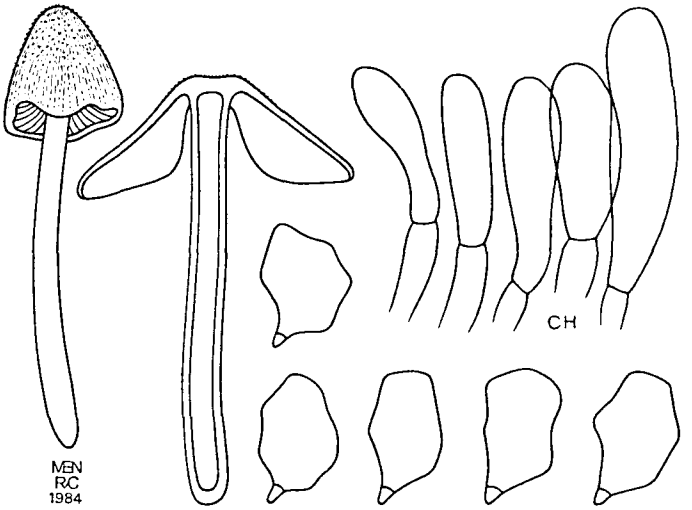

Fig. 175. *Entoloma chalybaeum* var. *chalybaeum.*

tinges; *E. chalybaeum* var. *lazulinum* differs in having more intensively blue colours in pileus, lamellae and stipe; *E. asprellum* has a red-brown pileus, sordid grey-pink lamellae, and larger spores.

121. Entoloma chalybaeum (Fr.: Fr.) Noordel. in Nord. J. Bot. 2: 163. 1982.

Agaricus chalybaeus Fr., Observ. mycol. 2: 93. 1818; *Agaricus chalybaeus* Fr.: Fr., Syst. mycol. 1: 203. 1821; *Leptonia chalybaea* (Fr.: Fr.) Kumm., Führ. Pilzk.: 96. 1871.

MISAPPL. – *Agaricus colombarius* sensu Sow., Col. Figs. Engl. Fungi 2: pl. 161. 1799.

KEY TO THE FORMS AND VARIETIES

1. Pileus not translucently striate when moist, entirely tomentose or squamulose. . . . . var. **chalybaeum**
1. Pileus distinctly translucently striate when moist, at least up to half the radius, (sub-)squamulose at centre only. . . . . var. **lazulinum**
2. The great majority of basidia 4-spored. . . . . f. **lazulinum**
2. The great majority of basidia 2-spored. . . . . f. **bisporigerum**

var. **chalybaeum** – Fig. 175.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 574. 1929.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 205-206, fig. 5. 1984.

Pileus 14-40 mm, conical or campanulate, sometimes truncate, usually not or only slightly depressed at centre, with involute margin, not very much expanding with age, not hygrophanous, not translucently striate, rarely striate up to one-third of radius, dark indigo-blue, almost black at centre, towards margin slightly paler, becoming more brownish blue with slight violaceous sheen with age, entirely tomentose breaking up in minute, radially arranged, adpressed to slightly reflexed squamules, sometimes glabrescent with age; sometimes radially sulcate at margin. Lamellae, L = 20-40, l = 1-5, moderately distant, deeply emarginate to almost free, ventricose, grey violaceous or blue violaceous when young, then greyish pink with entire, brownish edge. Stipe 20-50 × 2-3.5 mm, cylindrical with slightly to distinctly broadened base, sometimes compressed with groove, dark grey-blue, usually slightly to distinctly paler and brighter than pileus, minutely pruinose at apex, downwards glabrous, polished or with minute white tomentose patches; base white tomentose. Context concolorous with surface, white in innermost part

of pileus and stipe. Smell none. Taste none or slightly bitter.

Spores 8.5-12.5 × 6.5-8.5 µm, Q = 1.2-1.75, $\bar{Q}$ = 1.45, ellipsoid in side-view with 6-9 angles and dihedral base. Basidia 27-51 × 8.5-14 µm, 4-spored, clampless. Lamella edge entirely sterile. Cheilocystidia 35-75 × 5-18 µm, cylindrical to clavate, often with pale brown intracellular pigment. Pileipellis a trichoderm, at centre almost a hymeniderm made up of clavate up to 35 µm wide elements. Pigment brownish blue, intracellular in pileipellis and upper pileitrama. Brilliant granules usually present in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups in poorly manured, semi-natural grassland on loamy or sandy soil. Widespread in W.Europe; rare. Aug.-Oct.

var. **lazulinum** (Fr.) Noordel. in Persoonia 12: 206. 1984. – Fig. 176.

Agaricus lazulinus Fr., Epicr.: 153. 1838; *Leptonia lazulina* (Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 344. 1873 (Champ. Jura Vosges 2); *Rhodophyllus lazulinus* (Fr.) Quél., Enchir. Fung.: 60. 1886; *Entoloma lazulinum* (Fr.) Noordel. in Nord. J. Bot. 2: 162. 1982. – *Agaricus glaucus* Bull. ex DC. in DC. & Lam., FL. franç. 2: 179. 1805.

MISAPPL. – *Rhodophyllus cyanulus* sensu J.Lange, Fl. agar. dan. 2: pl. 77F. 1937.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 570, fig. 2. 1929 (as *L. lazulina*); J.Lange, Fl. agar. dan. 2: pl. 77F. 1973 (as *R. cyanulus*); R.Phillips, Mushr. other Fungi: 117. 1981 (as *L. lazulina*).

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 206-210, Fig. 6. 1985.

CHARACTERISTICS. – Pileus 6-35 mm, bright ultramarine, indigo or grey-blue, at centre and striae often blackish blue, turning brownish violaceous with age, not really hygrophanous but strongly translucently striate when moist, first entirely tomentose, then rugulose to reflexedly fibrillose-squamulose at centre, glabrescent at margin; lamellae 10-24, adnate to deeply emarginate, with concolorous to brown edge; stipe concolorous with pileus at first, with age turning greenish blue in basal part; taste none or slightly oily-rancid; spores 8.5-12.0 × 6.5-8.5 µm and basidia 4-spored in f. *lazulinum*, spores 10-12.5 × 7.0-9.0 µm and basidia 2-spored in f. *bisporigerum*; pileipellis a trichoderm at centre, more cutis-like at margin.

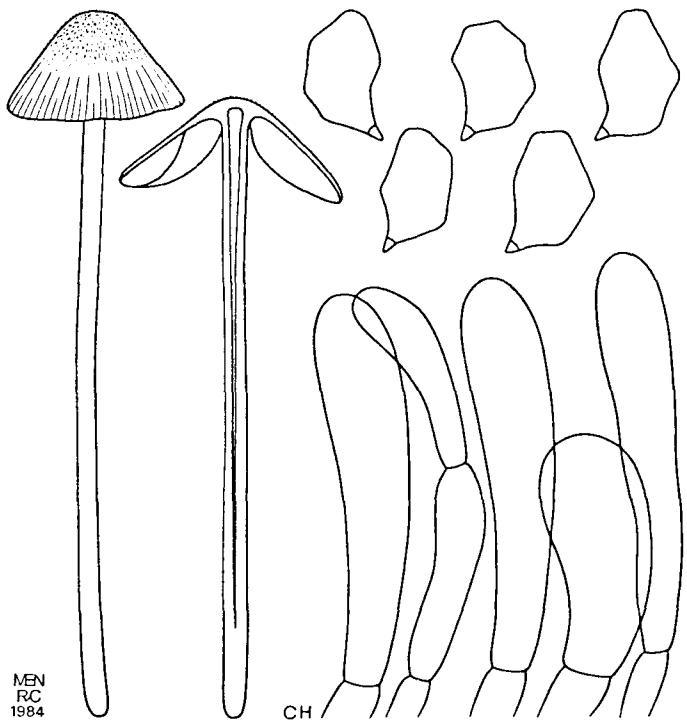

Fig. 176. *Entoloma chalybaeum* var. *lazulinum*.

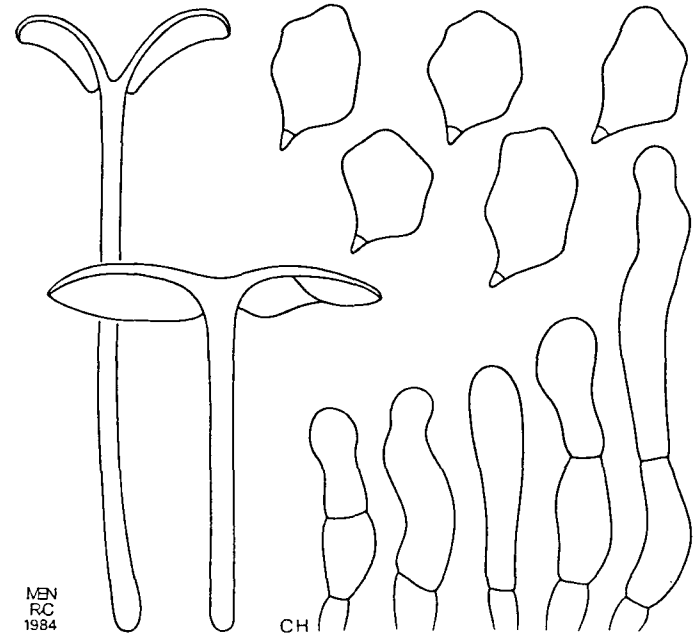

Fig. 177. *Entoloma mougeotii*.

HABITAT & DISTR. – In poorly manured, semi-natural grassland on acid or basic, sandy or loamy, moist to fairly dry soils, usually in small groups. Rare. Widespread but rare in Europe. July-Nov.

Entoloma chalybaeum is taken here in a rather broad sense, comprising classical *chalybaeum* with entirely squamulose, non-striate pileus and *lazulinum* with less squamulose, deeply striate pileus.

122. Entoloma mougeotii (Fr.) Hesler in Beih. Nova Hedwigia 23: 158. 1967. – Fig. 177.

Eccilia mougeotii Fr. in Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 345. 1873 (Champ. Jura Vosges 2); *Rhodophyllus mougeotii* (Fr.) J.Lange in Dansk. bot. Ark. 2(11): 39. 1921; *Leptonia mougeotii* (Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 290. 1960; *Entoloma ardosiacum* var. *mougeotii* (Fr.) Pears. & Dennis in Trans. Br. mycol. Soc. 31: 170. 1948.

MISAPPL. – *Eccilia griseorubellus* sensu Quél. in Mém. Soc. Emul. Montbéliard, ser. II, 5: 248. 1872 (Champ. Jura Vosges 1); *Entoloma ardosiacum* sensu Quél. in C.R. Ass. franç. Av. Sci. (La Rochelle, 1882) 11: 392. 1883 (Champ. Jura Vosges 11); sensu Bres., Iconogr. mycol. 11: pl. 549. 1929.

SEL. ICON. – Bres., Iconogr. mycol. 11: pl. 549. 1929 (as *E. ardosiacum*); J.Lange, Fl. agar. dan 2: pl. 80H. 1937; Ryman & Holmåsen, Svampar: 384. 1984 (as *E. ardosiacum*).

Pileus 15-45 mm, convex with strongly involute margin, with slightly depressed to deeply umbilicate centre, expanding with age, finally irregularly applanate to concave with irregular marginal zone, not hygrophanous, not translucently striate, dark violaceous black at centre, violaceous grey towards margin, becoming brownish grey with distinct violaceous tinge when old (Mu. 10 YR 2-5/3; 3-6/1-2 with violaceous tinge or more like K. & W. 14F2, 14C-D2), entirely tomentose or velutinous at first, then breaking up in minute squamules that are adpressed at margin and uplifted at centre, often breaking up in radial

rows of small squamules, showing the context between the fibrils. Lamellae, L = 20-40, l = 1-9, moderately distant to rather crowded, adnate, sometimes slightly emarginate or with decurrent tooth, rarely distinctly decurrent, segmentiform to ventricose, up to 10 mm broad, pale creamy or white, then pink, rarely with slight lilaceous tinge, finally sordid brown-pink with slightly irregular, concolorous (or brown, see note) edge. Stipe 30-80 × 2-4.5 mm, cylindrical or compressed, sometimes slightly broadened at apex or base, grey violaceous or steel-grey, paler than pileus, with darker, fibrillose-flocculose covering, white tomentose at base, solid or fistulose. Context rather thin in pileus, with about same colour as surface, fibrillose and slightly paler in stipe. Smell not distinctive or slightly sweetish like flowers. Taste none or slightly oily-rancid.

Spores 9.0-11.5 (-12.5) × 6.0-8.0 (-9.0) µm, Q = 1.2-1.7, $\bar{Q}$ = 1.45, ellipsoid in outline with 5-9 angles in side-view. Basidia 27-48 × 8-11 µm, 4-, rarely also 2-spored, clampless. Lamella edge sterile. Cheilocystidia 16-60 (-110) × 8-15 µm, cylindrical to clavate. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of 8-20 µm wide cylindrical or slightly inflated hyphae with up to 25 µm wide terminal elements. Pigment violaceous brown, intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups among grasses and mosses or on humus in hayfields, dune-valleys, often in open forest of deciduous trees (*Salix*, *Alnus*, etc.) always on slightly to distinctly calcareous soil. Rare. Not uncommon in the lowlands of W. and N.Europe and the mountains of N. and C.Europe in (semi-)natural grasslands and open woodland. Aug.-Oct.

