Mycenas of Kerala

Dollymol M. Aravindakshan
Patinjareveettil Manimohan

Mycenas of Kerala

Dollymol M. Aravindakshan
and
Patinjareveettil Manimohan

Department of Botany, University of Calicut, Kerala, India

SporePrint Books
Calicut, Kerala, India

First published 10 September, 2015

Citation: Aravindakshan D.M., Manimohan P. (2015). Mycenas of Kerala. SporePrint Books, Calicut. 213 p.

ISBN 978-93-5235-568-6 (e-book)
978-93-5235-569-3 (hard cover)

Published by
SporePrint Books
51/1765, Thonichira Road, Naduvattom, North Beypore, Calicut, Kerala, India

Printed in India

Dedication

This book is dedicated to the memory of Dr. R. A. Maas Geesteranus in appreciation of both his monumental contributions to the taxonomy of *Mycena* and his gracious gift of his 2-volume treatise "Mycenas of the Northern Hemisphere" to the second author (PM). In order to preserve the spirit of gifting shown by him, we have made our book (in e-book form) freely available at ResearchGate.

Acknowledgements

We would like to thank the authorities of the University of Calicut for partially funding the project and for providing research facilities. Thanks are also due to the University Grants Commission, India, for financial support in the form of a post-doctoral fellowship to the first author (DMA). We are also grateful to the Principal Chief Conservator of Forests, Government of Kerala for giving us permission to collect mycenas from the forests of Kerala. We are extremely grateful to Prof. K. M. Leelavathy, formerly of University of Calicut, for reading and correcting the manuscript.

Contents

Abstract

A study of the diversity and taxonomy of the agaric genus *Mycena* (*Mycenaceae*, *Agaricales*, *Basidiomycota*) in Kerala State, India was carried out based on morphology. It revealed a total of fifty species belonging to the following fifteen sections: *Sacchariferae* (ten species), *Fragilipedes* (seven species), *Hiemales* (six species), *Basipedes, Longisetae* (five species each), *Adonideae* (three species), *Exornatae*, *Galactopoda*, *Polyadelphia*, *Rubromarginatae, Spinosae* (two species each) *Calodontes*, *Hygrocyboideae*, *Radiatae* and *Supinae* (one species each). All the fifty species discovered are presented here with detailed descriptions, photographs, illustrations and discussions. Key to the sections of the genus *Mycena* and keys to the *Mycena* species of each section encountered in Kerala are also given. Thirty five of these species are proposed here as new: *Sacchariferae* (*M. albinea*, *M. apala, M. delicata*, *M. distincta*, *M. furfuracea, M. globispora*, *M. roseotincta* and *M. silvana*), *Fragilipedes* (*M. aruna*, *M. kapila*, *M. lomaza*, *M. parnaja*, *M. rajatha* and *M. ziragra*), *Hiemales* (*M. mulika*, *M. nimna*, *M. niranjana*, *M. sandra*, *M. sravaka* and *M. vamana*), *Basipedes* (*M. kapotha*, *M. nirbala*, *M. patala*, *M. sukshma* and *M. zikhara*), *Adonideae* (*M. kamala*, *M. kanika* and *M. rohitha*), *Polyadelphia* (*M. amala*), *Rubromarginatae* (*M. pingala* and *M. valkaja*), *Calodontes* (*M. sirayuktha*), *Hygrocyboideae* (*M. vimala*), *Radiatae* (*M. samula*) and *Supinae* (*M. swaathiae*). Two taxa earlier reported from Kerala as two varieties (*Mycena alphitophora* var. *distincta* and *Mycena alphitophora* var. *globispora*) are elevated to species status. In most cases, there was no difficulty in incorporating the Kerala species into the infrageneric taxonomy developed by R. A. Maas Geesteranus. Several of these *Mycena* species showed high habitat specificity. The remarkably high number of new taxa and the habitat preferences of some of them together indicate that this region has a unique *Mycena* mycobiota with several probably endemic species.

Keywords

Agaricales, *Basidiomycota*, biodiversity, *Mycenaceae*, mycobiota, new taxa, taxonomy, tropical fungi.

1

Introduction

Mycena (Pers.) Roussel (*Mycenaceae, Agaricales, Basidiomycota*, *Fungi*) is a large genus with around five hundred species (Kirk *et al*. 2008) known worldwide. They are mostly small mushrooms rarely exceeding a few centimeters in diameter and are often very fragile. Species of this genus play a vital role in litter decomposition in forests and woodlands (Frankland 1998; Miyamoto *et al*. 2000; Osono & Takeda 2001, 2002; Osono *et al*. 2003; O'Brien *et al*. 2005; Yamashita & Hijii 2004, 2006; Lindahl *et al*. 2007; Fukasawa *et al*. 2009). Studies have revealed that *Mycena* species are very promising sources of bioactive secondary metabolites (Eijk 1975; Bäuerle & Anke 1980; Bäuerle *et al*. 1982; Jente *et al*. 1985; Hautzel *et al*. 1990; Zapf *et al*. 1995; Chard *et al*. 1985; Becker *et al*. 1997; Guzmán *et al*. 1998; Engler *et al*. 1998; Aqueveque *et al*. 2005; Peters & Spiteller 2006, 2007; Peters *et al*. 2008; Shen *et al*. 2009; Jaeger & Spiteller 2010). Several species of this genus are bioluminescent (Corner 1954, 1994; Horak 1978; Bermudes *et al*. 1992; Niitsu & Hanyuda 2000; Desjardin *et al*. 2007, 2008, 2010; Mori *et al*. 2011; Aravindakshan *et al*. 2012; Chew *et al*. 2014, 2015). Despite some eminent agaricologists of the last century producing monographs and revisions of the genus (Kühner 1938; Smith 1947; Maas Geesteranus 1992a, b; Maas Geesteranus & de Meijer 1997), several parts of the world, especially in the tropics, remains inadequately explored for the diversity of mycenas. Also, the morphology-based taxonomic framework built over a century around this genus is in urgent need of validation by molecular phylogeny.

Despite the vast area and diverse climatic conditions of India, so far, only a few species of this genus have been documented from this country. Although Kerala State is known to harbor a luxuriant agaric flora (Farook *et al*. 2013), only a few species of *Mycena* have been reported from this region. Until very recently, only six taxa of *Mycena* were known from this region (Farook *et al*. 2013). Additional eleven species and one new section of the genus *Mycena* were published recently from this region. All these *Mycena* taxa known from Kerala and those recorded from rest of India are listed in Table 1.

In this treatise, we present a systematic account of the genus as it occurs in Kerala based on an exclusive floristic study spanning five years (2006-2011).

Table 1. Agarics recorded as species of *Mycena* from different parts of India

Species	**State/Region**	**Author & Year**
M. abietina Maas Geest.	Kashmir	Maas Geesteranus (1992d)
M. acrocephala Maas Geest. & E. Horak	Sikkim	Maas Geesteranus & Horak (1993)
M. aetites (Fr.) Quél.	Jammu & Kashmir	Watling & Gregory (1980)
M. alcalina (Fr.) P. Kumm.	Tamil Nadu Kashmir	Sathe & Sasangan (1977) Gardezi (2003)
M. alphitophora (Berk.) Sacc. var. *distincta* Manim. & Leelav.	Kerala	Manimohan & Leelavathy (1989)
M. alphitophora (Berk.) Sacc. var. *globispora* Manim. & Leelav.	Kerala	Manimohan & Leelavathy (1989)
M. arata (Berk.) Sacc.	Sikkim	Berkeley (1850)
M. atrocyanea (Batsch) Gillet	Jammu & Kashmir	Watling & Gregory (1980)
M. auroricolor (Berk. & Broome) Petch	Kerala	Manimohan *et al.* (1988), Mohanan (2011)
M. avenacea (Fr.) Quél.	Maharashtra	Trivedi (1972)
M. babruka Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2013b)
M. bathyrrhiza Maas Geest.	Jammu & Kashmir	Maas Geesteranus (1992d)
M. bicrenata (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. broomeana (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. cinnabarina Maas Geest.	Uttar Pradesh	Maas Geesteranus (1992d)
M. coalita Maas Geest.	Uttar Pradesh	Maas Geesteranus (1992d)
M. colligata (Berk.) Sacc.	Sikkim	Berkeley (1852)
M. conocephala Henn.	Uttar Pradesh	Hennings (1901)
M. deeptha Aravind. & Manim.	Kerala	Aravindakshan *et al.* (2012)
M. dentosa (Berk.) Sacc.	Sikkim	Berkeley (1852)
M. discors (Berk.) Sacc.	Sikkim	Berkeley (1852)
M. epipterygia (Scop.) Gray	Sikkim	Berkeley (1852)
M. flavominiata (Berk.) Sacc.	Sikkim	Berkeley (1852)
M. galericulata (Scop.) Gray	Sikkim, Himachal Pradesh, Jammu & Kashmir	Berkeley (1852); Maas Geesteranus (1992d) Watling & Gregory (1980)
M. gentilis Maas Geest.	Uttar Pradesh	Maas Geesteranus (1992d)
M. gypsea (Fr.) Quél. (= *Hemimycena cucullata* (Pers.) Singer)	Uttar Pradesh	Hennings (1901)
M. haematopus (Pers.) P. Kumm.	Kerala	Bhavanidevi & Nair (1983)
M. incommiscibilis (Berk.) Sacc. (= *Mycenella incommiscibilis* (Berk.) Mass Geest.)	Sikkim	Berkeley (1852)
M. indica Sarwal & Rawla	Chandigarh	Sarwal & Rawla (1983)
M. jatila Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2014)
M. lohitha Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2013b)