Entoloma mougeotii comes very close to *E. corvinum*, but that is a dark blue species without violaceous tinges.

Var. *fuscomarginatum* Noordel. with brown lamella edge has been found in Norway, Denmark and West Germany.

123. Entoloma corvinum (Kühner) Noordel. in Nord. J. Bot. 2: 162. 1982. – Fig. 178.

Rhodophyllus corvinus Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 4. 1954 (Compl. Fl. anal. 1); *Leptonia corvina* (Kühner) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960.

SEL. DESCR. & FIGS. – Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 42-43, figs. 10, 11. 1954 (Compl. Fl. anal. 1).

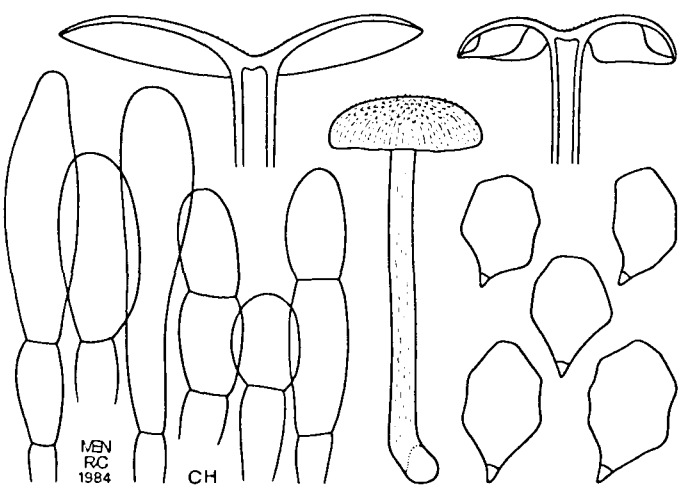

Fig. 178. *Entoloma corvinum.*

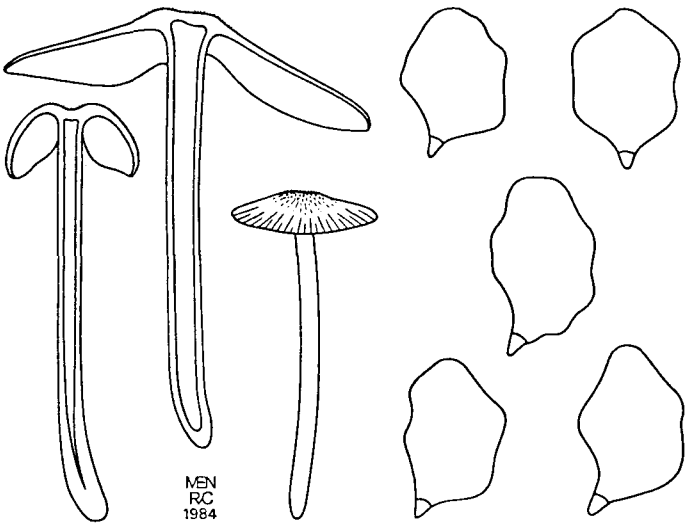

Fig. 179. *Entoloma incanum.*

Pileus 8-30 mm, truncately conical or hemispherical, then expanding to convex, slightly to distinctly depressed at centre with slightly inflexed, then straight margin, not hygrophanous, not translucently striate, dark blackish blue or indigo, becoming more brownish when expanded, entirely velutinous to tomentose when young, then pellis breaking up in small adpressed to reflexed squamules, becoming radially fibrillose-subsquamulose at margin, shiny. Lamellae, L = 25-30, l = 3-5, moderately crowded, broadly adnate, often slightly emarginate or with decurrent tooth, segmentiform to subventricose, white, then pink with concolorous, entire or fimbriate edge. Stipe 30-60 × 1.5-3 (-4) mm, cylindrical or compressed, concolorous with pileus at first, then pallescent to pale blue-grey sometimes with slight violaceous tinge (K. & W. 16E2 then more like 14C2, B2-3) with minute fibrillose-striate covering of darker fibrils, white tomentose at base. Context concolorous with surface in cortex, paler in inner parts. Smell none. Taste none.

Spores 8.0-11.0 (-11.5) × 6.0-7.5 (-8.0) µm, Q = 1.1-1.6, $\bar{Q}$ = 1.3-1.4, ellipsoid in outline, with 5-7 angles in side-view. Basidia 30-48 × 7.5-14 µm, 4-spored, clampless. Lamella edge sterile. Cheilocystidia 20-60 × 5-12 µm, cylindrical to clavate. Pileipellis a trichoderm at centre, towards margin a cutis, made up of radially arranged 10-18 µm wide, cylindrical to inflated hyphae with clavate, up to 20 µm wide terminal elements. Pigment brownish blue, intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups among grass in poorly manured semi-natural grassland in coastal dunes and in the 'Fluviatiel district' (Voorne; Drongelens kanaal). Rare in W., N. and C.Europe, from lowlands up into subalpine zone.

124. Entoloma incanum (Fr.: Fr.) Hesler in Beih. Nova Hedwigia 23: 147. 1967. – Fig. 179.

Agaricus incanus Fr.: Fr., Syst. mycol. 1: 209. 1821; *Leptonia incana* (Fr.: Fr.) Gillet, Hyménomycètes: 414. 1876; *Rhodophyllus incanus* (Fr.: Fr.) Kühn. & Romagn., Fl. anal. Champ. sup.: 203. 1953. – *Agaricus euchlorus* Lasch ex Fr., Epicr.: 154. 1838; *Leptonia euchlora* (Lasch ex Fr.) Kumm., Führ. Pilzk.: 96. 1871; *Rhodophyllus euchlorus* (Lasch ex Fr.) Quél., Enchir. Fung.: 61. 1886. – *Leptonia incana* var. *citrina* D.Reid in Fung. rar. Icol. col. 6: 18. 1972. – *Entoloma incanum* var. *citrinobrunneum* Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 336. ('1982') 1983.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl.

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Drenthe, Netherlands 3: pl. 4f ('1982') 1983 (as var. *citrinobrunneum*); Bres., Iconogr. mycol. 12: pl. 575. 1929; Cetto, Funghi Vero 1: pl. 99. 1975; J.Lange, Fl. agar. dan 2: pl. 77C. 1937 (as *R. euchlorus*); R.Phillips, Mushr. other Fungi: 117. 1981; D.Reid in Fung. rar. Ic. col. 6: pl. 44a (as var. *citrina*) and pl. 44b (as var. *incana*). 1972; Ryman & Holmåsen, Svampar: 380. 1984.

VERN. NAME. – Groensteelsatijnzwam.

Pileus 10-40 mm, hemispherical, then convex, finally applanate, more rarely truncately conical, then expanding, usually depressed at centre, with involute margin when young, slightly to distinctly hygrophanous, when moist translucently striate up to centre, olivaceous green or olivaceous brown, sometimes yellow-green, lemon-yellow or (reddish) brown, usually darker at centre (ranging from K. & W. 1-3 B-E 5-6 or 7B-E 5-6; Mu. 5 Y 4-8/3-6, 10 YR 3-4/2, 2.5 Y 6-7/6) pallescent on drying, radially fibrillose, often minutely squamulose at centre, sometimes entirely tomentose, becoming radially rimose and minutely squamulose with age. Lamellae, L = 15-23, l = 3-7, moderately distant to crowded, adnate, slightly emarginate or with decurrent tooth to decurrent, arcuate, then segmentiform, rarely ventricose, up to 5 mm broad, sometimes transvenose, with slight green tinge when young, then sordid pink with entire, concolorous edge. Stipe 20-80 × 1.5-4 mm, cylindrical or compressed with groove, rarely distinctly broadened at base, vivid green-yellow, sometimes turning brown with age or towards base, sometimes with bluish tinges, quickly turning blue-green when bruised, especially in lower parts (1A-B4, 3A6-7, 4A-B7 turning 25D7, 26D7, 28D7, 26A5-6), glabrous, polished, rarely innately fibrillose and twisted, white tomentose at base. Context pale green olivaceous in pileus and stipe, turning blue-green when cut or bruised. Smell none to fairly strong, somewhat nauseating (often compared with the smell of mice or certain sweet cheeses). Taste none or nasty.

Spores (9.0-) 10.5-13.0 (-14.0) × 7.5-9.5 (-10.0) µm, Q = 1.2-1.7, $\bar{Q}$ = 1.4, ellipsoid in outline, 6-9-angled in side-view. Basidia 28-60 × 9-16 µm, 2- or 4-spored, clampless. Lamella edge fertile. Cheilocystidia absent. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of 10-20 µm wide cylindrical to inflated hyphae with clavate, up to 25 µm wide terminal elements. Pigment intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups among mosses and grasses in poorly manured, semi-natural meadows on fairly dry, loamy or sandy, often slightly calcareous soils. Rare. Widespread and locally fairlly common in similar habitats in temperate and boreal regions of Europe. June-Oct.

Entoloma incanum is readily recognized by the green or olivaceous colours, and the blue-green tinges that quickly appear when the fungus is bruised. The colour, especially that of the pileus, is rather variable, which made Arnolds (loc. cit.), and Reid (loc. cit.) distinguish varieties on account of a slightly differently coloured pileus. These colours, however, intergrade in one and the same population. Therefore I do not attach a taxonomic value to them.

125. Entoloma exile (Fr.: Fr.) Hesler in Beih. Nova Hedwigia 23: 178. 1967.

Agaricus exilis Fr., Observ. mycol. 2: 93. 1818; *Agaricus exilis* Fr.: Fr., Syst. mycol. 1: 206. 1821; *Rhodophyllus exilis* (Fr.: Fr.) Quél., Enchir. Fung.: 65. 1886; *Leptonia exilis* (Fr.: Fr.) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960.

KEY TO THE VARIETIES

1. Pileus conico-campanulate or hemispherical, with distinct papilla; base of stipe white tomentose, not changing colour when bruised. var. **exile**

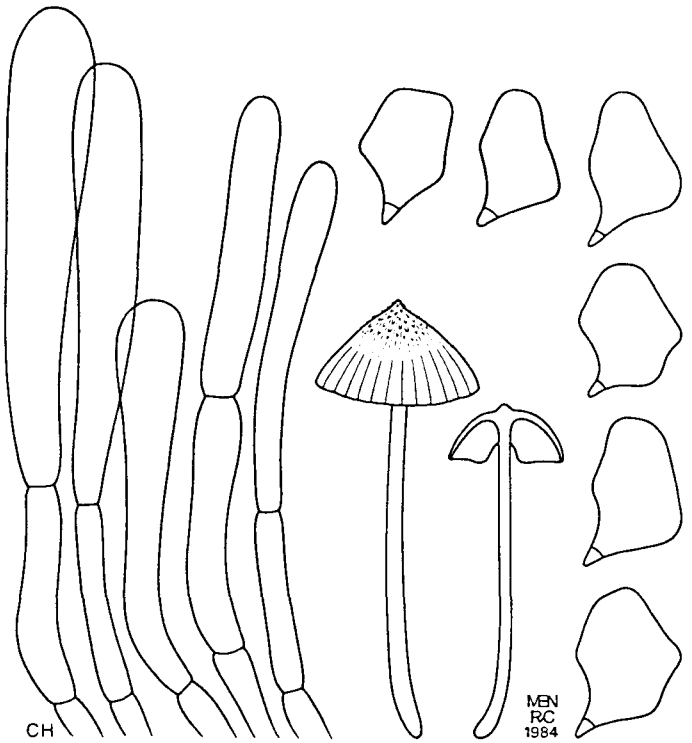

Fig. 180. *Entoloma exile* var. *exile*.

1. Pileus conico-convex or hemispherical, then applanate, with depressed centre; base of stipe quickly turning bright orange with age or when bruised. . . . . var. **pyrospilum**

var. **exile** – Fig. 180.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 590, fig. 2. 1929.

SEL. DESCR. – Romagn. in Bull. trimest. Soc. mycol. Fr. 60: 93-94. 1944.

Pileus 8-20 mm, conico-campanulate or hemispherical, with distinct papilla, with involute margin when young, distinctly hygrophanous, deeply translucently striate when moist, pale grey-brown or yellow-brown (Mu. 10 YR 6-8/2-3) much darker at centre (10 YR 4/2), often with a faint bluish green tinge (glaucous), minutely squamulose at centre, radially fibrillose at margin. Lamellae, L = 12-20, l = 3-7, distant, adnate or with slight decurrent tooth, sometimes emarginate, segmentiform to ventricose up to 6 mm broad, almost white, then pale greyish pink, with minutely denticulate or fimbriate, concolorous edge. Stipe 12-50 × 1-2 mm, cylindrical, sometimes twisted, sometimes broadened at base, pale greenish grey, glaucous, greenish-bluish or yellowish-greenish, but always dull (2.5 Y 7/4-6, 6/6, 8/4; 5 Y 7-8/3) sometimes minutely pruinose at apex, downwards glabrous, polished or interruptedly silky-striate, white tomentose at base. Context pale grey or yellowish in cortex of pileus and stipe, slightly tinged grey-yellow above attachment of lamellae, brittle. Smell weak, slightly spermatic. Taste not known.

Spores 9.0-10.5(-12.0) × 6.0-8.0 µm, Q = 1.25-1.5, $\bar{Q}$ = 1.35, ellipsoid in outline with 5 or 6 angles in side-view. Basidia 25-47 × 8-12.5 µm, 2- and 4-spored, clampless. Lamella edge sterile. Cheilocystidia 25-85 × 6-17 µm, cylindrical or clavate, often septate. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of 12-20 µm wide cylindrical or inflated hyphae with clavate, up to 25 µm wide terminal elements. Pigment brownish intracellular in pileipellis. Brilliant granules abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In poorly manured meadow on river clay. Very rare (Zwolle: Hengforder waarden). Very rare in W. and N.Europe. July-Oct.

var. **pyrospilum** (Romagn. ex P.D.Orton) Noordel. in Persoonia 12: 461. 1985. – Fig. 181.

Leptonia pyrospila (Romagn. ex) P.D.Orton in Trans. Br. mycol. Soc. 43: 298. 1960; *Entoloma pyrospilum* (P.D.Orton) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 200. 1978.

SEL. DESCR. & FIGS. – P.D.Orton in Trans. Br. mycol. Soc. 43: 298. 1960; Romagn. in Bull. trimest. Soc. mycol. Fr. 60: 96. 1944.

CHARACTERISTICS. – Pileus conico-convex to convex or applanate with depressed centre; lamellae pale, then pink with concolorous or brown edge; stipe with basal tomentum that quickly turns bright orange with age or when bruised.

HABITAT & DISTR. – In meadows, poorly manured grasslands, and also in peaty areas among *Sphagnum*. Very rare (Bemelen: Bemelerberg). Widespread in Europe, occurring from the lowlands up into the subalpine zone. Rare. Aug.-Nov.

126. Entoloma xanthochroum (P.D.Orton) Noordel. in Persoonia 12: 462. 1985. – Fig. 182.

Leptonia xanthochroa P.D.Orton in Notes R. bot. Gdn Edinb. 26: 54. 1964.

MISAPPL. – *Rhodophyllus whitae* sensu Romagn. & Favre in Rev. Mycol. 3: 68-70. 1938; sensu Einh. in Ber. bayer. bot. Ges. 47: 127. 1976. – *Leptonia formosa* sensu Rick., Blätterpilze: 290. 1913; sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 203. 1953.

SEL. ICON. – Einh. in Ber. bayer. bot. Ges. 47: pl. 1. 1976 (as *R. whitae*).

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 47: 127-128. 1976 (as *R. whitae*); P.D.Orton in Notes R. bot. Gdn Edinb. 26: 54. 1964; Romagn. & Favre in Rev. Mycol. 3: 68-70. 1938 (as *R. whitae*).

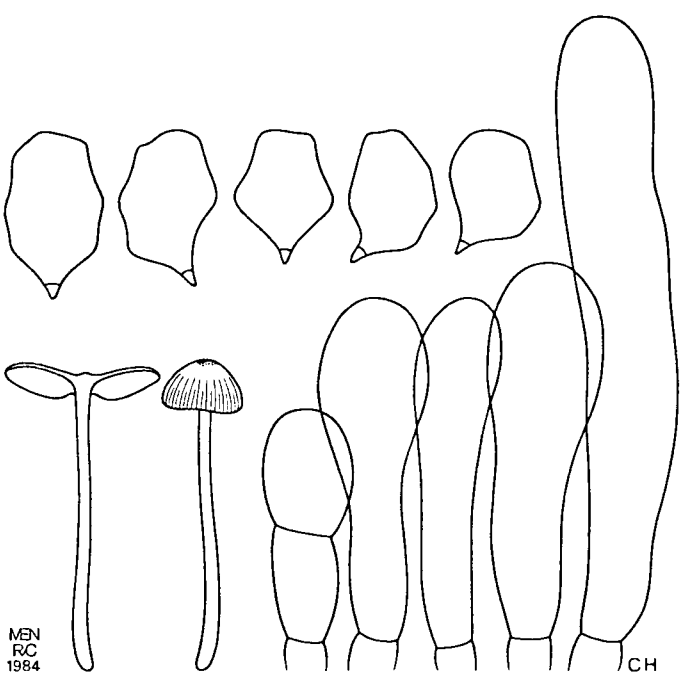

Fig. 181. *Entoloma exile* var. *pyrospilum*.

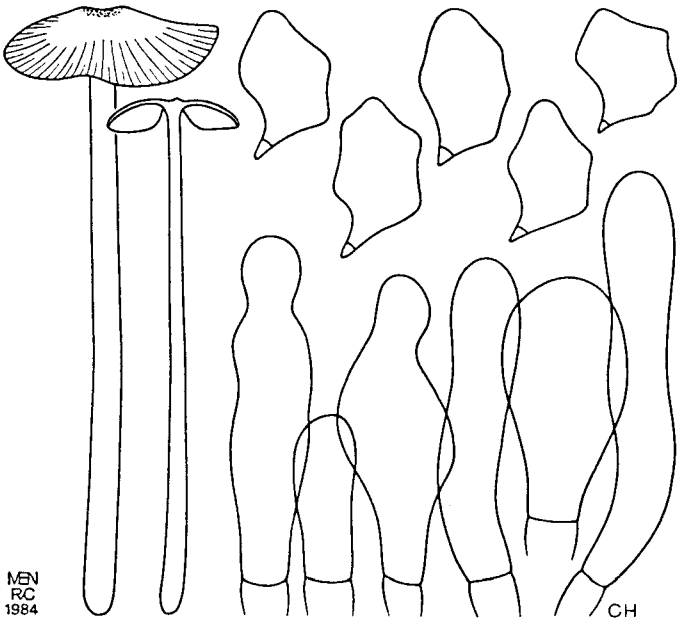

Fig. 182. *Entoloma xanthochroum*.

Pileus 19-40 mm, truncately conical, campanulate or convex with slightly to distinctly depressed centre, sometimes with small papilla in central depression, with slightly involute margin when young, not or weakly hygrophanous, when moist translucently striate up to half of radius, yellow, ochraceous yellow or orange-yellow with darker brown centre (Mu. 2.5 Y 4-6/8; 10 YR 6/8; 7.5 YR 5-6/6, centre 7.5 YR 4/6), slightly pallescent on drying, entirely tomentose or fibrillose when young, then minutely squamulose at centre, towards margin radially fibrillose-subsquamulose. Lamellae, L = 18-30, l = 3-7, moderately crowded, broadly adnate-emarginate or with decurrent tooth, segmentiform to ventricose, pale yellow ochraceous with pink tinge (10 YR 8/4, 8/6; 7.5 YR 7-8/6), with brown, rarely concolorous, fimbriate edge. Stipe 30-70 × 1-4 (-5) mm, cylindrical or compressed, yellow to yellow-brown, paler and more yellow than pileus, glabrous, polished, at base white tomentose. Context thin, brittle, concolorous or slightly paler than surface. Smell none or sweetish, like flowers. Taste more or less pronouncedly acidulous or subrancid, a bit nasty.

Spores (9.0-) 10.0-13.5 (-14.5) × 6.5-9.0 µm, Q = 1.2-1.75, $\overline{Q}$ = 1.45-1.55, ellipsoid in outline with 5-8(-9) angles in side-view. Basidia 30-50 × 8-13 µm, 4-spored, clampless. Lamella edge sterile, rarely heterogeneous. Cheilocystidia 25-85 (-90) × 4-25 µm, cylindrical to clavate, rarely subcapitate, frequently with brown intracellular pigment, always abundant, sometimes mixed with basidia. Pileipellis a trichoderm or a hymeniderm at centre, towards margin a transition between a cutis and a trichoderm, made up of 10-25 µm wide hyphae with clavate, up to 30 µm wide terminal elements. Pigment yellowish, intracellular in pileipellis. Brilliant granules absent or present, never abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups in poorly manured, semi-natural grassland on peaty or loamy soil, probably with preference for basic soils. Very rare (Winterswijk: Willinks Weust). Rare but widespread in N.W.Europe. Aug.-Oct.

Entoloma xanthochroum belongs to the group of *E. sarcitulum*, and is distinguished by its pale, yellow tinges in all parts of the basidiocarp, large spores, and brown lamella edge. *Entoloma formosum* comes very close, but lacks yellow tinges in the lamellae, and has a concolorous lamella edge without or with scattered cheilocystidia.

The description above is based on two Netherlands' collections, each

consisting of one basidiocarp from the same locality, but is supplemented by data from rich collections from Scotland.

127. Entoloma formosum (Fr.: Fr.) Noordel. in Persoonia 12: 461. 1985. – Fig. 183.

Agaricus formosus Fr.: Fr., Syst. mycol. 1: 208. 1821; *Leptonia formosa* (Fr.: Fr.) Gillet, Hyménomycètes: 414. 1876; *Rhodophyllus formosus* (Fr.: Fr.) Quél., Enchir. Fung.: 61. 1886. – *Leptonia fulva* P.D.Orton in Trans. Br. mycol. Soc. 43: 293. 1960; *Entoloma fulvum* (P.D.Orton) Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 331. ('1982') 1983.

MISAPPL. – *Leptonia andrianae* sensu F.Møller, Fungi Faeröes 1: 243. 1945.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 4d. ('1982') 1983.

SEL. DESCR. & FIGS. – Arnolds, loc.cit.: 331-332, fig. 146. ('1982') 1983 (as *E. fulvum*); F.Møller, loc.cit.: 243-244, fig. 113. 1945 (as *L. andrianae*).

Pileus 6-50 mm, conico-convex then convex to applanate with slightly to distinctly depressed centre, rarely with small papilla in central depression, with slightly involute margin, weakly hygrophanous, when moist translucently striate up to half of radius, reddish yellow to fulvous (Mu. 7.5 YR 3-5/4; 10 YR 5-6/6) paler towards margin, at centre often darker, slightly pallescent on drying, squamulose with uplifted squamules at centre, radially fibrillose-subsquamulose at margin. Lamellae, L = 15-26, l = 1-7, moderately crowded, adnate, often slightly emarginate, segmentiform to ventricose, white or tinged cream, then pale pink with entire or more or less fimbriate, concolorous edge. Stipe 30-90 × 1-4 mm, cylindrical, often slightly broadened at base, concolorous with or paler and more yellow than pileus (2.5 Y 8/4-6; 10 YR 6-8/6), glabrous or substriate with scattered silvery fibrils. Context thin, concolorous with surface. Smell none. Taste none or slightly oily-rancid.

Spores 9.0-12.5(-13.5) × 6.0-8.0(-9.0) µm, Q = 1.2-1.7, $\bar{Q}$ = 1.45-1.55, ellipsoid in outline with 6-7 angles in side-view. Basidia 24-55 × 9.5-14 µm, 4-spored, clampless. Lamella edge fertile or heterogeneous. Cheilocystidia 20-45 × 5-12 µm, subcylindrical to narrowly clavate, scattered among basidia. Pileipellis a trichoderm at centre, towards

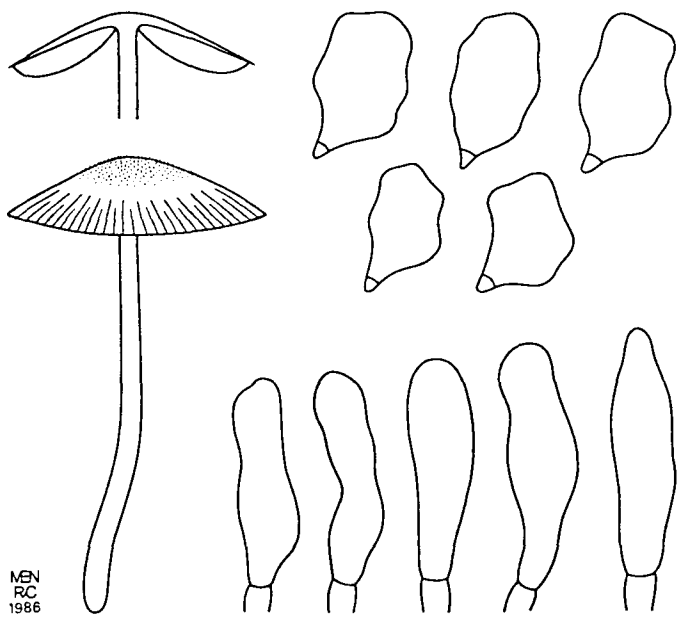

Fig. 183. *Entoloma formosum.*

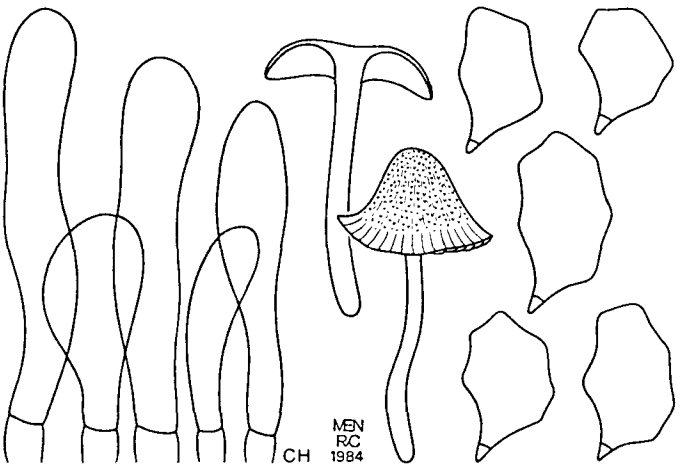

Fig. 184. *Entoloma turci.*

margin transition between a cutis and a trichoderm, made up of radially arranged 6-15 µm wide inflated hyphae with clavate 12-30 µm wide terminal elements. Pigment yellow-brown, intracellular in pileipellis. Brilliant granules sparsely present in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In mossy, poorly manured grassland, roadsides, etc. (*Nardo-Galion*), usually in small groups. Very rare (Anloo: Eexterveld). Aug.-Nov. Widespread and fairly common elsewhere in Europe.