Species	State/Region	Author & Year
M. lomamaya Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2014)
M. lomavritha Manim. (syn. *M. indica* Manim. & Leelav. nom. illeg.)	Kerala	Aravindakshan & Manimohan (2011) Manimohan & Leelavathy (1988b)
M. macrothela (Berk.) Sacc.	Assam	Berkeley(1852)
M. manipularis (Berk.) Sacc. (= *Favolaschia manipularis* (Berk.) Teng)	Himalaya	Berkeley (1850)
M. mridula Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2013c)
M. myriadea (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. nubigena (Berk.) Sacc. (= *M. galericulata*)	West Bengal	Berkeley (1850)
M. olida Bres.	Uttar Pradesh	Maas Geesteranus (1992d)
M. pelava Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2014)
M. plicosa (Fr.) P. Kumm.	Uttar Pradesh	Hennings (1901)
M. prasia (Berk.) Sacc.	Sikkim	Berkeley (1850)
M. profusa Manim. & Leelav.	Kerala	Manimohan and Leelavathy (1988a)
M. puberula (Berk.) Sacc.	Sikkim	Berkeley (1852)
M. pura (Pers.) P. Kumm.	Sikkim, Uttar Pradesh, Kerala	Berkeley (1852); Maas Geesteranus (1992d); Mohanan (2011)
M. rubiaetincta (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. rufata (Berk.) Sacc. (= *Collybia rufata* (Berk.) Manjula)	West Bengal	Berkeley (1850)
M. rufopicta (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. russulina (Berk.) Sacc.	West Bengal	Berkeley (1850)
M. saloma Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2011)
M. saparna Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2012)
M. snigdha Aravind. & Manim.	Kerala	Aravindakshan & Manimohan (2013a)
M. subcaerulea (Berk.) Sacc.	Maharashtra	Sathe & Rahalkar (1975)
M. tintinnabulum (Paulet) Quél.	Punjab	Maas Geesteranus (1992d)
M. xanthophylla (Berk.) Sacc.	West Bengal	Berkeley (1850)

2

Materials and methods

Physiography of Kerala

Kerala State is a narrow strip of land on the southwestern part of Peninsular India, extending between 8°18' and 12°48' north latitudes and 74°28' and 77°38' east longitudes. It has an area of 38,863 km^2 which is about 1.18 % of the total area of India. The middle part of Kerala is about 130 km wide and narrows down towards the north and south to about 30 km. The coast line is 580 km long. Geographically, Kerala can roughly be divided into three regions: the highlands (600–1800 m high), the midlands (300–600 m high) and the lowlands (6–300 m high). The eastern highlands (rugged and cool mountainous terrain) slope down from the Western Ghats, which rise to an average height of 1500 m, with a number of peaks well over 1,800 m in height. The highlands are covered with dense forests and plantations of tea, coffee, rubber and cardamom. In the central midlands, the terrain is uneven with hills and broad valleys. Cashew, coconut, areca nut, tapioca, banana and vegetables are the major cultivations of this area. The western lowlands (coastal plains) are made of shallow lagoons, river deltas, backwaters and the shores of the Arabian Sea. Coconut groves and rice paddies occupy much of this land.

Vegetation of Kerala

Kerala State possesses some of the most luxuriant tropical moist vegetations in the country. Kerala has a total forest area of 11,125.59 km^2, covering 28.88% of the total land area of the State. Much of the forest cover of Kerala spreads over the Western Ghats. The Western Ghats represents one of the world's hotspots of biodiversity and is a repository of endemic, rare and endangered flora and fauna. The forest types of Kerala include evergreen forests (wet evergreen and semi-evergreen climax forests, west coast tropical evergreen forests, southern hill top tropical evergreen forests and semi-evergreen forests), deciduous forests (secondary dry deciduous forests, southern dry deciduous forests, secondary moist deciduous forests and dry deciduous forests), shola forests, grasslands, mangroves, and the subtypes such as dry teak forests, lateritic semi-evergreen forests, littoral forests, myristica swamps, Nilgiri subtropical hill forests, south Indian subtropical hill savannah, southern moist mixed deciduous forests, southern secondary moist mixed deciduous forests, and very moist teak forests. These different forest types together support a luxuriant flora. *Artocarpus hirsutus*, *Bischofia javanica*, *Canarium strictum*, *Calophyllum elatum*, *Dysoxylum malabaricum*, *Actinodaphne hookeri*, *Cinnamomum zeylanicum*, *Euphoria longana*, *Myristica beddomei* and *Vateria indica* are some of the trees of tropical evergreen forests. *Dillenia pentagyna*, *Tabernaemontana heyneana*, *Strychnos nux-vomica*, and *Xylia xylocarpa* are some common trees of tropical moist deciduous forests. Kerala harbors about 25% of India's total plant species.

Climate of Kerala

The climate of Kerala is tropical, maritime and monsoonal. The average annual maximum temperature is around 30°C and the average annual minimum temperature is around 22°C. Occasionally, the maximum day temperature crosses beyond 40°C in some places in the plains in summer and the minimum night temperature dips to 0°C in the highlands in winter. Kerala receives an average of 120–140 rainy days per year and an average annual rainfall of about 3000 mm. Almost 85% of the rain received in Kerala are contributed by two monsoons. The southwest monsoon is the main rainy season in Kerala. This season begins by early June and lasts till the end of September. The northeast monsoon (retreating monsoon or reverse monsoon) brings less rain in the months of October, November and sometimes December. Besides the two monsoons, occasional rain with low average rainfall also occurs during the winter and summer.

Field study and research material

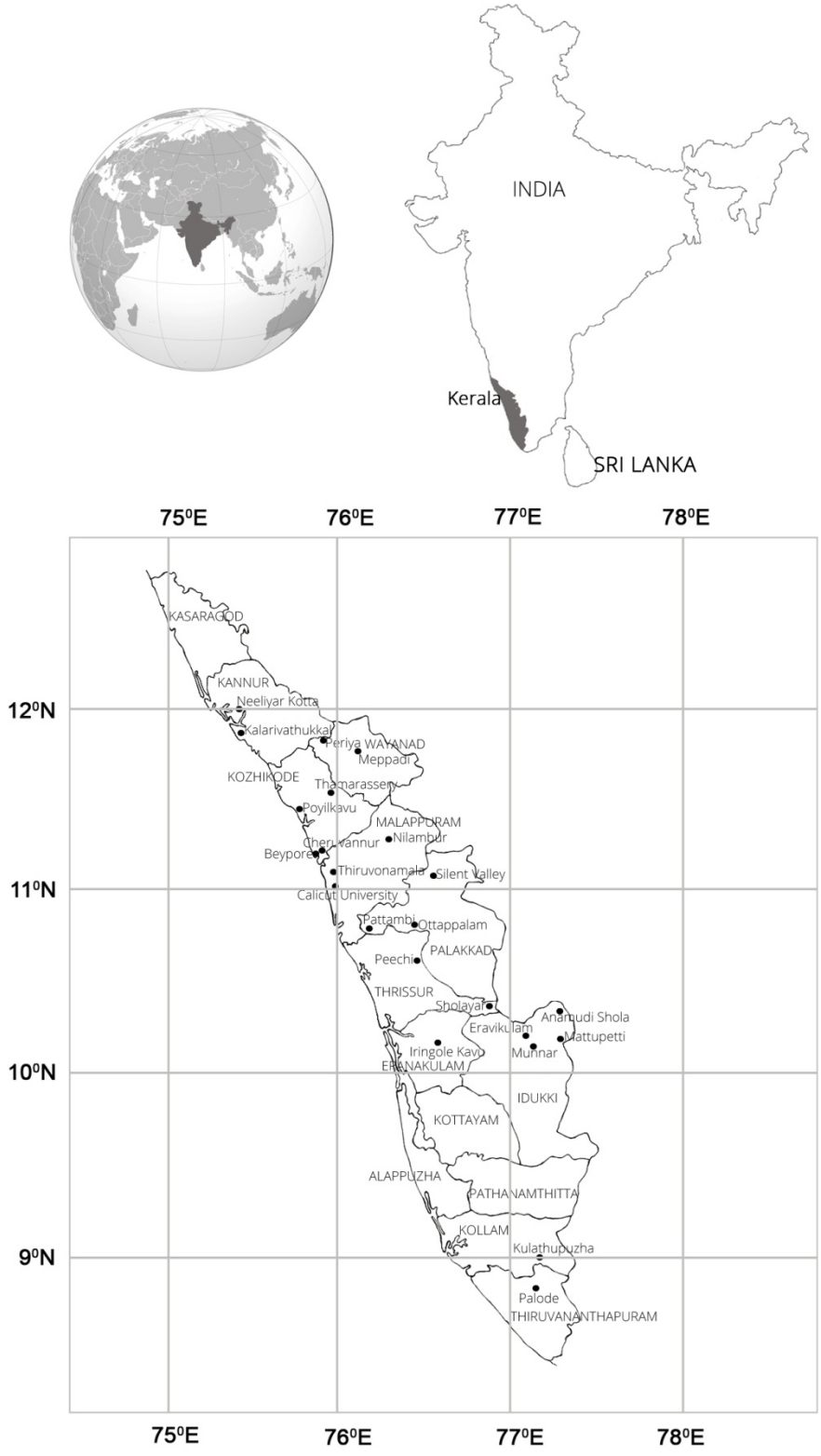
All the *Mycena* species described in this treatise were collected by the authors during the years 2006–2011 from different parts of Kerala State. Most of the collections were made during the southwest monsoon season (June to September). Northeast monsoon months (October to December) also often yielded mycenas. Most of the collections were made from the Calicut University Campus, which has an area of about 500 hectares. The collecting localities, however, also included various natural forests, sacred groves, botanical gardens, and private wooded lands. Mycenas were collected from leaf-litter, decaying logs and bark of standing trees. All collecting locations are indicated on Map 1.