128. Entoloma turci (Bres.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 200. 1978. – Fig. 184.

Leptonia turci Bres., Fungi trident. 1: 47. 1884; *Rhodophyllus turci* (Bres.) Kühn. & Romagn., Fl. anal. Champ. sup.: 205. 1953 (not valid, basionym not mentioned). – *Entoloma turci* var. *marginatum* M.Bon in Doc. mycol. 12(46): 8. 1982.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 572. 1929.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 108, figs. 19, 22, 24. 1969; P.D.Orton in Trans. Br. mycol. Soc. 43: 302. 1960.

Pileus 10-45 mm broad, truncately campanulate or truncately conical, then convex, not very much expanding with age, with depressed to umbilicate centre, with slightly involute margin when young, with irregularly lobed marginal zone when old, not hygrophanous, not translucently striate or at outermost margin only, rather dark grey-brown or reddish brown (Mu. 5-7.5 YR 3/2; 10 YR 3-5/2-3) entirely adpressedly fibrillose-squamulose or lanate, then coarsely squamulose at centre, radially fibrillose-streaky towards margin, often showing context between the fibrils. Lamellae, L = 20-35 (-45), l = (1-) 3-7, fairly crowded, broadly adnate, often with small decurrent tooth, segmentiform to ventricose, brown with pink tinge with concolorous or (in part) brownish, entire edge. Stipe 20-60 × 2-5 mm, cylindrical or compressed, sometimes broadened towards base, grey-brown with yellow or reddish tinge (7.5 YR 3/2; 10 YR 3-6/2-4), often paler and less grey than pileus, glabrous, polished or with some scattered silvery fibrils lengthwise, sometimes with metallic sheen, at base white tomentose, slowly turning orange-red with age or when bruised, solid or narrowly fistulose. Context concolorous with surface, in base of stipe, and often also in lamellae slowly turning orange-red when bruised. Smell none or subfarinaceous. Taste not distinctive.

Spores 9.0-12.5 (-13.5) × 6.0-9.0 µm, Q = 1.25-1.75, $\bar{Q}$ = 1.4-1.5, ellipsoid in outline with 5-7 angles in side-view. Basidia 22-45 × 7-12 µm, 4-spored, clampless. Lamella edge sterile, rarely heterogeneous.

Cheilocystidia 25-70 × 6-17 µm, cylindrical to clavate, sometimes with brown intracellular pigment. Pileipellis a trichoderm at centre, transitions between a trichoderm and a cutis at margin, made up of radially arranged, inflated 7-20 µm wide hyphae with clavate 10-23 µm wide terminal elements. Pigment brown, intracellular in pileipellis. Brilliant granules present or absent in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups, terrestrial among mosses and grasses in poorly manured, semi-natural grassland, frequently with *Salix repens* in coastal dunes, also found in moist *Calluna*-heath. Very rare (Oostvoorne; Havelte). Widespread, rare in W. and N.Europe, from lowlands up into subalpine zone. July-Oct.

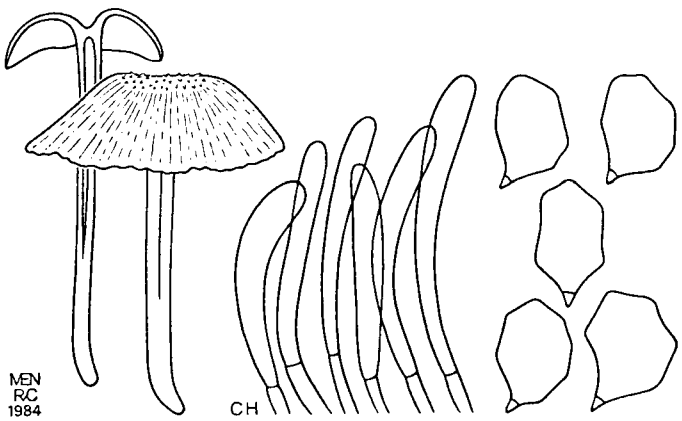

Fig. 185. *Entoloma pseudoturci.*

129. Entoloma pseudoturci Noordel. in Persoonia 12: 215. 1984. – Fig. 185.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 215-217, fig. 11. 1984.

Pileus 8-50 mm, truncately conical to convex with depressed centre, with involute margin when young, then more or less straight, not hygrophanous, not translucently striate, or at outermost margin only, dark reddish brown or sepia, sometimes with grey tinge (Mu. 10 YR 3-6/3-4; 7.5 YR 5/4) with darker centre, entirely velutinous when young, then with small uplifted squamules at centre, adpressedly fibrillose-squamulose towards margin. Lamellae, L = 20-25, l = 1-7, moderately distant, broadly adnate, sometimes slightly emarginate, segmentiform to ventricose, pallid, almost white when young then pale brown pink (7.5 YR 7-8/4), with concolorous, entire edge. Stipe 25-50 × 2-3 (-4) mm, cylindrical, slightly broadened at base or slightly tapering downwards, grey-brown, paler than pileus, glabrous, polished or substriate with some scattered silvery fibrils, white tomentose at base, solid or narrowly fistulose. Context thin, brittle, concolorous with surface in cortex of pileus and stipe, in inner parts paler. Smell none or faintly aromatic like fruit or flowers. Taste none or slightly acrid.

Spores 7.5-10.0 × 6.0-7.0 (-8.0) µm, Q = 1.1-1.7, $\overline{Q}$ = 1.35-1.4, ellipsoid in outline with 6-8 angles in side-view. Basidia 28-45 × 7-14 µm, 4-, rarely also 2- or 3-spored, clampless. Lamella edge sterile or heterogeneous. Cheilocystidia 35-60 × 3-11.5 µm, cylindrical to narrowly clavate. Pileipellis a trichoderm to a hymeniderm at centre, made up of clavate elements, 7.5-35 µm wide. Pigment brown, intracellular in pileipellis. Brilliant granules present but never abundant in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in moist dune-valley among grasses and mosses on more or less calcareous sandy soil, also found in xerophytic grassland on calcareous soil. Very rare (Vogelenzang; Drongelens Kanaal). Also known from Norway, Denmark and Belgium. July-Nov.

Entoloma pseudoturci resembles *E. turci* in the dull grey-brown colours and non-striate stipe, but it clearly differs from that species in spore-size and lack of reddish tinges in the base of the stipe and trama of lamellae when old or bruised.

130. Entoloma porphyrofibrillum Noordel. in Persoonia 12: 217. 1984. – Fig. 186.

SEL. DESCR. & FIGS. – Noordel. in Persoonia 12: 217-219, fig. 12. 1984.

Pileus 35-65 mm, convex, deeply umbilicate, with almost straight margin, not hygrophanous, not translucently striate, grey porphyraceous with purplish tinge, strongly radially fibrillose-tomentose at centre, breaking up in small squamules with age, becoming strongly radially fibrillose-rimose at margin when old. Lamellae, L = 30-40, l = 3-7, crowded, adnate-emarginate or adnate with small decurrent tooth, segmentiform to subventricose, pale yellowish pink with strongly dentate concolorous edge. Stipe 60-85 × 3-4 mm, cylindrical, slightly broadened towards base, white creamy, glabrous at apex, downwards densely fibrillose-flocculose with grey porphyraceous fibrils, concolorous with pileus, on slightly paler background, white tomentose at base. Context thin, very brittle, pallid, with slightly purple tinge in pileus, fibrillose, whitish in stipe. Smell none. Taste none.

Spores 10.0-13.5 × 6.0-8.0 µm, Q = 1.4-2.0, $\overline{Q}$ = 1.6, ellipsoid in side-view with many almost nodulose angles. Basidia 32-54 × 8-14 µm,

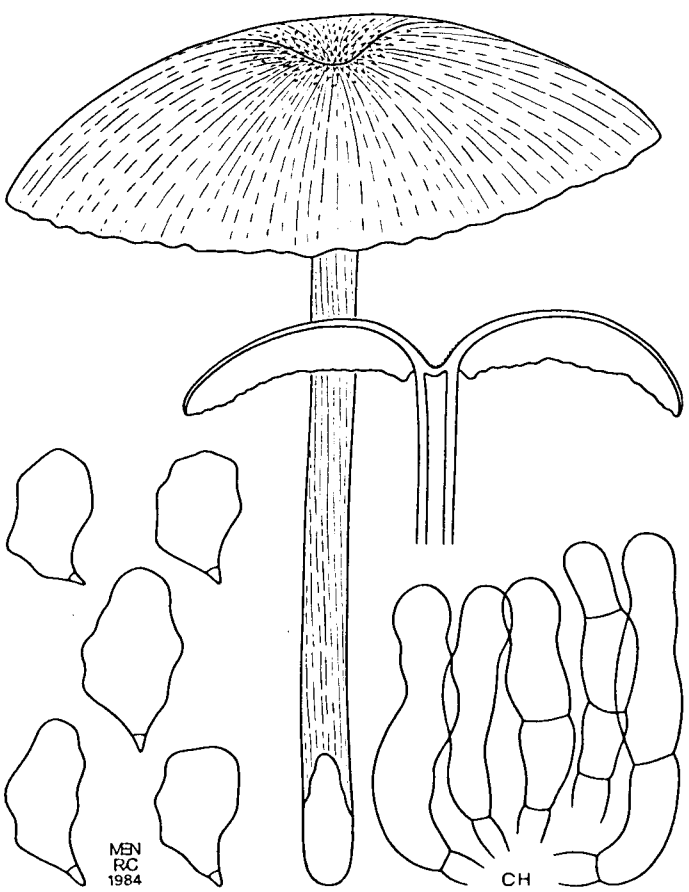

Fig. 186. *Entoloma porphyrofibrillum.*

4-spored, clampless. Lamella edge sterile. Cheilocystidia 15-40 × 5-15 µm, cylindrical to clavate, in dense fascicules born on sterile band along edge. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of radially arranged, inflated 7-14 µm wide hyphae with clavate up to 15 µm wide terminal elements. Pigment purplish brown, intracellular in pileipellis. Brilliant granules absent. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups in poorly manured grassland with *Juniperus communis* on subneutral to slightly acid loamy soil. Very rare (Winterswijk: Willinks Weust). Only known from type-locality. July-Aug.

Entoloma porphyrofibrillum resembles *E. porphyrophaeum* in colour but clearly differs in shape of pileus, in size and shape of spores and cheilocystidia, and in having clampless basidia.

131. Entoloma sarcitulum (Kühn. & Romagn. ex P.D.Orton) Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 348. ('1982') 1983.

Rhodophyllus sarcitulus Kühn. & Romagn., Fl. anal. Champ. sup.: 204. 1953 (not valid, no Latin diagn.); *Leptonia sarcitula* P.D.Orton in Trans. Br. mycol. Soc. 43: 301. 1960.

KEY TO THE VARIETIES

1. Spores small, 7.5-10.5 × 6.5-8.5 (-9.0) µm, average per collection 8.5-10 × 6.5-7.5 µm. . . . . var. **microsporum**
1. Spores larger, average per collection 10-11.5 × 7-8 µm. 2
2. Pileus distinctly hygrophanous; lamellae with distinct brown tinge; stipe dull brown often with metallic-grey tinge in lower part. var. **majusculum**
2. Pileus less distinctly hygrophanous; lamellae pale then pink; stipe yellow or yellow-brown without a distinct grey tinge. var. **sarcitulum**

var. **sarcitulum** – Fig. 187.

Entoloma sarcitulum var. *spurcifolium* (Kühner ex) Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 348. ('1982') 1983; *Rhodophyllus sarcitulus* var. *spurcifolius* Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 9. 1954 (Compl. Fl. anal. 1).

MISAPPL. – *Leptonia sarcita* sensu Konr. & M., Ic. sel. Fung. 2: pl. 183, fig. 2. 1930.

SEL. ICON. – Konr. & M., Ic. sel. Fung. 2: pl. 183, fig. 2. 1930 (as *L. sarcita*).

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 348-350, fig. 158. ('1982') 1983 (incl. var. *spurcifolium*); Kühn. & Romagn. in Rev. Mycol. 19: 38-40, figs. 8, 10. 1954; P.D.Orton in Trans. Br. mycol. Soc. 43: 301, fig. 323. 1960.