Recording of macroscopic characters

In the field, basidiomata of all stages were collected as far as possible. Colour photographs of the fresh material in the field were taken with a digital camera. The photographs of very tiny basidiomata and primordia were taken using a digital camera attached to a stereomicroscope in the laboratory. Characters such as the substrate, colour of the fresh basidiomata, and the tackiness, if any, of both pileus and stipe surfaces were checked at the time of collection. Characters such as the taste and odour of the basidiomata were also checked whenever possible. Features such as the type of insertion of the stipe-base into the substratum, nature of the basal mycelium, and presence or absence of latex were also noted in the field itself. In the laboratory, each collection was carefully examined under a stereomicroscope and the macroscopic characters were recorded in a systematic manner. Spore print was taken in all cases when sufficient basidiomata were available. By observing fresh basidiomata in a dark room, their capability to produce bioluminescence, if any, was checked. After recording the characters, the specimens were dried in a hot-air oven for 24–48 hours at 50°C for further preservation.

Microscopic observation

Fresh specimens were used for microscopic analysis whenever possible. But in the case of material collected from distant places, only dried specimens were available for the study of microscopic features. Small pieces of different parts of the basidiomata were cut under a stereomicroscope using a razor blade. These pieces were revived in 3% aqueous KOH and then



MAP 1. Geographical location of the region and collecting localities (District names in capital letters).

thin free-hand sections were taken and stained. Occasionally, 70% ethanol was also used for reviving the dried material, followed by washing with water and 3% KOH and finally stained.Staining was done by immersing the sections in one drop of 1% aqueous solution of Congo red. Excess stain was removed and sections were mounted in 3% aqueous KOH. Careful tapping on the cover slip using a rubber-tipped pencil, interrupted by repeated inspection, was found crucial for the loosening of the individual components such as basidia and cystidia. Melzer's reagent [composition: Iodine (1.5 g), Potassium Iodide (5 g), Chloral Hydrate (100 g), and water (100 ml)] was used to test the amyloidity of the basidiospores and vinoid reaction of tramal hyphae.

After staining, the sections were examined under an Olympus CX21 trinocular compound microscope. The morphology and dimensions of basidia, basidiospores, cystidia and hyphae as well as the structure of the lamellar trama, pileus trama, pileipellis and stipitipellis were noted using the oil-immersion objective of the microscope and a calibrated ocular micrometer. Line drawings of all important structures were made using a mirror-type camera-lucida fixed to the same microscope with 100× oil-immersion objective for basidiospores, basidia and cystidia and 40× objective for pileosetae, hyphae of the pileipellis, and hyphae of the stipitipellis.

Basidiospores taken from either the spore prints or the hymenium were used for both measuring their dimensions and for determining their shape. For statistical analysis of dimensions of basidiospores, random measurements of 20 mature basidiospores of each specimen were made. The arithmetic mean of length and breadth of the basidiospore and the root mean-square deviation are provided. The ratio of basidiospore length to its width (Q) was calculated for each of the 20 basidiospores and the average of these values was calculated and given as Q_m.

The ranges of length and breadth of basidia and cystidia were taken from the smallest and largest cells in each collection examined, excluding sterigmata, protrusions or excrescences whose measurements were noted separately. Similarly, the width of the cuticular or tramal hyphae indicated is excluding the ornamentation on them. Basidia were carefully examined for their 2-spored and 4-spored nature. A thin section of the lamella-edge was always used to observe the cheilocystidia and to differentiate them from pleurocystidia. The presence of pigments or exudations of various microstructures was determined by mounting the sections in water.

Structure of the pileipellis was studied from radial sections of the pileus. The arrangement of pileipellis hyphae and the presence of excrescences, pileocystidia, acanthocysts, cherocytes, pileosetae, and gelatinisation of hyphae, if any, were also noted. In some cases, the sections of pileus margin were also observed to study pileus marginal cells. The width and the ornamentation and gelatinisation, if any, of the hyphae of the stipitipellis were also noted. Caulocystidia from both the apex and the base of the stipe were studied. Sections from stipe base were also taken when the stipe basal cells are relevant for species identifications. All the microstructures were carefully examined for the presence of clamp connections.

Terminology

For descriptive terminology of macro- and microscopic characters, the books 'How to Identify Mushrooms to Genus I: Macroscopic Features' (Largent 1973), 'How to Identify

Mushrooms to Genus III: Microscopic Features' (Largent *et al*. 1977), and 'Flora Agaricina Neerlandica, vol. I' (Vellinga 1988) were followed. The colour names followed by colour notations (e.g. 9B8) in the description of the species are from Kornerup & Wanscher (1978). Colour names not followed by colour notations are author-generated. The author citations are according to the Index Fungorum website (http://www.indexfungorum.org/).

Taxonomic concepts and classification system followed

The genus concept of *Mycena* and the infrageneric classification followed in this treatise are essentially those of Maas Geesteranus (1992a, b) with a few minor modifications.

Major monographs and floras used in the identification of species of *Mycena* in the present study are: North American Species of *Mycena* (Smith 1947); Les *Mycène*s de Madagascar (Métrod 1949); A preliminary Agaric Flora of East Africa (Pegler 1977); Agaric flora of the Lesser Antilles (Pegler 1983); Agaric flora of Sri Lanka (Pegler 1986); Mycenas of the Northern Hemisphere (Maas Geesteranus 1992a, b); Agarics in Malesia (Corner 1994); *Mycena* and related genera from Papua New Guinea and New Caledonia (Maas Geesteranus & Horak 1995); Mycenae Paranaenses (Maas Geesteranus & de Meijer 1997); The Genus *Mycena* in South-Eastern Australia (Grgurinovic 2003); Mycena d' Europa (Robich 2003); Apart from these major works, numerous papers on the distribution and taxonomy of the genus *Mycena* were also consulted. Herbarium abbreviations follow Index Herbariorum (Thiers, continuously updated). The collections cited without herbarium accession numbers are in the personal herbarium of the second author.

3

An overview of the genus *Mycena*

Genus concept

It was Persoon (1797, 1801) who first proposed the name *Mycena* for a section of the genus *Agaricus* L. Roussel (1806) raised the section *Mycena* to generic level. Fries (1821) treated *Mycena* as a tribe of genus *Agaricus*. But, Gray (1821) and Kummer (1871) treated *Mycena* at the generic level. All these nineteenth century authors used only macroscopic characters to define *Mycena*. They considered all agarics with a conic to campanulate, submembraneous pileus, a hollow, cartilaginous and smooth stipe, and lamellae that are never decurrent as belonging to *Mycena*. It took almost a century for the modern concept of *Mycena* to emerge from this highly nebulous early concept of the genus.

It was Lange (1914) who first used the microscopic characters in the taxonomy of *Mycena*. Kühner's (1938) inclusion of microscopic characters in the circumscription of the genus also greatly helped the evolution of the modern concept of *Mycena*. According to Kühner, the following were the defining characters of *Mycena*: basidiomata gymnocarpic, small, slender, delicate, putrescent; hyphae with clamp connections, with non-aeriferous intercellular passages, the pigment in general vacuolar; pileus thin, submembraneous, more or less translucent striate or sometimes plicate, very often conic, campanulate or furnished with a pointed umbo, the margin at first straight or more rarely somewhat incurved; flesh of pileus with the upper hyphae generally short and inflated; covering of the pileus with superficial hyphae almost always furnished with short protuberances or with the ends straightened to form numerous hairs; stipe central, cartilaginous, more or less fistulose, with the base frequently bristling with rhizoids; lamellae ascending and more or less adnate, more rarely arcuate-decurrent; subhymenium ramose, generally thin; basidioles cylindric; mature basidia more or less clavate; cystidia almost always present, smooth or roughened; basidiospores white in mass, smooth or nodulose, almost with a thin-wall; habit epiphytic or lignicolous. This definition given by Kühner (1938) was adopted by Smith (1947) with some modifications such as the inclusion of species with falsely echinulate basidiospores in *Mycena* subgenus *Mycenella*.

One major limitation of both Kühner's (1930) and Smith's (1947) treatment of *Mycena* was that their works were based on materials derived entirely from the temperate regions. Later Singer's (1962a, 1975b, 1986) concept of the genus *Mycena* became widely accepted since it was based on the studies of temperate, sub-tropical, and tropical species. From the *Mycena*-complex, he segregated genera like *Hemimycena* Singer and *Hydropus* Kühner ex Singer and substantiated earlier segregate genera such as *Fayodia* Kühner, *Xeromphalina* Kühner & Maire and *Delicatula* Fayod. Singer (1986) stated that if the genera *Hemimycena, Xeromphalina* and *Hydropus* were not

separated from it, *Mycena* would become an unwieldy, unnatural, giant genus impossible to define properly.