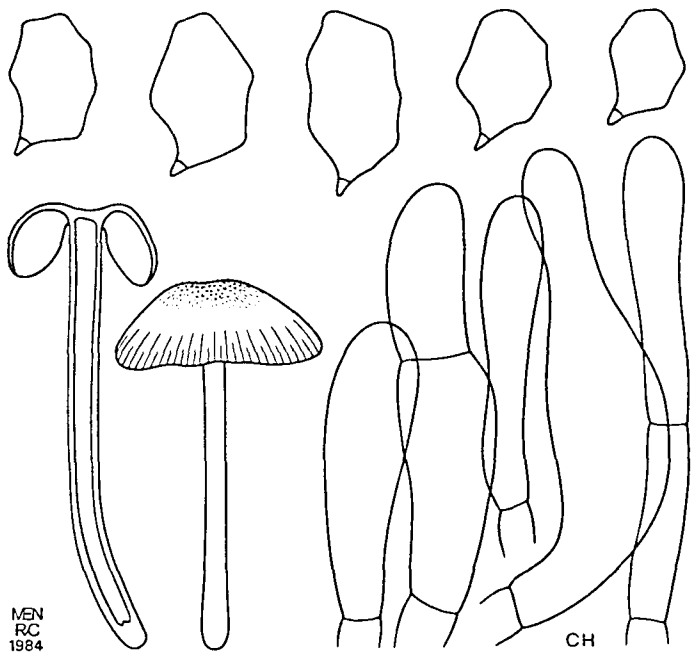

Fig. 187. *Entoloma sarcitulum* var. *sarcitulum*.

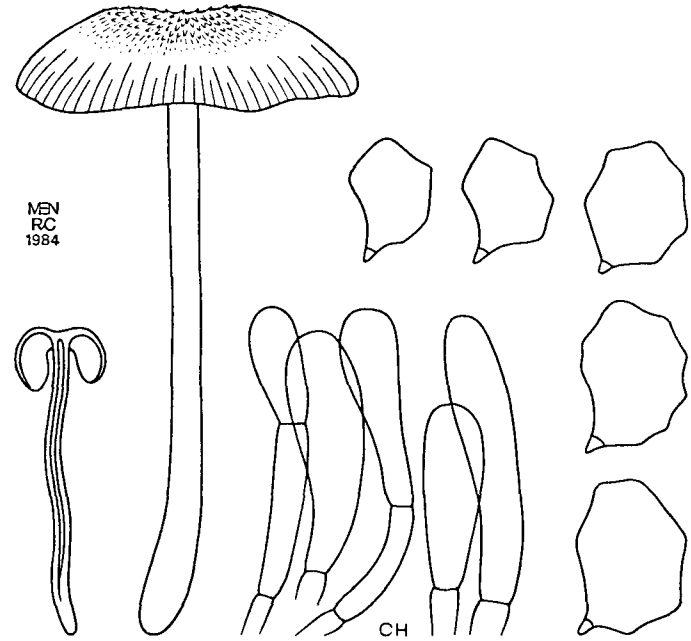

Fig. 188. *Entoloma sarcitulum* var. *majusculum*.

Pileus 6-25 mm, truncately conical or campanulate, then conico-convex, finally applanate with slightly depressed to distinctly umbilicate centre, rarely with small papilla, with slightly involute margin when young, not or weakly hygrophanous, when moist translucently striate up to centre, dull brown with reddish, greyish or yellowish tinges (Mu. 7.5 to 10 YR 4-5/3-4), darker to almost black at centre, paler at margin, slightly pallescent on drying or not, rugulose at centre, breaking up in small squamules with age, towards margin radially fibrillose to almost glabrous. Lamellae, L = 20-30, l = 1-5, moderately crowded, broadly to narrowly adnate, sometimes emarginate or with small decurrent tooth, white to pale cream, then pink with concolorous or brown, entire edge. Stipe 20-60 (-80) × 1-4 mm, cylindrical or compressed, sometimes broadened at base, yellow-brown, paler than pileus, rarely with slight grey tinge, glabrous, polished or with scattered innate fibrils to substriate, white tomentose at base, solid, then narrowly fistulose. Context thin, concolorous with surface or slightly paler in inner parts of pileus and stipe. Smell none or faintly sweetish-subaromatic. Taste none or slightly rancid-farinaceous.

Spores 9.0-12.5 (-13.5) × 6.0-9.0 µm, Q = 1.2-1.7, $\bar{Q}$ = 1.45, ellipsoid in outline with 5-9 angles in side-view. Basidia 22-45 × 7.5-11.5 µm, 4-, rarely also 2-spored, clampless. Lamella edge heterogeneous, more rarely fertile or entirely sterile. Cheilocystidia, if present, cylindrical to clavate, 25-60 × 6-11(-15) µm, sometimes with brown intracellular pigment. Pileipellis a trichoderm at centre, towards margin more like a cutis, made up of radially arranged cylindrical to inflated, 10-22 µm wide hyphae with inflated to clavate, up to 25 µm wide terminal

elements. Pigment brown, intracellular in pileipellis. Brilliant granules usually abundant, more rarely absent, in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In groups in poorly manured grassland, hayfields, dune-meadows, on slightly acid to calcareous soils. Rare. Widespread but generally rare in N. and W.Europe. July-Sept.

var. **majusculum** (Kühn. & Romagn.) Noordel. in Persoonia 12: 462. 1985. – Fig. 188.

Rhodophyllus sarcitulus var. *majusculus* Kühn. & Romagn., Fl. anal. Champ. sup.: 204. 1953 (not valid, no Latin diagn.); *Rhodophyllus majusculus* Kühn. & Romagn. in Rev. Mycol. 19: 6. 1954 (Compl. Fl. anal. 1); *Leptonia majuscula* (Kühn. & Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 178. 1960.

SEL. ICON. – Kühn. & Romagn. in Rev. Mycol. 20: pl. 3C. 1955 (Compl. Fl. anal. 1).

SEL. DESCR. & FIGS. – Kühn. & Romagn. in Rev. Mycol. 19: 41-42, figs. 8, 10. 1954 (Compl. Fl. anal. 1); Kühn. & Romagn. in Rev. Mycol. 20: 70-72, fig. 21. 1955 (Compl. Fl. anal. 1).

CHARACTERISTICS. – Pileus distinctly hygrophanous, translucently striate, dark yellow-brown (Mu. 10 YR 3-4/4-6), with darker centre, pallescent along radial streaks to dull yellowish brown, squamulose at centre only; lamellae brown, then pink (10 YR 6/3; then 7.5-5 YR 7-8/8; 10 YR 4-5/3), with fimbriate, brown or concolorous edge; stipe yellowish brown with distinct grey tinge especially in lower part; spores 9-14.5 × 6.0-9.0 (-11.0) µm.

HABITAT & DISTR. – In small groups in poorly manured grassland on heavy loamy-clayey soil. Very rare (Buren, loampits; Staverden, loampits). Rare, but widespread in W.Europe (Great Britain, France). July-Nov.

var. **microsporum** Noordel. in Persoonia 12: 461. 1985. – Fig. 189.

CHARACTERISTICS. – Differs from var. *sarcitulum* mainly in having much smaller spores: 7.5-10.5 x 6.5-8.5 (-9.0) µm.

HABITAT & DISTR. – In small groups among grass and mosses in moist valley in coastal dunes, on slightly humose, calcareous sandy soil. Very rare (Castricum; Wassenaar: Meyendell; Rockanje: Quackjeswater). Distribution in Europe poorly known: in Norway found on black, slightly calcareous soil in open, mixed woodland. July-Oct.

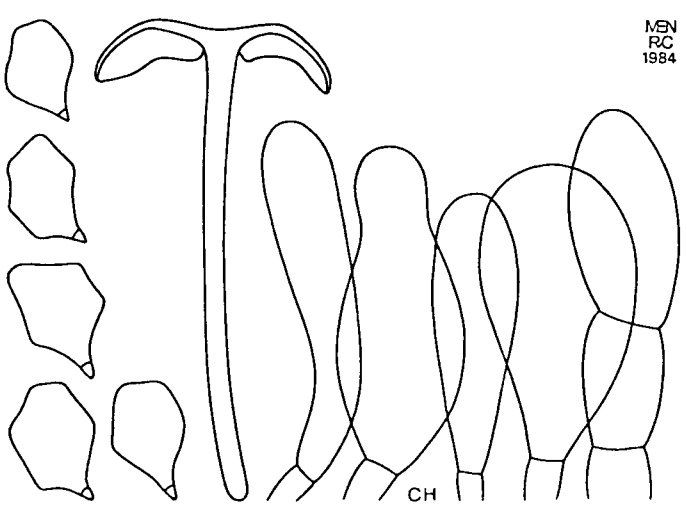

Fig. 189. *Entoloma sarcitulum* var. *microsporum*.

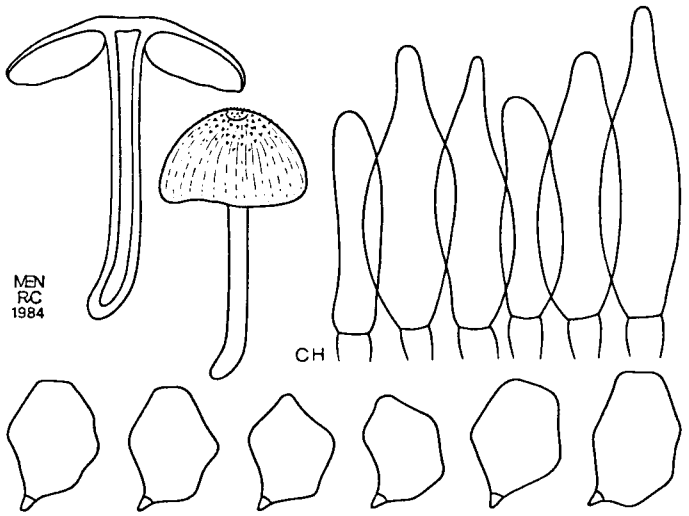

Fig. 190. *Entoloma roseum*.

132. Entoloma roseum (Longyear) Hesler in Beih. Nova Hedwigia 23: 165. 1967. – Fig. 190.

Leptonia rosea Longyear in Trans. Mich. Acad. Sci. 3: 59. 1902; *Rhodophyllus roseus* (Longyear) Mos., Röhrlinge-Blätterpilze 3. Aufl.: 158. 1967. – *Entoloma griseocyaneum* var. *roseum* Maire in Trans. Br. mycol. Soc. 3: 170. 1910.

SEL. DESCR. & FIGS. – Noordel. in Cryptog. Mycol. 4: 34-36, fig. 2. 1983; P.D.Orton in Trans. Br. mycol. Soc. 43: 300-301. 1960.

Pileus 15-30 mm, truncately conical or campanulate, hemispherical, then convex, with slight to distinct umbilicus, with involute margin when young, not hygrophanous, not translucently striate, deep rosy pink when young, usually with darker carmine or brown-red centre, slightly fading with age, entirely velutinous, then granulose to squamulose at centre, radially fibrillose-subsquamulose towards margin. Lamellae, L = 15-20, l = 3-7, moderately crowded, adnate-emarginate, (sub-) ventricose, white, then pink with concolorous, pruinose or entire edge. Stipe 25-60 × 2.5-6 mm, cylindrical or compressed, sometimes broadened towards base, almost concolorous with pileus, becoming brownish pink with age, smooth or white pruinose at apex, white tomentose at base, narrowly fistulose. Context thin, pale pink in cortex of pileus and stipe, white in inner parts. Smell none. Taste none.

Spores 8.5-10.5 (-11.5) × 7.0-8.0 µm, Q = 1.15-1.5, $\overline{Q}$ = 1.3, ellipsoid in outline with 6-9 angles in side-view. Basidia 27-42 × 9-16 µm, 4-spored, clampless. Lamella edge sterile or heterogeneous, sometimes fertile. Cheilocystidia 20-50 × 5-17 µm, broadly clavate to cylindrical, sometimes fusiform or lageniform, scattered to abundant, rarely absent. Pileipellis a trichoderm, at centre almost a hymeniderm, made up of inflated 15-25 µm wide hyphae with clavate terminal elements up to 35 µm wide. Pigment pale pink, intracellular in pileipellis. Brilliant granules present in pileitrama. Clamp-connections absent.

HABITAT & DISTR. – In small groups, sometimes fasciculate in poorly manured grassland on river clay, and on sand dunes among *Salix repens* or *Juniperus communis* on relatively dry to fairly moist soil. Very rare (Rockanje: Quackjeswater; Ommen: Stekkenkamp; Helvoirt: Drongelens kanaal). Widespread but rare in Europe and N.America. Sept.-Oct.

133. Entoloma queletii (Boud.) Noordel. in Cryptog. Mycol. 4: 37. 1983.

Leptonia queletii Boud. in Bull. Soc. bot. Fr. 24: 307. 1877; *Rhodophyllus queletii* (Boud.) Quél., Enchir. Fung.: 61. 1886.

SEL. DESCR. & FIGS. – Noordel. in Cryptog. Mycol. 4: 37-38, fig. 5. 1983.

CHARACTERISTICS. – Pileus pink, with ochraceous centre when old; lamellae pale, then pink; stipe white, densely fibrillose-striate; lamella edge sterile with cylindrical, often flexuose cheilocystidia; clamp-connections absent.

HABITAT & DISTR. – In damp places, preferably in *Alnus* and/or *Fraxinus* forest on humus-rich soils. Widespread in north-western and central Europe.

Although not recorded from the Netherlands yet, it may be expected here in swamp-forest. For that reason, this species is included in the keys.

Subgen. CLAUDOPUS (Gillet) Noordel.

Habit pleurotoid, omphalioid or collybioid; stipe central, excentric or lateral, sometimes lacking; lamellae often decurrent; pigment incrusting or membranal, sometimes in addition also intracellular.

134. Entoloma byssisedum (Pers.: Fr.) Donk in Bull. bot. Gdns Buitenz., ser. III, 18: 158. 1949. – Fig. 191.

Agaricus byssisedus Pers., Ic. Descr. Fung. 2: 56. 1800 (as *A. byssoideus*); *Agaricus byssisedus* Pers.: Fr., Syst. mycol. 1: 276. 1821; *Crepidotus byssisedus* (Pers.: Fr.) Kumm., Führ. Pilzk.: 74. 1871; *Claudopus byssisedus* (Pers.: Fr.) Gillet, Hyménomycètes: 427. 1876; *Rhodophyllus byssisedus* (Pers.: Fr.) Quél., Enchir. Fung.: 65. 1886.

EXCL. – *Crepidotus byssisedus* sensu Rick., Blätterpilze: 304. 1913 (= *Crepidotus* spec.); *Claudopus byssisedus* sensu Horak in Beih. Nova Hedwigia 43: 83-84, fig. 51. 1973 (another species of *Entoloma*); sensu Larg. in Madroño 22: 364-366, 1974 (= *Entoloma* aff. *depluens*).

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 80C. 1973; Ryman & Holmåsen, Svampar: 386. 1984.

VERN. NAME. – Schelpsatijnzwam.

Pileus 3-11 mm, plano-convex to applanate with irregularly undulating margin, sometimes concave to infundibuliform with uplifted margin, cylindrical to reniform when seen above, with slightly involute margin when young, not hygrophanous, not translucently striate, pale grey or brown (e.g. Mu. 10 YR 7/3; 7.5 YR 7/4), radially fibrillose to hirsute, sometimes zonate, dull or shiny. Lamellae, L = 10-25, l = 0-5, rather distant to fairly crowded, thin, adnate to decurrent, arcuate to segmentiform, pale grey or white, then pinkish brown (7.5 YR 7/4), with entire or slightly eroded, concolorous edge. Stipe 1-5 × 0.5-1 mm, strongly reduced, initially sometimes central, soon excentric or lateral, pale grey-brown, concolorous with pileus, pruinose to distinctly silky-striate, sometimes with white mycelial strands at base, solid. Context very thin, concolorous with surface. Smell farinaceous, especially when cut and/or bruised. Taste farinaceous-rancid.

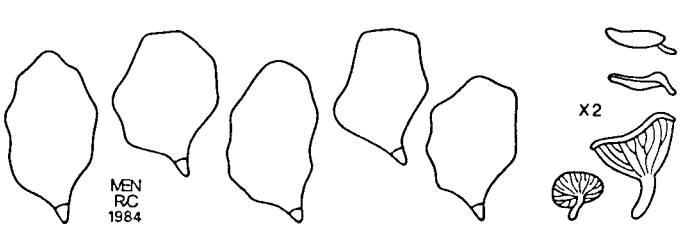

Fig. 191. *Entoloma byssisedum.*

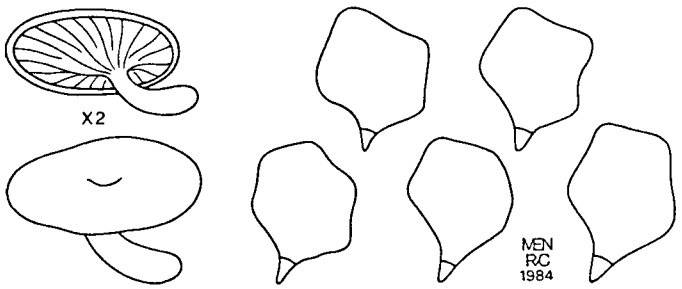

Fig. 192. *Entoloma parasiticum.*

Spores (9.5-) 10.0-12.0 (-12.5) × 6.5-8.0 µm, Q = 1.3-1.7 (-1.85), $\bar{Q}$ = 1.45, irregularly nodulose-angular in side-view. Basidia 22-37 × 9-11.5 µm, 4-, rarely also 2-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of 2-9 µm wide, radially arranged hyphae, sometimes forming a transition to a trichoderm with ascending cylindrical to slightly inflated up to 15 µm wide terminal elements. Pigment membranal and incrusting in pileipellis and pileitrama. Clamp-connections present, but rare, in hymenium and pileitrama.

HABITAT & DISTR. – Single or in groups on the ground or on mosses, rotten leaves, wood, etc. Rare, but probably frequently overlooked. Widespread and probably world-wide in temperate and boreal regions. July-Sept.

135. Entoloma parasiticum (Quél.) Kreisel in Feddes Repertorium 95: 699. 1984. – Fig. 192.

Leptonia parasitica Quél. in Bull. Soc. bot. Fr. 25: 287. 1878 (Champ. Jura Vosges 6); *Rhodophyllus parasiticus* (Quél.) Quél., Enchir. Fung.: 61. 1886; *Claudopus parasiticus* (Quél.) Rick., Blätterpilze: 304. 1913. – *Claudopus subdepluens* Fitzp. in Mycologia 7: 37. 1915; *Rhodophyllus subdepluens* (Fitzp.) S.Ito, Mycol. Fl. Japan 2: 436. 1959.

MISAPPL. – *Claudopus depluens* sensu Cooke, Ill. Brit. Fungi: pl. 371 (343, middle figures only). 1884.

SEL. ICON. – Cooke, Ill. Brit. Fungi: pl. 371 (343, middle figures only) 1884 (as *C. depluens*).

SEL. DESCR. – Romagn. in Bull. trimest. Soc. mycol. Fr. 60: 91-93. 1944.

Pileus 3-9 mm broad, circular, then irregularly reniform with slightly involute margin, white, entirely tomentose. Lamellae distant, adnate, narrowly ventricose, up to 2 mm broad, pale, then pink with concolorous, entire edge. Stipe up to 5 × 1 mm, eccentrical to lateral, white, pruinose. Smell none. Taste not known.

Spores 9.5-11.0 × 8.0-9.5 µm, Q = 1.1-1.2, $\bar{Q}$ = 1.15, isodiametrical with 4-6-angles in side-view. Basidia 24-45 × 10-15 µm, 2-, and 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of radially arranged, cylindrical, 2-6 µm wide hyphae. Pigment absent. Clamp-connections present.

HABITAT & DISTR. – In groups on bark of dead wood of deciduous trees. Very rare (Wouw: Wouwse Plantage). From Germany and France also known growing on mosses, but very few data available. Aug.-Oct.

Entoloma parasiticum is treated here in accordance with the description of Romagnesi and the plate of Cooke cited above. It is not clear whether this is the same fungus as originally described by Quélet (l.c.) as growing on *Cantharellus*. The taxonomy of the small, reduced species of *Entoloma* known as '*Claudopus*' is still very confused; more material

must be found and studied to solve the problems. For the time being Romagnesi's concept is maintained for *E. parasiticum*, and apart from the substratum it is readily recognised by its white, pleurotoid basidiocarps and isodiametrical spores.

136. Entoloma depluens (Batsch: Fr.) Hesler in Beih. Nova Hedwigia 23: 16. 1967. – Fig. 193.

Agaricus depluens Batsch, Elench. Fung. Contin. 1: 167. 1786; *Agaricus depluens* Batsch: Fr., Syst. mycol. 1: 275. 1821; *Claudopus depluens* (Batsch: Fr.) Gillet, Hyménomycètes: 427. 1876; *Rhodophyllus depluens* (Batsch: Fr.) Quél., Enchir. Fung.: 65. 1886.

EXCL. – *Claudopus depluens* sensu Cooke, Ill. Brit. Fungi: pl. 371 (343), middle figures (= *E. parasiticum*).

SEL. DESCR. & FIGS. – Noordel. in Nord. J. Bot. 2: 157-159, fig. 10. 1982; P.D.Orton in Trans. Br. mycol. Soc. 43: 186, fig. 239. 1960.

CHARACTERISTICS. – Pileus 4-20 mm, not hygrophanous, not translucently striate, pale grey (brown), densely white-fibrillose, at centre often tomentose; lamellae pale grey with fimbriate, concolorous or paler edge; stipe lacking or strongly reduced, pale grey, finely tomentose; spores 8.0-9.0 (-10.0) × 6.0-7.0 (-8.0) µm, Q = 1.2-1.5, $\bar{Q}$ = 1.3, 5-7-angled in side-view; lamella edge with rare to abundant cylindrical cheilocystidia 28-50 × 3.5-9 µm; clamp-connections present in all tissues.

HABITAT & DISTR. – On mosses, wood or on the ground; very rare, but probably overlooked. Sept.-Oct.

Not yet know from the Netherlands, but in recent years recorded from Denmark and Great Britain. Easily confused with *E. byssisedum* and *E. parasiticum*.

137. Entoloma undatum (Fr. → Gillet) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 211. 1978. – Fig. 194.

Agaricus undatus Fr., Epicr.: 149. 1838, non *A. undatus* Berk., 1836; *Clitopilus undatus* (Fr. →) Gillet, Hyménomycètes: 407. 1876; *Eccilia undata* (Fr. → Gillet) Quél. in Bull. Soc. Amis Sci. Nat. Rouen, sér. II, 15: 157. 1880 (Champ. Jura Vosges 4); *Rhodophyllus undatus* (Fr. → Gillet) Quél., Enchir. Fung.: 62. 1886. – *Eccilia sericeonitida* P.D.Orton in Trans. Br. mycol. Soc. 43: 175. 1960 (illeg., superfluous name); *Entoloma sericeonitidum* (P.D.Orton) Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 350. ('1982') 1983. – *Entoloma undatoides* Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 352. ('1982') 1983.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 3D (as *E. sericeonitidum*), and pl. 3E (as *E. undatoides*) ('1982')' 1983; Bres., Iconogr. mycol. 12: pl. 566. 1929; Ryman & Holmåsen, Svampar: 387. 1984.

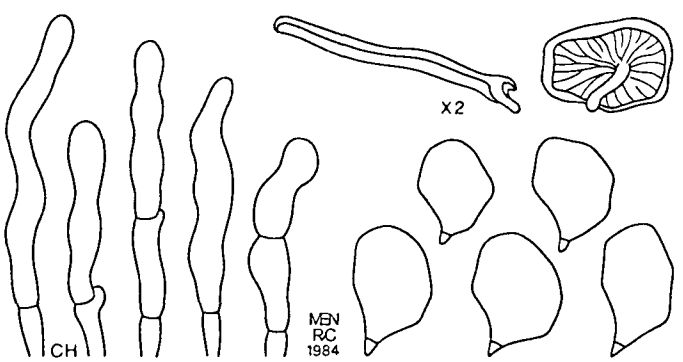

Fig. 193. *Entoloma depluens*.

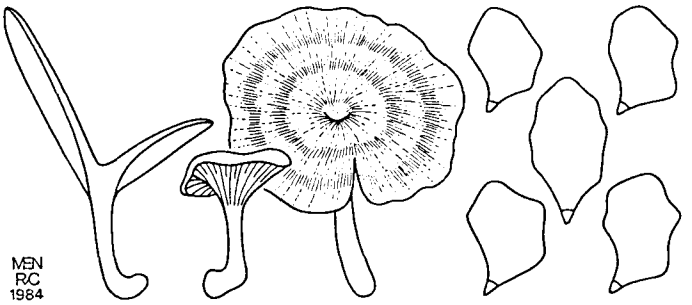

Fig. 194. *Entoloma undatum*.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 350-354, figs. 159, 160 ('1982') 1983 (as *E. sericeonitidum* and *E. undatoides*).

VERN. NAME. – Geribbelde satijnzwam.

Pileus 8-40 mm broad, convex to concave, usually deeply umbilicate, with slightly to distinctly involute margin when young, then straight or reflexed in old specimens, not distinctly hygrophanous, not translucently striate, dark grey-brown, sometimes paler with age, or pale grey-brown from the start, densely radially fibrillose with adpressed to loosely attached silvery-greyish fibrils, often with one or more concentrical zones, shiny, especially when dry. Lamellae, L = 20-35, l = 1-5, crowded, decurrent arcuate, grey or brown, then tinged pink, with entire, concolorous edge. Stipe 10-30 × 1-4(-6) mm, cylindrical or compressed, sometimes broadened at base, pale brown to yellow-brown, much paler than pileus, smooth or finely white pruinose-puberulous, especially in upper part. Context thin, concolorous with surface. Smell none or distinctly farinaceous. Taste none or farinaceous-rancid.

Spores (7.0-)7.5-10.0 × 6.0-7.0 µm, Q = 1.2-1.65, $\bar{Q}$ = 1.35-1.4, 6-8-angled in side-view with weak, rounded angles. Basidia 22-35 (-45) × 7-12 µm, 4-spored, clamped. Lamella edge fertile, Cheilocystidia absent, rarely some scattered cylindrical 'hairs' present, 25-60 × 3.5-8 µm. Pileipellis a cutis of radially arranged, cylindrical to clavate terminal cells up to 15 µm wide. Pigment yellow-brown, membranal and incrusting the hyphae of pileipellis and pileitrama. Clamp-connections present in hymenium.

HABITAT & DISTR. – Terrestrial in groups in grasslands on poor, sandy soil. Not uncommon. Common and widespread in N. and W.Europe. Aug.-Oct.

Entoloma undatum is taken here in a broad sense, including odourless forms and forms with a distinct farinaceous smell. Small specimens of *E. undatum* can be distinguished from *E. rusticoides* and *E. phaeocyathus* by the heterodiametrical spores.