According to the definition given by Singer (1986), the genus *Mycena* has (a) a mycenoid or omphalioid habit; (b) usually thin and pellucid-striate pileus; (c) a usually distinctly lamellate hymenophore and ascendant, horizontal or descendent, subfree to decurrent lamellae; (d) a central, thin, fragile to subcartilaginous, tubulose stipe sometimes with latex; (e) an insititious stipe-base or a stipe base with a disc, or with a pseudorrhiza, or with a fibrous to wooly basal mycelium; (f) non-reviving cortex; (g) a white to pale cream-coloured spore print and hyaline, homogeneous, smooth, thin, and acyanophilic basidiospore wall; (h) normal, often 1- to 3-spored basidia; (i) cheilocystidia; (j) a subregular to regular, often strongly pseudoamyloid hymenophoral trama; (k) a pileipellis usually consisting of diverticulate, filamentous or elongate and irregular hyphae (if the epicuticular hyphae are smooth, then the basidiospores are distinctly amyloid); (l) a stipitipellis analogous to that of the pileus or with dermatocystidia or hairs and (m) hyphae often with numerous clamp connections.

Delimitations of the genus

It is difficult to segregate some of the genera of the tribe *Myceneae* from genus *Mycena* in the field. Singer's (1986) definition of *Mycena* helps one in separating *Mycena* from related genera such as *Hemimycena*, *Fayodia*, *Hydropus*, *Resinomycena* Redhead & Singer, *Delicatula* and *Mycenella* (J.E. Lange) Singer. There is a clear chemical and structural hiatus between *Mycena* and *Hemimycena* (Singer 1986) as the former has a contrasting reddish colour on stipe trama in cresyl blue mounts, a more or less differentiated hypodermium, a regular hymenophoral trama of short swollen elements, and a separation layer between the trama of the stipe and the trama of the pileus. But Emmett (1993c) found that the metachromatic reaction of stipe hyphae with cresyl blue was not an entirely reliable one. According to him the Q-value (length/width ratio) of the basidiospores is a more useful guide in that it is usually close to or exceeding two for *Hemimycena*, but rarely so large in *Mycena*. It appears that the separation of the genus *Hemimycena* from *Mycena* is still tenuous and further research is required to clarify the matter (Emmett 1993c).

Fayodia species have spherical, amyloid, double-walled, and apparently ornamented basidiospores with a very small apiculus. The outer layer of the basidiospore is amyloid and smooth and the inner layer is pitted and visible through the outer one giving the impression of a warted basidiospore (Emmett 1993c). *Hydropus* species are differentiated from *Mycena* species mainly by the structure of the pileus surface. In *Hydropus*, there are fascicles of dermatocystidia which may form a continuous layer. These often contain a liquid phase with dull coloured pigments dispersed or dissolved in it. There are a few *Hydropus* species which show a pileipellis without these cystidia. They, however, still contain the same type of pigmentation in the repent hyphae of their pileipellis and they often show similarly pigmented caulocystidia (Emmett 1993c). *Resinomycena* is distinguished from *Mycena* by the resin-filled cystidia scattered over the whole basidioma and while sectioning, the sections stick tenaciously to the scalpel (Emmett 1993c).

Some species of *Mycena* are similar to *Delicatula* but lack the velar covering of the latter genus (Singer 1986). Amyloid basidiospores, inamyloid and subregular lamellar trama with numerous clamp connections, absence of cystidia, and narrow lamellae, often reduced to mere veins, also characterise *Delicatula* (Singer 1986). *Mycenella* species are characterised by inamyloid and usually ornamented basidiospores with a large apiculus. In the field, the densely pruinose, tough, and often rooting stipe is a helpful pointer to the genus and none of its tissues react with Melzer's reagent (Emmett 1993c). Kühner (1938) found that all hyphae of the trama of most *Mycena* are pseudoamyloid in Melzer's reagent and according to Singer (1986), the hyphae of *Mycena* is vinaceous to vinaceous brown in Melzer's reagent.

Singer (1986) placed *Mycena* in the family *Tricholomataceae*. Redhead (1987) however, placed it in the *Xerulaceae* with the suggestion that this family does not have its origin in the *Tricholomataceae* but directly in the *Aphyllophorales,* where a hyphal structure similar to the sarcodimitic type is seen. Redhead's (1987) concept of *Xerulaceae* is supported by the occurrence of a group of antibiotics (Strobilurin A, B, and C, and Oudemansin A and B) in species of *Hydropus*, *Mycena*, *Oudemansiella* Speg., *Strobilurus* Singer and *Xerula* Maire.

Redhead's inclusion of *Mycena*, a genus without sarcodimitic tissue, in the *Xerulaceae* weakens this family considerably (Bas 1990). Redhead (1987) justified his classification with the argument that the hyphal system with fundamental and connective hyphae found in many species of *Mycena* must be considered as a reduced state of the sarcodimitic hyphal system.

Kühner (1980) and Singer (1986) attributed very little taxonomic value to the sarcodimitic type of trama. Watling and Turnbull (1998) however, stated that the sarcodimitic hyphal structure is an important character by which the very large family *Tricholomataceae* could be subdivided. Grgurinovic (2003) has given a detailed account of the sarcodimitic tissue and its significance in the classification of *Mycena*.

According to Singer (1986), the tribe *Myceneae* of *Tricholomataceae* incorporates the genera such as *Fayodia*, *Hemimycena*, *Delicatula*, *Xeromphalina*, *Filoboletus* Henn., *Baeospora* Singer, *Dermoloma* J. E. Lange ex Herink, *Dennisiomyces* Singer, *Pegleromyces* Singer, *Hydropus*, *Amparoina* Singer, *Resinomycena* and *Mycena.* But the recent phylogenetic studies (Jin *et al.* 2001; Moncalvo *et al*. 2002; Matheny *et al.* 2006) place the genus *Mycena* and allied taxa (*Resinomycena, Panellus stipticus* (Bull.) P. Karst., *Dictyopanus* Pat., *Favolaschia* (Pat.) Pat., *Poromycena* Overeem, *Filoboletus* spp., *Prunulus* Gray and *Mycenoporella griseipora* Corner) in the family *Mycenaceae*. According to Cannon and Kirk (2007), further molecular studies will identify other constituent genera in this family. Most recently, Cooper (2014) stressed the urgent need of a multilocus phylogenetic revision to clarify the boundaries of *Mycena* and related genera.

Infrageneric taxonomy

In his 'Systema Mycologicum', Fries (1821) divided the tribe *Mycena* into three subdivisions: *Genuinae* with 42 species, *Hygrocyboideae* with 4 species and *Omphalariae* with 14 species.

Lange (1914) used smooth- or rough-wall of the basidiospores as the main character in his classification. He divided the genus *Mycena* into two subgenera: *Eumycena* with smooth basidiospores and *Mycenella* with warted basidiospores. Besides, he divided the subgenus *Eumycena* into three sections, *Ciliatae, Granulatae* and *Gummosae*, based on features of the lamellae.

On the basis of whether or not the context of the stipe was distinct from that of the pileus Kühner (1926) divided the genus into two subgenera: subgenus *Eumycena* and subgenus *Insiticia*. Cejp (1930) later recognised these two subgenera as genus *Mycena* and genus *Pseudomycena* Cejp respectively and within *Mycena*, he included two subgenera: *Mycenopsis* and *Mycenella*. Later, Kühner (1931) used amyloidity of basidiospores as a major character for the infrageneric classification and classified the genus *Mycena* into two broad categories: 'Spores amyloides' and 'Spores non amyloides'. Within these two categories, he also erected some major sections *Lactipedes, Typicae, Glutinosae, Roridae, Viscipelles* and *Basipedes* and treated the genus *Mycenella* as a section of *Mycena*. Kühner (1938) followed the same classification using the term *Eu-Mycena* for the group of species having amyloid basidiospores and the term *Para-Mycena* for the group of species having inamyloid basidiospores in his monumental work, Le Genre *Mycena*. Kühner (1980) also classified *Mycena* into two subgenera, *Mycena* and *Paramycena*, based on reaction of both stipe tissue and basidiospores with Melzer's reagent. For a detailed taxonomic history of *Mycena*, see Grgurinovic (2003).

After Kühner (1938), Smith (1947), Métrod (1949), Singer (1951, 1962a, 1975b, 1986), Maas Geesteranus (1992a, b), Maas Geesteranus & de Meijer (1997), Grgurinovic (2003) and Robich (2003) have published significant treatises on the genus.

Smith (1947) in his 'North American species of *Mycena*,' recorded 218 species of *Mycena* from the United States and Canada and 19 from the American tropics. He recognised four subgenera viz. *Mycenella, Pseudomycena, Glutinipes* and *Eumycena* based on characters such as basidiospore ornamentation, continuity of stipe trama with that of the pileus, presence or absence of a basal disc on the stipe and presence or absence of a glutinous layer on the stipe surface. Subgenus *Mycenella* included section *Pseudoechinulatae* with falsely echinulate basidiospores and section *Nodulosae* with nodulose basidiospores. Subgenus *Pseudomycena* consisted of two sections *Tenerrimae* and *Basipedes*. Four sections, namely *Diversiformes, Caespitosae, Viscosae* and *Fuliginellae* together constituted the subgenus *Glutinipes*. Subgenus *Eumycena* included 11 sections (*Lactipedes, Hydropus, Corticolae, Cyanescentes, Deminutivae, Adonideae, Calodontes, Corticatae, Omphaliariae, Floccipedes* and *Typicae*) in which sections *Deminutivae*, *Adonideae* and *Calodontes* were subdivided into 5 subsections, 3 subsections and 2 subsections respectively.

Métrod (1949), in his monograph on the mycenas of Madagascar, described 85 species of *Mycena* spanned over four sections (*Basipedes, Granulatae, Nodosae* and *Ciliatae*) and 18 subsections. One section (*Nodosae*) and 8 subsections (*Tenaces, Alveolariae, Viscatae, Setosae, Heterocystidiae, Rubrae, Subtles* and *Ambiguae*) that he proposed as new were not validly published (Grgurinovic 2003). Métrod used both macro- and microscopic characters in his classification.

Singer (1986) divided the genus *Mycena* into 15 sections, of which two (*Cyanocephalae* and *Kermesinae*) were proposed as new. In his classification, Singer proposed two new subsections, viz. *Pseudocrocatae* and *Lilacifolinae* under the sections *Lactipedes* and *Hygrocyboideae* respectively. A total of 24 stirpes (ten stirpes in subsection *Mycena*, eight stirpes in subsection *Ciliatae*, three stirpes in subsection *Galactopodinae* and three stirpes in section *Purae*) were also recognised. In his monumental work 'Mycenas of the Northern Hemisphere', Maas Geesteranus (1992a, b) divided the genus into 40 sections, of which 15 sections and one subsection (*Hiemales*) were new. Most of the other sections in his classification were introduced by elevating Singer's (1943, 1951, 1986) subsections and stirpes of sections *Mycena*, *Hygrocyboideae* and *Purae* to sectional level.

After this major work, Maas Geesteranus himself and other authors have added several new sections in *Mycena*. Just after the publication of 'Mycenas of the Northern Hemisphere', Redhead and Norvell (1993) rediscovered *Mycena gaultheri* A.H. Sm. after 50 years and placed it under a new section *Testudini*. Earlier, Smith (1947) had placed *M. gaultheri* under the stirps *Mucor* of section *Basipedes* of the subgenus *Pseudomycena* Cejp. Maas Geesteranus & Horak (1995), in their monograph '*Mycena* and related genera from Papua New Guinea and New Caledonia', considered 15 sections out of which four sections, *Nubilae, Rufolimitatae, Phloginae* and *Detrusae*, were new.

Maas Geesteranus & de Meijer (1997), in their account of Brazilian mycenas, suggested 14 new sections. They also proposed new subsection *Generosae* under the section *Calodontes*. In that monograph, they described 63 species under 30 sections. Also, they recognised the section *Roridae* to incorporate three *Mycena* species. Maas Geesteranus & Ovrebo (1997) recorded a new species from Costa Rica, *Mycena seclusa* Maas Geest. & Ovrebo, under the new section *Seclusae*. Maas Geesteranus & Hausknecht (1998) introduced two monotypic sections, viz. *Fuscoradiatae* and *Viscidocruentae*. The type species of the latter section, *M. viscidocruenta* Cleland, has been subsequently proposed as the type of a new genus, *Cruentomycena* R. H. Petersen, Kovalenko & O.V. Morozova, based on molecular studies (Petersen *et al*. 2008).

Villarreal *et al*. (1998) and Esteve-Raventós *et al*. (2001) erected two new sections, *Rubescentes* and *Dunicolae* respectively, to place two striking species from Spain. A new section *Cecidiophilae* was introduced by Berg *et al*. (2000), to fit *Mycena cecidiophila* A. P. Berg, Berg-Block, Noordel. & Uljé, that shows some resemblance with the species of section *Sacchariferae* but differing in having inamyloid lamellar trama, and in lacking cheilocystidia.

Grgurinovic (2003) used a slightly different classification from that of Maas Geesteranus, and she introduced three new sections, viz. *Maldeae, Mulawaestres* and *Metuloidiferae*. In her monograph 'The genus *Mycena* in South-Eastern Australia' Grgurinovic (2003) grouped 66 species of *Mycena* under 21 sections and she did not consider any section erected by Maas Geesteranus in her classification. Also, she has given emended descriptions for sections *Adonideae, Calodontes, Cinerellae, Fragilipedes, Galactopoda* and *Lactipedes*. In addition, she has provided an excellent comparison of classifications of Kühner (1938), Smith (1947), Singer (1986), Maas Geesteranus (1992a, b) and Maas Geesteranus & Horak (1995).

Interestingly, Robich (2003) could fit all the 143 *Mycena* species known from Europe under 24 existing sections without introducing any new section. Basically he followed Maas Geesteranus's (1992a, b) classification but with refined circumscription of sections and with the addition of section *Roridae* which was not considered by Maas Geesteranus (1992a, b). Maas Geesteranus (1992b) used basidiospore shape as a major character in his key. Robich (2003) used globose to subglobose basidiospore shape to separate section *Supinae* from other sections. These two authors have conflicting concepts regarding the shapes of basidiospores allowed within a section. For example, in the section *Filipedes*, Maas Geesteranus (1992b) assigned species with pip-shaped basidiospores while Robich (2003) allowed a range of spore-shapes such as subglobose, subellipsoid, ellipsoid and cylindrical in that section. In short, Maas Geesteranus used a narrow range of character states for spore shape, while Robich used a wide range.

Several workers have provided monographic treatments of sections such as *Sacchariferae, Longisetae, Polyadelphia* and *Fragilipedes*. For example, Desjardin (1995) gave an account of worldwide members of *Mycena* section *Sacchariferae*. He subdivided the section *Sacchariferae* into three stirpes: *Amparoina*, *Alphitophora* and *Adscendens*. Later, Maas Geesteranus & de Meijer (1998) introduced a new stirps *Fuscinea* under the section *Sacchariferae* to include *Mycena fuscinea* and *Mycena fuliginea* that have dark content in acanthocysts. Desjardin *et al*. (2002) provided an account of worldwide species of *Mycena* section *Longisetae* where they recognised two stirpes viz. stirps *Brunneisetosa* with four species and stirps *Longiseta* with seven species. Villarreal *et al*. (2002) have provided a key to eighteen Northern Hemisphere *Mycena* species of section *Polyadelphia*. Robich (2006a) presented a revised key to the species of *Mycena* section *Fragilipedes* of the Northern Hemisphere. New taxa published between 1988 and 2003, and some species transferred from other sections of *Mycena* and from the genus *Hydropus* are also included in his work. This work showed that section *Fragilipedes* was the largest section in *Mycena* with 90 taxa of 87 species and 3 varieties known at that time.

Macroscopic characters used in the infrageneric classification of *Mycena*

Habitat

Habitat of species of *Mycena* is sometimes taxonomically useful. There is a striking tendency for certain species of *Mycena* to grow on a particular habitat (Smith 1947). They may be humicolous, foliicolous, lignicolous or corticolous. Foliicolous *Mycena* species are the most diverse group (Eckblad & Gulden 1974). Species of *Mycena* exhibit all degrees of affinity for higher plants (Smith 1947) although some are exclusively seen on a particular habitat. *Mycena pseudoclavicularis* A.H. Sm. appears to be a characteristic species of the ponderosa-pine forests of North America (Smith 1947). *Mycena juniperina* Aronsen grow on the bark of living *Juniperus communis* L. (Aronsen 1996). *Mycena cupressina* Antonín & Maas Geest. is found predominantly on the bark of living or dead *Cupressus sempervirens* L. (Antonín & Maas Geesteranus 1998). Maas Geesteranus & Hausknecht (1994) reported the occurrence of *Mycena dura* Maas Geest. & Hauskn. in the company of thermophilic species such as *Agaricus maskae* Pilát and *Agaricus pseudopratensis* (Bohus) Wasser. Several species of the section *Hiemales* are found growing on living hosts and are considered parasitic (Maas Geesteranus & Hausknecht 1994). *Mycena arundinarialis* Pegler (Pegler 1977) and *Mycena hawaiiensis* Desjardin (Desjardin 1995) of section *Sacchariferae* are known from

monocotyledonous debris. *Mycena pseudopicta* (J.E. Lange) Kühner, a member of section *Cinerellae*, is unique with its graminicolous habitat (Moreno & Heykoop 2002). Thus, habitat is useful to identify species within some sections (Robich & Hausknecht 2001). At the same time, as Desjardin (1995) opined, for poorly known taxa, known only from the holotype specimen and consist of a single basidiomata, the taxonomic value of the substrate is rather limited.

Basidiomata

Two modes of development of the basidiomata may be distinguished in *Mycena* (Corner 1994). Monophasic type or stipitocarpic morphogenesis (Reijnders 1963; Walther *et al*. 2001), where the stipe lengthens as the pileus is growing, is typical for the majority of *Mycena* species. In sections *Basipedes* and *Sacchariferae,* the development is diphasic or pileostipitocarpic, i.e., all structures of the mature fruit body developed in the primordium, and the stipe extends quickly and then the pileus expands to expose the hymenium. Corner (1994) separates his 'group 1' from others on the basis of their development from a hemispherical primordium. The presence of velar elements on the surface of the basidiomata is not known in most mycenas. However, the presence of velar elements is a unique feature of members of section *Sacchariferae*. The universal veil is rudimentary and evident only on primordia, and when they mature, these structures disarticulate and fall off (Desjardin 1995). Therefore, primordial stages must be collected to observe veil tissue on the cap for correct species identification (Hemmes & Desjardin 2002). The ontogenetic studies on *Mycena stylobates* (Pers.) P. Kumm. (Walther *et al*. 2001) revealed the development of a 'primary veil', composed of undifferentiated plectenchyma, within the primordium.