138. Entoloma rhodocylix (Lasch: Fr.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 210. 1978. – Fig. 195.

Agaricus rhodocylix Lasch in Linnaea 4: 542. 1829; *Agaricus rhodocylix* Lasch: Fr., Syst. mycol. 3 (Index): 39. 1832; *Rhodophyllus rhodocylix* (Lasch: Fr.) Quél., Enchir. Fung.: 63. 1886.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 595. 1929; J.Lange, Fl. agar. dan. 2: pl. 80A. 1937.

SEL. DESCR. – Romagn. in Bull. trimest. Soc. mycol. Fr. 48: 313. 1932; Romagn. in Bull. trimest. Soc. mycol. Fr. 49: 437-438. 1933.

VERN. NAME. – Dwergsatijnzwam.

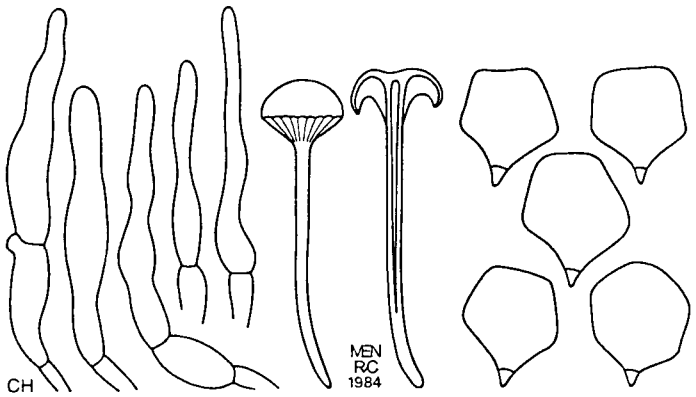

Fig. 195. *Entoloma rhodocylix.*

Pileus 3-10 mm, convex, often slightly depressed to distinctly umbilicate, finally expanded, infundibuliform with irregularly undulating margin, hygrophanous, when moist translucently striate up to centre, pinkish brown or yellow-brown, slightly darker at centre (Mu. 10 YR 7/4; 7.5 YR 7/4-6/4, 5/4), pallescent on drying to very pale brown, glabrous or with some radial fibrils. Lamellae, L = 10-15, l = 0-1 (-3), distant, decurrent, triangular or arcuate, white, then pink with entire, concolorous edge. Stipe 15-40 × 0.5-1 (-2) mm, cylindrical, yellowish (2.5 Y 8/4, 7/4; 10 YR 8/4, 7/4), glabrous, hyaline, polished or with some scattered silvery fibrils. Context very thin, concolorous with surface. Smell none. Taste none.

Spores 8.0-10.0 × 7.0-9.0 µm, Q = 1.0-1.25, $\bar{Q}$ = 1.1, isodiametrical, 5-6-angled in side-view. Basidia 35-50 × 10-14 µm, 4-spored, clamped. Lamella edge heterogeneous. Cheilocystidia cylindrical to lageniform with swollen base and long, tapering neck, 18-60 × 4-10 × 2-7 µm, in clusters among basidia. Pileipellis a cutis of narrow, cylindrical hyphae, 2.5-11 µm wide. Pigment minutely incrusting the hyphae of pileipellis and upper pileitrama. Clamp-connections present.

HABITAT & DISTR. – Among mosses, particularly *Leucobryum glaucum*, on acid, sandy soils. Not uncommon. July-Oct.

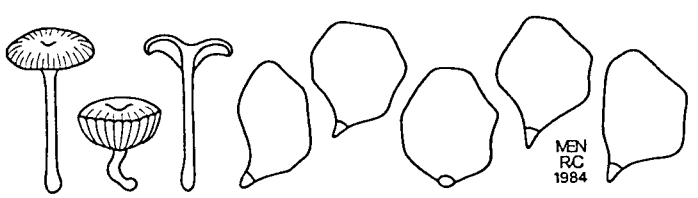

Fig. 196. *Entoloma rusticoides.*

139. Entoloma rusticoides (Gillet) Noordel. in Persoonia 11: 150. 1981. – Fig. 196.

Eccilia rusticoides Gillet, Hyménomycètes: 425. 1876; *Rhodophyllus rusticoides* (Gillet) J.Lange in Dansk bot. Ark. 2(11): 40. 1921.

EXCL. – *Rhodophyllus rusticoides* sensu Einh. in Ber. bayer. bot. Ges. 41: 107. 1969 (= *E. phaeocyathus*).

SEL. ICON. – J.Lange, Fl. agar. dan. 2: pl. 80D1. 1937.

SEL. DESCR. & FIGS. – M.Bon in Doc. mycol. 7(27-28): 74. 1977; Nath.-W. in Friesia 8: 10. 1966.

VERN. NAME. – Kortstelige satijnzwam.

Pileus 5-15 mm, convex, usually deeply umbilicate, with involute margin when young, later on straight, crenulate, hygrophanous, when moist translucently striate up to centre, pale to moderately dark yellow-brown, slightly darker at centre, paler at margin (Mu. 10 YR 6/3, 6/4, centre towards 5/3, 4/3), smooth or slightly rugulose at centre. Lamellae, L = 10-22, l = 1-5, moderately distant, decurrent, arcuate, then ventricose, pale then brownish pink with concolorous, entire edge. Stipe 3-30 × 1-2 mm, cylindrical, often slightly broadened at base, yellow-brown, concolorous with or slightly paler than pileus, glabrous, innately fibrillose-striate lengthwise (lens); base white tomentose. Context thin, concolorous with surface. Smell none. Taste none.

Spores 8.0-10.5 (-11.0) × 7.0-9.0 (-9.5) µm, Q = 1.0-1.25, $\bar{Q}$ = 1.1, rounded-isodiametrical, 5-6-angled in side-view with basal facet. Basidia 23-35 × 10-12.5 µm, 4-, frequently also 2-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm at centre, made up of radially arranged cylindrical 4-11 µm wide hyphae with cylindrical or clavate up to 20 µm wide terminal elements; subpellis sometimes well-developed, made up of inflated elements, 40-150 × 10-40 µm. Pigment membranal-incrusting in pileipellis and upper pileitrama, in addition pale, granular and intracellular especially in subpellis. Clamp-connections absent.

HABITAT & DISTR. – In humus-rich places, gardens, waste-places, etc. Rare. Widespread in N. and W.Europe. June-Nov.

Entoloma rusticoides differs from *E. rhodocylix* in slightly darker colour, clampless basidia, lacking cheilocystidia and habitat, from *E. phaeocyathus* in paler colours, lacking cheilocystidia, different pigmentation of pileipellis, and habitat.

140. Entoloma phaeocyathus Noordel. in Persoonia 12: 461. 1985. – Fig. 197.

Eccilia tristis Bres. in Sacc., Syll. Fung. 9: 89. 1891; *Rhodophyllus tristis* (Bres.) Mal. & Bert., Fl. Champ. sup. Maroc. 1: 573. 1970, non *Entoloma triste* (Velen.) Noordel., 1979.

MISAPPL. – *Rhodophyllus rusticoides* sensu Einh. in Ber. bayer. bot. Ges. 41: 107. 1969.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 591, fig. 1. 1929 (as *E. tristis*); Einh. in Ber. bayer. bot. Ges. 41: pl. 10C. 1969 (as *R. rusticoides*).

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 41: 107, figs. 19, 22. 1969 (as *R. rusticoides*).

Pileus 3-18 mm, hemispherical, then convex with blunt, sometimes slightly depressed centre or with weak papilla, with slightly involute margin when young, hygrophanous, when moist deeply translucently striate, very dark sepia or reddish brown (Mu. 10 YR 2/2, 3/2; 7.5 YR 3/4, 4/4, margin and between striae 10 YR 4/4; 7.5 YR 5/4), pallescent on drying, at centre usually distinctly rugulose, towards margin glabrous or radially fibrillose. Lamellae, L = 10-20, l = 1-3(-5), (moderately) distant, thickish, decurrent, arcuate, grey then dark brown-pink

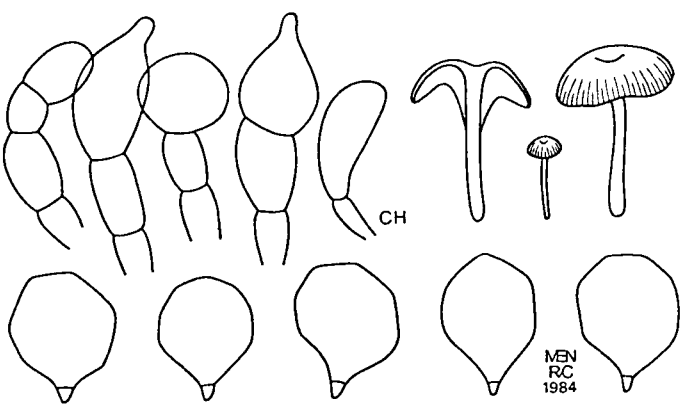

Fig. 197. *Entoloma phaeocyathus.*

with concolorous, entire edge. Stipe 8-20 × 0.5-2 mm, cylindrical or slightly broadened to bulbous at base, yellow-brown to dark brown, glabrous, polished or with some scattered silvery fibrils. Context very thin, concolorous with surface. Smell strongly farinaceous, rarely indistinct. Taste rancid-farinaceous.

Spores 8.0-10.0 × 7.0-9.0 µm, Q = 1.0-1.5, $\bar{Q}$ = 1.1-1.3, isodiametrical in side-view with thin walls. Basidia 30-45 × 9-15 µm, 4- and 2-spored, clampless. Lamella edge heterogeneous. Cheilocystidia 15-40 × 7-18 µm, broadly clavate to subglobose, scattered or in groups among the basidia. Pileipellis a cutis with transitions to a trichoderm, made up of inflated hyphae, 5-12 µm wide with, especially at centre, large, inflated terminal elements up to 30 µm wide. Pigment coarsely incrusting the hyphae of pileipellis, pileitrama and hymenophoral trama. Clamp-connections absent.

HABITAT & DISTR. – In the Netherlands found with the grass *Ammophila arenaria* in coastal dunes. Very rare (Terschelling: Boschplaat, Noordsvaarder; Grevelingen: Hompelvoet). Also found in dry grassland on calcareous soil in Belgium, and in the German Federal Republic and Switzerland. Not much known about distribution and ecology in north-western Europe. Sept.-Nov.

Entoloma phaeocyathus is characterized by its dark colours and clavate to subglobose cheilocystidia.

Subgen. OMPHALIOPSIS Noordel.

SEL. LIT. – Noordel. in Persoonia 11: 148. 1981.

Habit omphalioid; pileus usually distinctly hygrophanous; pigment intracellular sometimes also incrusting the hyphae of pileitrama; clamp-connections present or absent; spores with dihedral base.

141. Entoloma incarnatofuscescens (Britz.) Noordel. in Persoonia 12: 461. 1985. – Fig. 198.

Agaricus incarnatofuscescens Britz., Hymenomyc. Südbayern 8: 6. ('1891') 1894; *Leptonia incarnatofuscescens* (Britz.) Sacc., Syll. Fung. 11: 47. 1895. – *Rhodophyllus leptonipes* Kühn. & Romagn. in Rev. Mycol. 19: 6. 1954 (Compl. Fl. anal. 1); *Leptonia leptonipes* (Kühn. & Romagn.) P.D.Orton in Trans. Br. mycol. Soc. 43: 177. 1960; *Entoloma leptonipes* (Kühn. & Romagn.) Mos., Röhrlinge-Blätterpilze, 4. Aufl.: 210. 1978.

SEL. ICON. – Britz., Hymenomyc. Südbayern 8: pl. 195, fig. 137. ('1891') 1894; Romagn. in Kühn. & Romagn. in Rev. Mycol. 20: pl. 3a. 1955 (Compl. Fl. anal. 1) (as *R. leptonipes*).

SEL. DESCR. & FIGS. – Kühner in Kühn. & Romagn. in Rev. Mycol. 19: 33-35, fig. 7. 1954 (Compl. Fl. anal. 1) (as *R. leptonipes*); Romagn. in Kühn. & Romagn. in Rev. Mycol. 20: 214-216, fig. 19. 1955 (Compl. Fl. anal. 1) (as *R. leptonipes*).

Pileus 5-35 mm, convex, soon applanate with slightly depressed to distinctly umbilicate centre, finally usually infundibuliform, rarely with small papilla within central depression, with margin slightly involute, then straight, weakly to distinctly hygrophanous, when moist flesh-coloured brown to reddish brown, often with purple or lilacinous sheen, rarely tinged blue at margin, with centre usually darker (centre Mu. 10 YR 3-5/1-2; 7.5 YR 3/2; 5 YR 2.5/2; towards margin 10 YR 5-7/3-4; 7.5 YR 6/2; 5 YR 4/2), usually distinctly translucently striate up to half or three-quarters of radius, slightly to distinctly pallescent on drying to greyish brown (10 YR 6/3, 7/3, 7/2, 8/1), distinctly minutely squamulose at centre and fibrillose towards margin, sometimes entirely adpressed squamulose, sometimes glabrescent with age. Lamellae, L = 10-30, l = 1-3, distant to moderately crowded, adnate, often with decurrent tooth, becoming more pronouncedly decurrent with age, rarely transvenose, triangular or arcuate, finally segmentiform to very weakly ventricose, pallid then greyish or brownish pink (10 YR 7/4; then 7.5 YR 7-6/4; finally 5 YR 7/2-3) with entire, concolorous, rarely slightly darker edge. Stipe 15-60 × 1-2 mm, cylindrical sometimes slightly to distinctly broadened towards base (up to 4 mm), blue-grey or steel-blue (10 YR 4/1; K. & W. 16E3, F3), sometimes fading to brown with age, glabrous and polished or substriate with some scattered longitudinal fibrils, sometimes pruinose at apex, at base white tomentose, solid then fistulose. Context pallid, brownish to white in pileus, bluish grey in stipe-cortex. Smell none or weakly to distinctly farinaceous. Taste none to farinaceous-rancid.