Size and stature of the basidiomata are influenced by substratum and local conditions and has little taxonomic value (Desjardin 1995). However, Smith (1947) used minute basidiomata as a character to define the section *Deminutivae*.

Colour of the basidiomata as a character is very important in the taxonomy of *Mycena*. Its value, however, depends to a large extend on the degree of difference shown by the specimen and their nearest relatives (Smith 1947). The distribution of various pigments throughout the basidiomata is also important. The section *Adonideae,* for example, is characterised by brightly coloured pileus (Maas Geesteranus & Horak 1995). Species of the sections *Sacchariferae* and *Basipedes* are usually whitish or greyish. The age and exposure of the basidiomata to intense light during development will often influence colour in some species such as *Mycena citrinomarginata* Gillet (Smith 1947). Robich & Hausknecht (2001) used pileus colour along with other characters to differentiate species within the same section.

Pileus

The size of the pileus generally varies from 0.5–70 mm diameter. Pileus has a range of shape from parabolic to campanulate or applanate, furnished with or without an umbo. Almost all taxa are initially translucent-striate, becoming sulcate or plicate-striate with age. Corner (1994) used pileus shape, along with other characters, to separate species within infrageneric groups. Pileus surface may be glabrous, finely pruinose, pubescent or spinulose. In section *Sacchariferae*, the white sugary coating over the pileus is the manifestation of acanthocysts or cherocytes. In general, those species with numerous pileocystidia or fibrils over the cap have a rather dry

appearance and in some species such as *M. delicatella* (Peck) A.H. Sm., it is an important diagnostic feature (Smith 1947). Pileus ornamented with thick-walled, hyaline or brown setae is the unique feature of the section *Longisetae* (Desjardin & Horak 2002). The viscidity or glutinous nature of the pileus is a character of major importance (Maas Geesteranus 1992a, b). Pileus covered with a separable, tenacious pellicle is a major diagnostic feature of sections *Adornatae*, *Basipedes*, *Caespitosae, Calamophilae, Indutae, Infuscatae* and *Viscipelles*. The pileus context of species of section *Saniosae* exudates a red juice when broken.

Stipe

The stipe surface also exhibits the same variations in its characters as the pileus. Section *Aspratiles* is characterised by a dry pileus and a glutinous stipe. Both the pileus and the stipe are viscid in species of sections *Hygrocyboideae, Fuliginellae*, *Caespitosae*, *Insignes* and *Euspeireae*. Viscidity of the stipe surface distinguishes 'Group 4' from 'Group 5' of Corner (1994). The stipe that exudes coloured juice when cut is a character of high taxonomic value. If the exudation is milky white, such species are included in section *Lactipedes* (Smith 1947; Pegler 1986; Maas Geesteranus 1992a, b). Species exuding coloured juice when cut are grouped in sections *Galactopoda, Sanguinolentae* and *Crocatae*. Another taxonomically useful character is the mode of attachment of the stipe base to the substratum. The stipe base may be insititious or with fine radiating fibrils. Presence of a basal disc or bulb is a character of major importance (Smith 1947). In the section *Basipedes*, the stipe is characterised by fimbriate basal disc (Smith 1947). Walther *et al*. (2001) describes the formation of imprints of lamella-edge on the basal disc in *M. stylobates* of section *Basipedes*. The base of the stipe may extend to form a long root-like projection termed pseudorrhiza and this is a diagnostic feature of some species such as *M. galericulata* and *M. megaspora* Kauffman (Smith 1947).

Lamellae

All *Mycena* species, except *M. cylindrospora* A.H. Sm., *M. paucilamellata* A.H. Sm., *M. oligophylla* Aronsen & Maas Geest. and *M. echinocephala* (G.F. Atk.) Desjardin, have well-developed lamellae (Smith 1947; Aronsen & Maas Geesteranus 1990; Desjardin 1993). The attachment of lamellae to the stipe is an important character in the infrageneric classification. In *Mycena*, this character varies from free to deeply decurrent. In *M. stylobates* and several other species, the lamellae are attached to a slight collar around the stipe apex (Corner 1994). Although they are given only secondary importance (Smith 1947), the number of lamellae and lamellulae, and their thickness are used as characters at the species level (Corner 1994). Along with other characters, Corner (1994) considered the crowded nature of lamellae of *M. alphitophora* (Berk.) Sacc. to differentiate it from *M. perechinulata* Corner that has subdistant gills.

Maas Geesteranus (1992a, b) noted that the shape of the lamellae was an important character and he used it as the only character to differentiate the subsections *Hiemales* (having ascending lamellae) and *Omphaliariae* (having arcuate lamellae) within the section *Hiemales*. Arcuate lamella is one of the diagnostic features of the sections *Insignes* and *Adornatae*. Coloured lamella-edge is taxonomically very important. The colour of the lamella-edge generally varies from brown to reddish to black. However, a blue-coloured lamella-edge is seen in section

Cyanocephalae. Together with other characters, colour of the lamella-edge is diagnostic of the sections *Rubromarginatae*, *Luculentae, Saniosae, Dactylinae, Pictae* and *Pterigenae*. In species of sections *Hygrocyboideae, Fuliginellae, Bulbosae* and *Exiguae*, the lamella-edge can be separated as a gelatinous thread. Maas Geesteranus (1992b) and Maas Geesteranus & Horak (1995) used this feature as a major taxonomic character. Development of veins in the space between the lamellae forms an important character in some species such as *M. galericulata* and *M. pura* (Pers.) P. Kumm. (Smith 1947). Pegler (1986) used it as a diagnostic character of section *Purae*.

Odour and taste

Odour and taste of the basidiomata are minor characters often useful in the field. In most cases, the odour of the basidiomata is not distinctive. But in some cases the basidiomata have a distinct raphanoid, nitrous, farinaceous, fragrant or fruity odour (Smith 1947) or the smell of hypochlorite bleach or iodoform (Emmet 1992a). Nitrous odour of the basidiomata along with other characters is used as a diagnostic feature of section *Fragilipedes* (Pegler 1977; Maas Geesteranus & de Meijer 1997). Foetid alliaceous odour is a distinct character of *M. myrifica* Corner (Corner 1994). The taste is merely mild or slightly farinaceous in most species. However, *M. pura* and *M. cinerella* (P. Karst.) P. Karst. are characterised by a radish-like or rancid taste (Smith 1947).

Some *Mycena* species tend to show a dark coloured (sordid-reddish) staining reaction when cut or bruised, or become spotted with dark colour with age. Smith (1947) has found this as a constant feature in some species such as *M. maculata* P. Karst., *M. rubrotincta* A.H. Sm. and *M. viscosa* Secr. ex Maire.

Bioluminescence

Corner (1994) used bioluminescence as a taxonomic character to define certain sections and groups. Desjardin *et al*. (2010) revealed that most species of section *Exornatae* are bioluminescent.

Microscopic characters used in the infrageneric classification of *Mycena*

Basidiospores

The basidiospores of *Mycena* species always appear thin-walled, smooth, and hyaline in transmitted light, but the colour of the spore print can range from pure white to pale brown, pale cream or pale yellow (Pegler & Young 1971). Size and shape of the basidiospores are taxonomically very important in recognizing species. According to Smith (1947), the length of the basidiospores of *Mycena* species ranges from as low as 3–4 µm to 15–18 µm with the majority of species showing basidiospores that are 6–11 µm long. Basidiospore morphology is fairly constant in the genus. Ellipsoid basidiospores are seen in vast majority of species, but globose, ovoid, oblong, cylindric, and clavate-fusoid basidiospores are seen in some (Pegler & Young 1971). The basidiospore apex is always obtusely rounded and the base is generally broad with a sharply delimited hilar appendix. The species of the sections *Supinae, Clavulares* and *Exiguae* invariably

have globose to subglobose and amyloid basidiospores. The basidiospore shape is of limited taxonomic value within a section (Desjardin 1995).

It is now generally recognised that the basidiopores from four-spored basidia are smaller than those from two-spored individuals of the same species and that this difference is not of sufficient taxonomic importance (Smith 1947). The increase in spore-size in two-spored forms appears to be the result of the distribution of the contents of the basidia into two instead of four basidiospores. However, in general, the basidiospores from two-spored and four-spored individuals of the same species have the same shape (Smith 1947). But in *Mycena supina* (Fr.) Quél., the four-spored forms have globose or subglobose basidiospores and in the four-spored forms they are broadly ellipsoid (Smith 1947). No species with truly echinulate basidiospores are included in *Mycena* (Smith 1947).

Basidia

Morphology of basidia has little taxonomic significance in *Mycena*. But two-spored and four-spored basidia are used taxonomically to characterise species (Smith 1947). Generally 4-spored basidia always have clamp connections and 2-spored basidia do not have clamp connections at their base (Maas Geesteranus 1992a, b).

Cheilocystidia

The size, shape, distribution and pigmentation of the cystidia are among the most important characters used to distinguish subsections and species of *Mycena* (Smith 1947). Size of cystidia appears to be of some importance in species such as *M. macrocystidiata* Singer and *M. flavescens* Velen. in section *Fragilipedes* (Smith 1947). In a large number of species, the cystidia are fusoid-ventricose. The cystidial apex may be pointed, obtuse or forked, and the surface, smooth or covered fully or partially with excrescences. Corner (1994) and Maas Geesteranus (1992a, b) used ornamentation over the cheilocystidia as a taxonomic character.