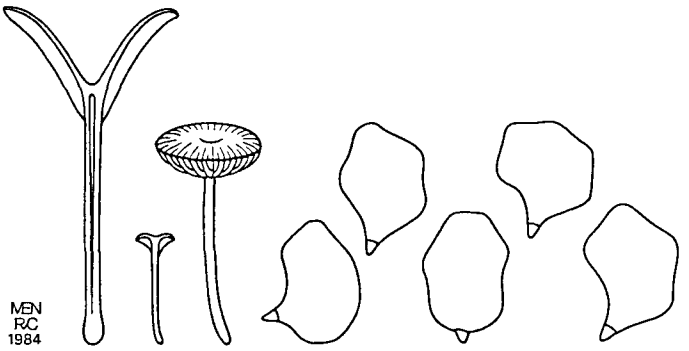

Fig. 198. *Entoloma incarnatofuscescens.*

Spores 8.0-10.5(-11.0) × 6.0-8.0(-9.0) µm, Q = 1.1-1.5, $\bar{Q}$ = 1.25-1.4, ellipsoid in outline with 5-7 angles in side-view. Basidia 25-43 × 7.5-14 µm, 4-, rarely also 2-spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a trichoderm at centre, more like a cutis at margin, made up of radially arranged cylindrical to inflated 10-20 µm wide hyphae with clavate, up to 30 µm wide terminal elements. Pigment brown, intracellular in pileipellis and pale-yellow, membranal to finely incrusting in pileitrama. Brilliant granules absent to very sparsely present in pileitrama. Clamp-connections absent from all tissues.

HABITAT & DISTR. – Terrestrial, often on bare soil in forest on clayey soil, also in humus-rich places in gardens, etc. Not uncommon. Widespread in N., W. and C.Europe in similar habitats. July-Sept.

Subgen. PARALEPTONIA Romagn. ex Noordel.

SEL. LIT. – Noordel. in Persoonia 11: 149. 1981.

Basidiocarps collybioid, omphalioid or pleurotoid; pileipellis a cutis with transitions to a trichoderm, made up of inflated hyphae up to 30 µm wide with intracellular pigment; clamp-connections present, spores complex with basal facet; cystidia usually absent.

Sect. Paraleptonia Noordel.

Basidiocarps pale coloured.

142. Entoloma neglectum (Lasch) Mos., Guida Det. Funghi: 224. 1980. – Fig. 199.

Agaricus neglectus Lasch in Linnaea 3: 287. 1828; *Clitopilus neglec-*

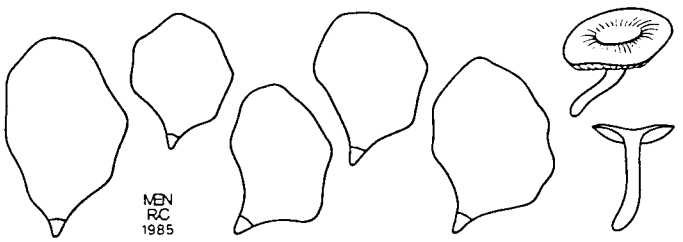

Fig. 199. *Entoloma neglectum.*

tus (Lasch) Kumm., Führ. Pilzk.: 97. 1871; *Rhodophyllus neglectus* (Lasch) J.Favre, Assoc. fong. Hauts-Marais: 50. 1948. – *Entoloma neglectum* var. *tetrasporum* Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 339. ('1982') 1983. – *Agaricus cancrinus* Fr., Epicr.: 150. 1838; *Clitopilus cancrinus* (Fr.) Quél. in Mém. Soc. Emul. Montbéliard, sér. II, 5: 247. 1872 (Champ. Jura Vosges 1); *Rhodophyllus cancrinus* (Fr.) Quél., Enchir. Fung.: 62. 1886; *Eccilia cancrina* (Fr.) Rick., Blätterpilze: 301. 1913; *Entoloma cancrinum* (Fr.) Noordel. in Persoonia 11: 149. 1981.

SEL. ICON. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: pl. 3F. ('1982') 1983; Bres., Iconogr. mycol. 12: pl. 595. 1929 (as *E. cancrina*); Einh. in Ber. bayer. bot. Ges. 41: pl. 11b. 1969; J.Lange, Fl. agar. dan. 2: pl. 79D. 1937.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 339-340, fig. 152. ('1982') 1983; Einh. in Ber. bayer. bot. Ges. 41: 106, fig. 19, 22, 24. 1969; J.Favre, Assoc. fong. Hauts-Marais: 50, fig. 14. 1948; Krieglsteiner in Westf. Pilzbr. 10/11: 254-259. 1983 (as *E. cancrinum*); Trimb. in Doc. mycol. 13(50): 45-46. 1983.

VERN. NAME. – Bleekgele satijnzwam.

Pileus 5-40 mm, plano-convex, then applanate, slightly depressed to deeply umbilicate, with inflexed margin, irregularly lobed with age, not hygrophanous, not translucently striate, uniformly pale cream, flesh-colour or pale brownish isabella (K. & W. 4A-B2), entirely tomentose, sometimes subsquamulose at centre, sometimes zonate, dull. Lamellae, L = 15-20, l = 3-7, moderately distant, sometimes thickish, broadly adnate to subdecurrent, sometimes furcate, arcuate, then segmentiform, up to 4.5 mm broad, white, then pink, with entire, concolorous edge. Stipe 10-25 × 2-2.5(-3) mm, cylindrical or compressed, sometimes bulbous at base, white, hyaline, sometimes with grey or yellow tinge, usually entirely white arachnoid or subtomentose. Context thin, hyaline in pileus and stipe. Smell strongly farinaceous or weak, almost none. Taste none to distinctly farinaceous.

Spores 9.0-12.5 × 6.0-9.0 (-10.0) µm, Q = 1.1-1.6, $\overline{Q}$ = 1.35-1.45, irregularly nodulose-angular in outline with 6-10 angles in side-view. Basidia 25-45 × 7-15 µm, 4- or 2-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged, cylindrical to inflated 4-16 µm wide hyphae with numerous free, up to 25 µm wide terminal elements. Pigment pale yellowish, intracellular in pileipellis. Clamp-connections present.

HABITAT & DISTR. – Solitary or in small groups in poorly manured grassland and among mosses, usually on poor, acid soil (Z.Beveland: Kaloot; Markelo; Beilen).

Entoloma neglectum is taken here in a rather wide concept, comprising also *E. cancrinum*, in agreement with Krieglsteiner (Westf. Pilzbr. 10-11: 254-259. 1983). However, the epithet *neglectum* is used, being the oldest available. I do not accept 2- and 4-spored forms at the rank of variety, since intermediates occur. (Compare Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 339-340. ('1982') 1983.)

143. Entoloma pallens (Maire) Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 341. ('1982') 1983. – Fig. 200.

Eccilia pallens Maire in Publ. Inst. bot. Barcelona 3: 96. 1937; *Rhodophyllus pallens* (Maire) J.Favre, Assoc. fong. Hauts-Marais: 52. 1948.

SEL. DESCR. & FIGS. – Arnolds, Ecol. Coenol. Macrofungi Grassl. Heathl. Drenthe, Netherlands 3: 341, fig. 153. ('1982') 1983.

Pileus 15-33 mm, plano-convex, then expanded with depressed centre, not hygrophanous, not translucently striate, pale yellow or greyish pink with slightly darker concentrical zones, innately radially fibrillose to slightly squamulose around centre. Lamellae, L = 20-25, l = 1-3, fairly distant, decurrent, thickish, arcuate to subventricose, up to 3 mm broad, sometimes intervenose, white, then salmon pink. Stipe 14-25 × 2-4 mm, cylindrical, white or pale ochraceous, slightly striate lengthwise, white tomentose at base. Context very thin in pileus, concolorous with surface; fairly brittle, concolorous with surface in stipe. Smell strongly farinaceous. Taste strongly farinaceous-rancid.

Spores (8.5-) 9.0-11.0 (-11.5) × 7.0-9.0 µm, Q = 1.15-1.4, $\overline{Q}$ = 1.3, broadly ellipsoid in outline with 6-8 angles. Basidia 27-35 × 10-15 µm, 4-(2-)spored, clampless. Lamella edge fertile. Cystidia absent. Pileipellis a cutis of more or less cylindrical, 2-9 µm wide hyphae. Pigment very pale, almost invisible, intracellular in pileipellis and upper pileitrama. Clamp-connections absent.

HABITAT & DISTR. – On soil in fertile meadow. Very rare (Westerbork: Mantinge; Texel). Distribution in Europe unknown. June-July.

Entoloma pallens comes very close to *E. neglectum*, from which it differs mainly in slightly smaller, less nodulose spores.

Sect. Sarcita (Romagn.) Noordel.

Basidiocarps brown; pileus sometimes weakly hygrophanous.

144. Entoloma sarcitum (Fr.) Noordel. in Persoonia 11: 150. 1981. – Fig. 201.

Agaricus sarcitus Fr., Epicr.: 155. 1838; *Leptonia sarcita* (Fr.) P.Karst., Ryssl., Finl. Skand. Halföns Hattsvamp. 1: 279. 1879; *Rhodophyllus sarcitus* (Fr.) Quél., Enchir. Fung.: 61. 1886.

EXCL. – *Rhodophyllus sarcitus* sensu Quél., Enchir. Fung.: 61. 1886; sensu J.Favre, Assoc. fong. Hauts-Marais: 54. 1948; *Leptonia sarcita* sensu Rick., Blätterpilze: 294. 1913; sensu A.Pears, in Trans. Br. mycol. Soc. 22: 31-32. 1938 (= *E. sarcitulum*).

Pileus 27 mm, convex with umbilicate centre and involute margin, slightly hygrophanous, slightly translucently striate at margin only, dark sepia brown, smooth, strongly silky-shiny. Lamellae, L = about 20, l = 3, moderately distant, thickish, broadly adnate with decurrent tooth, ar-

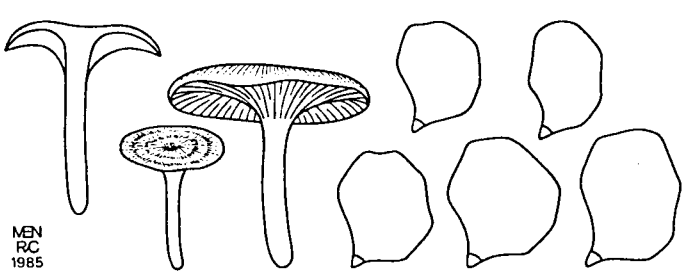

Fig. 200. *Entoloma pallens.*

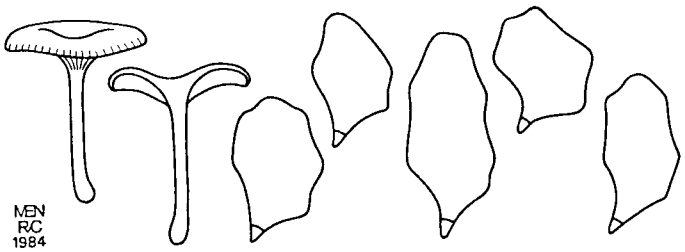

Fig. 201. *Entoloma sarcitum.*

cuate, then segmentiform, brown-pink with concolorous, entire edge. Stipe 28 × 2 mm, cylindrical with up to 2.5 mm wide, slightly swollen base, slightly twisted, pale sepia, paler than pileus, glabrous, polished. Context thin, concolorous with surface in pileus and stipe. Smell none. Taste not known.

Spores 9.0-13.5 (-18.0) × 6.0-9.0 µm, Q = 1.25-2.1, $\bar{Q}$ = 1.5, irregularly 5- many-angled in side-view. Basidia 20-35 × 8-12 µm, 4-spored, clamped. Lamella edge fertile. Cystidia absent. Pileipellis a cutis with transitions to a trichoderm, made up of radially arranged, inflated, 10-25 µm wide hyphae. Pigment brown, intracellular in pileipellis. Brilliant granules absent. Clamp-connections present.

HABITAT & DISTR. – Solitary in mossy lawn in mixed deciduous forest on humose, sandy-clayey soil. Very rare (Warmond). Distribution in the rest of Europe unknown. Oct.

The dark brown colour, clamped basidia, large spores, and intracellular pigment are distinctive for *E. sarcitum*. The omphalioid habit may cause confusion with some taxa from subgen. *Claudopus*, which all differ, however, by the incrusted hyphae of pileipellis and pileitrama. Probably *E. sarcitum* is a rather neglected species.

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