Most *Mycena* species have cheilocystidia with hyaline, homogeneous contents. But in some species, it may be yellow, pink, red, wine-coloured or dark sordid brown (Smith 1947). And in some cases, like *Mycena schildiana* Maas Geest., the initially concolourous lamella-edge becomes coloured with age. The pigment is dissolved in the cell sap and it may be present only in the cheilocystidia or in all the cystidia of the basidiomata. Some cystidia contain rather highly refractive droplets (Smith 1947). Cheilocystidia that are immersed in a gelatinous matter is of high taxonomic value in the infrageneric classification of the *Mycena*. Such cheilocystidia are seen in sections like *Hygrocyboideae* and *Sanguinolentae*. Whether the lamella-edge is fertile or sterile is used as a differentiating character at species-level (Corner 1994). In most *Mycena* species, however the lamella-edge is heterogeneous.

Clamp connections at the base of cheilocystidia in *Mycena* are correlated with their presence in other elements of hymenium and subhymenium (Maas Geesteranus 1978). Presence of clamps at the base of cheilocystidia is a character useful at species-level. For example, *M. jacobi* Maire and *M. niveipes* (Murrill) Murrill, long regarded as being identical, are now considered to

represent two separate species based on this character (Maas Geesteranus 1978). Cheilocystidia are absent in section *Radiatae*.

Pleurocystidia

Pleurocystidia do not play a very important role in the taxonomy of *Mycena*. However, the presence of pleurocystidia is an important feature in species with coloured lamella-edge. The combination of characters such as coloured lamella-edge and presence of pleurocystidia is found in species of sections *Rubromarginatae* and *Luculentae*. In sections *Pterigenae* and *Pictae*, on the other hand, coloured lamella-edge is correlated with absence of pleurocystidia. The thick-walled pleurocystidia are one of the most important diagnostic features of section *Metuloidiferae*. Pleurocystidia are consistently absent in sections *Sacchariferae, Hygrocyboideae, Rarifoliatae, Saetulipedes, Viscipelles,* and *Amictae*.

Caulocystidia

The presence and shape of caulocystidia varies from species to species. However, the morphology of caulocystidia is of immense importance in the section *Sacchariferae*, where two stirpes were erected mainly on the basis of smooth and rough caulocystidia (Desjardin 1995). Caulocystidia with brown contents were reported in *Mycena stictopus* Maas Geest. & Hauskn. (Maas Geesteranus & Hausknecht 1999). Smith (1947) suggested that there is no correlation between the shape of cystidia on the lamellae and those on the pileus and stipe. However, cheilo- and caulocystidia of same shape occur in section *Sanguinolentae*.

Pileocystidia

Pileocystidia are of limited importance in the infrageneric classification of *Mycena*. Its size, shape and excrescences are relevant only at species level. But the presence of pileocystidia along with the pileipellis hyphae with excrescences forms the diagnostic feature of section *Spinosae* (Aravindakshan & Manimohan 2013c). Thick-walled pileosetae, however, are a diagnostic feature of section *Longisetae*.

Pileipellis and stipitipellis

The pileus of a typical *Mycena* is characterised by a pellicle, a hypoderm and a mass of interwoven hyphae making up the trama (Smith 1947). The degree to which the pellicle is developed is an important character. A well-developed hypoderm is not a characteristic feature of all species of *Mycena* (Smith 1947). Gelatinous or subgelatinous nature of the pileus is a character of some taxonomic importance (Smith 1947).

The genus *Mycena* exhibits a variety of pileipellis structure that has significant taxonomic value. The structure of the pileipellis varies from normal cutis (as in *Mycena pura*) to ixotrichoderm (*Mycena luxaeterna* Desjardin, B.A. Perry & Stevani). It is generally thin-walled, mostly hyaline, and brownish in *Mycena atropapillata* Kühner & Maire. Hyphae of the pileipellis may be smooth (as in sections *Calodontes* and *Radiatae*) or diverticulate as in majority of the sections. Recently, density (Maas Geesteranus & Horak 1995) and the shape of the excrescences like short or long, conic, cylindrical, coarse or nodulose diverticulate (Maas Geesteranus & de Meijer 1997) are used as

characters of various sections. The hyphae of the pileipellis may be embedded in a gelatinous matter (sections *Caespitosae, Calamophilae, Euspeireae etc*.) or not (section *Sacchariferae*) (Maas Geesteranus 1992a, b). Hyphae of the pileipellis may be both diverticulate and embedded in a gelatinous separable layer as in section *Hygrocyboideae*. Section *Sacchariferae* is characterised by a well-defined universal veil composed of acanthocysts and cherocytes. As stated earlier, Maas Geesteranus & de Meijer (1998) erected a new stirps *Fuscinea* in section *Sacchariferae* based on the presence of dark content in the acanthocyst. The section *Exornatae* is characterised by the presence of thorn-like excrescences over the hyphae of the pileipellis that is embedded in a gelatinous matter.

The hyphae of the stipitipellis also show similar characteristic feature as that of pileipellis. It is generally thin-walled and hyaline. It may be either smooth (sections *Calodontes* and *Radiatae*) or diverticulate as in most species. The stipe may be covered with a glutinous, separable pellicle (section *Euspeireae*) or it may be somewhat viscid (*Hygrocyboideae*).

Trama

In *Mycena* and some related genera, the trama consist of hyphae which are unusually broad, relatively short and constricted at the septa (Singer 1986). Arrangement of hyphae of the lamellar trama varies from regular to subregular. Lamellar tramal hyphae are thin-walled and are either hyaline or with coloured contents. Similar hyphae are seen in the pileus trama as well. The dark-coloured pileus is usually the manifestation of contents of the pileus trama. The gelatinisation is rare in the lamellar and pileus trama. The nature of stipe trama is not taxonomically useful in the infrageneric classification of *Mycena*.

Reaction with Melzer's reagent

The reactions of Melzer's reagent with the basidiospores have been used as a major diagnostic feature in the infrageneric classification of *Mycena*. It varies from inamyloid to amyloid. All earlier workers on *Mycena* systematics used the reaction of basidiospores to Melzer's reagent as an important feature and keyed out the sections and species accordingly. Maas Geesteranus (1992a, b) used this character to segregate subsections within the section *Calodontes*. But later studies by Harder *et al*. (2011) revealed that amyloidity is not a diagnostic feature of this section and hence raises doubt about the taxonomic value of this character in *Mycena* systematics. However, inamyloid basidiospores consistently occur in species of sections *Adonideae, Aciculae, Hiemales* and *Oregonenses*.

Reaction of lamellar trama with iodine (Melzer's reagent) is an important feature in characterizing sections (Maas Geesteranus 1992b). The tissue turns dark vinaceous red or almost purple in a good positive reaction and remains hyaline or become yellowish to dull brown in negative reactions (Smith 1947).

McCracken & Dodd (1971) indicated that the amyloid reaction was due to the interaction of iodine and straight chained α, 1–4 glycosidic-linked polysaccharide. Singer (1975b) referred to the red colour reaction in iodine as "pseudoamyloid" but the more common term "dextrinoid" was used by Orton (Smith 1965). The dextrinoid precipitate of Melzer's solution (IKI) is due to the

presence of a quaternary ammonium compound called glycine betaine, and not due to the presence of starch (Blackwell *et al*. 2001).

Molecular studies

Studies on phylogenetic relationships of agarics based on nuclear large subunit ribosomal DNA sequence (nLSU) suggested that *Mycena* was a monophyletic group (Moncalvo *et al*. 2000). But later studies of Moncalvo *et al*. (2002) and Matheny *et al*. (2006) using multilocus analysis revealed that *Mycena* is a polyphyletic group and they positioned the genus *Mycena* at the base of the Tricholomatoid clade. Analysis of ITS site was considered as the good method for identifying closely related species in *Mycena* (Harder *et al*. 2010). But later, Harder *et al*. (2013) suggested that ITS alone cannot be used for species identification. Aronsen & Perry (2011) conducted phylogenetic studies of *Mycena* species belonging to section *Polyadelphia* using nLSU features and deduced that morphologically similar species *M. guldeniana* Aronsen & B.A. Perry and *M. terena* Aronsen & Maas Geest. are genetically different. As part of the phylogenetic treatment of fungi (Matheny *et al*. 2006, 2007), a few *Mycena* species were already sequenced in the last decade. Recently, a few bioluminescent *Mycena* species also have been sequenced (Aravindakshan *et al*. 2012, Shih *et al*. 2014; Chew *et al*. 2013, 2014, 2015). However, a comprehensive work on the phylogeny of *Mycena* is yet to come out. Boisselier-Dubayle *et al*. (1996) studied the genetic variability of eight loci in eight wild populations of *Mycena rosea* Gramberg and found that they exhibit high genetic variability or polymorphism.

Ecological aspects

Mycena species often dominate the decomposer communities in forest litter (Frankland 1998; O'Brien *et al*. 2005; Yamashita & Hijii 2004, 2006; Lindahl *et al*. 2007). *Mycena galopus* (Pers.) P. Kumm. is the most important leaf decomposer in coniferous and angiosperm woodlands of Great Britain, having the potential to utilize all the major constituents of plant litter (Hering 1982; Hitchcock *et al*. 1997), and causing characteristic white rot (Frankland 1982). Hence, the ecology and biochemistry of this fungus was widely studied (Frankland *et al*. 1981; Lindeberg 1985; Zheng *et al*. 2000). Saito (1957) and Hintikka (1970) had related the vigorous lignolytic activity of the *Basidiomycota* to the production of "white-rot humus" on forest soils. Litter decomposition studies (Osono & Takeda 2001, 2002; Osono *et al*. 2003) revealed that *Mycena* sp. and *Mycena polygramma* (Bull.) Gray (representing *Basidiomycota*) are vigorous decomposers of lignocelluloses causing significant weight loss of litter. Osono (2003) summarised that further experiments are required to evaluate the effect of carbon and nitrogen nutrition on lignin decomposition by litter-inhabiting species in the *Basidiomycota*. Ghosh *et al*. (2003) succeeded in isolating a combination of enzymes (laccase, mannases and xylanases) from *Mycena galopus*. Recently, *M. sanguinolenta* (Alb. & Schwein.) P. Kumm., *M. amicta* (Fr.) Quél., *M. pinastri* Robich, *M. pura*, *M. stylobates*, *M. vulgaris* (Pers.) P. Kumm., *M. aurantiidisca* (Murrill) Murrill, *M. polygramma* (Bull.) Gray, *M. clavicularis* (Fr.) Gillet (Miyamoto *et al*. 2000), *M. haematopus* (Pers.) P. Kumm. (Fukasawa *et al*. 2005), *M. epipterygia* (Boberg *et al*. 2008), *M. polygramma* (Fukasawa *et al*. 2009) were studied for their role in litter-degradation.

It has been pointed out that different species of *Mycena* and *Marasmius* Fr. are adapted to exploit the same resource at different times (Swift 1982). Remineralisation of nitrogen and phosphorus by various lignin-decomposing species of *Collybia* (Fr.) Staude, *Marasmius* and *Mycena* could be particularly important in forest soil, where these elements are usually less available than magnesium and potassium (Frankland 1982). Verhagen *et al*. (1996) reported the production of adsorbable organic halogen (AOX) by *Mycena metata* (Secr. ex Fr.) P. Kumm. in large quantities in forest litter. Similarly, de Meijer *et al*. (1988) reported cesium radionuclide accumulation by *Mycena galericulata*.

Molecular identification using internal transcribed spacer (ITS) and large subunit nuclear rDNA (nLSU) sequences showed that the non-photosynthetic orchid *Gastrodia confusa* Honda & Tuyama was associated with several litter- and wood-decomposing species of *Mycena* and these myco-heterotrophic plants gain carbon through these mycorrhizal partners. This condition seems to be a novel and specialised mycorrhizal parasitism (Ogura-Tsujita *et al*. 2009). Recently, similar studies (Zhang *et al*. 2012) also showed that a *Mycena* species associated with the *Dendrobium officinale*, an endangered Chinese medicinal plant, enhance the growth of seedlings and roots.

Biochemical aspects

Species of genus *Mycena* appear to be a very promising source of new bioactive secondary metabolites. *Mycena alcalina* (Fr.) P. Kumm., *M. galericulata*, *M. haematopus* and *M. pura* are medicinal due to their anti-tumour (anti-carcinogenic) properties (Becker *et al*. 1997; Shen *et al*. 2009). *Mycena dura* is the most poisonous member of the genus in Europe (Maas Geesteranus & Hausknecht 1994). *Mycena* (*M. cyanorhiza* Quél.) was included in the list of 14 fungal genera that contain psilocybin and therefore are neurotropic (Guzmán *et al*. 1998). Chard *et al*. (1985) reported the use of anti-*Mycena galopus* serum as an immunofluorescence agent. Upon wounding of the fruit bodies of *M. galopus*, esterases come into contact with the latex and cleave the benzoxepine esters to release the corresponding bioactive alcohols. Because of the wound-activated defence mechanism, the fruiting bodies of *M. galopus* are rarely attacked by fungivores and parasitic fungi. However, the zygomycete *Spinellus fusiger* (Link) Tiegh. is insensitive to this defence reaction, thus enabling that mycoparasite to grow on the fruiting bodies of *M. galopus*. A variety of pyrroloquinoline alkaloids have been detected in *M. sanguinolenta* and *M. haematopus* (Peters & Spiteller 2007; Peters *et al*. 2008). From pure cultures of several *Mycena* species, a number of metabolites have been isolated (Eijk 1975; Bäuerle *et al*. 1982; Jente *et al*. 1985; Harttig *et al*. 1990; Hautzel *et al*. 1990; Aqueveque *et al*. 2005; Peters & Spiteller 2006). Metabolites have also been extracted from fresh specimens of *M. pura*, *M. aurantiomarginata* (Fr.) Quél., *M. polygramma*, *M. rosea*, *M. tintinnabulum* (Paulet) Quél., and *M. crocata* (Hatanaka & Katayama 1975; Bäuerle & Anke 1980; Zapf *et al*. 1995; Engler *et al*. 1998; Buchanan et al. 1999; Jaeger & Spiteller 2010).

Clough (1993) and Milata (2008) studied various fungal derivatives, including those of mycenas. Cultures of *Mycena avenacea* (Fr.) Quél. were shown to metabolize pentachlorophenol (PCP), 2,3,5,6-tetrachloro-p-hydroquinone, and 2,3,5,6-tetrachloro-p-benzoquinone (Kremer *et al*. 1992). Hoekstra *et al*. (1998) reported that pure cultures of *M. metata* produces chloroform, like another basidiomycete *Peniophora pseudopini* Weresub & I.A.S. Gibson and the deuteromycete

Caldariomyces fumago Woron., suggesting that fungi are important sources of elevated concentrations of chloroform in air in the soil. *Mycena* is one of the twelve genera of basidiomycetes that produce chlorinated anisyl metabolites (CAM), the most common type of organohalogens, when grown on a defined medium (Swarts *et al*. 1997). CAM alcohols play an important role in the ligninolytic system of white-rot fungi as oxidase substrates and thus making the fungi an ecologically important group.

Along with other basidiomycetes, *Mycena maculata*, *M. leucogala* (Cooke) Sacc., *M. aurantiomarginata* and *M.* cf. *alcalina* were screened for antimicrobial activity by Suay *et al*. (2000). Vahidi *et al*. (2004) studied the effect of cultural conditions on growth and antifungal activity of *M. leptocephala* (Pers.) Gillet.

Bioluminescence

Many *Mycena* species are renowned for their ability to emit visible light. A total of eighty one species of luminous fungi are currently known, fifty two taxa of which belong to the genus *Mycena*, distributed in 17 sections (Desjardin *et al*. 2007, 2008, 2010; Aravindakshan *et al*. 2012; Chew *et al*. 2013, 2014, 2015). Other genera with luminescent members are *Panellus* P. Karst., *Armillaria* (Fr.) Staude, *Omphalina* Quél., *Omphalotus* Fayod, *Lampteromyces* Singer, *Pleurotus* (Fr.) P. Kumm. and *Gerronema* Singer. Desjardin *et al*. (2008) classified all the then-known 64 luminescent fungi, all white-spored agarics, in three distinct lineages viz. *Omphalotus* lineage (*Omphalotaceae*) with fourteen species, *Armillaria* lineage (*Physalacriaceae*) with five species, and mycenoid lineage (*Mycenaceae*) with forty-seven species. But within the mycenoid lineage, the origin and development of this character in the evolution remains to be studied. Desjardin *et al*. (2008) have given an excellent account of the physiological and ecological aspects and mechanism of bioluminescence.

In many species, only the mycelium is luminescent. In others both the mycelium and the basidiomata emit light. Very rarely the basidioma has been reported as luminescent while the mycelium is non-luminescent (*M. irritans* E. Horak, *M. lamprospora* (Corner) E. Horak, *M. sublucens* Corner) (Corner 1954; Horak 1978; Desjardin *et al*. 2007, 2008). In *M. polygramma* and *M. lamprospora*, the basidiospores are luminescent (Herring 1994; Horak 1978). *Mycena haematopus* showed only a low-level bioluminescence, detected only when a photometer is used (Bermudes *et al*. 1992).

Mycena chlorophos (Berk. & M. A. Curtis) Sacc. is one of the brightly luminescent mycenas. To study the effect of different cultural conditions on luminescence, many cultural studies have been carried out on *M. chlorophos* (Niitsu & Hanyuda 2000; Niitsu *et al*. 2000; Mori *et al*. 2011). Berliner (1961a, b), Isobe *et al*. (1994), and Weitz *et al*. (2001) studied the effect of various cultural conditions on bioluminescence of different *Mycena* species. Studies of Berliner (1961a) on cultures of bioluminescent fungi, including *M. polygramma* revealed that highest light intensity is observed between 6 and 9 PM and peak at 7 PM and lowest intensities between 6 and 9 AM.

Although fungal bioluminescence has been known from ancient days, there is no solid information on the role of bioluminescence in fungi. It has been speculated that luminescent fungi attract insects which aid in dispersal of spores (O'Kane *et al*. 1990; Bermudes *et al*. 1992). However,

in many fungi only the mycelium, and not the fruiting body, shows luminescence. It has been hypothesised (Sivinsky 1981; Herring 1994) that the emitted light either attracts the predator of mycetophagous invertebrates or serves as a warning signal to repel nocturnal fungivores. Desjardin *et al*. (2007) hypothesised that fungal bioluminescence is a process that provides protection against deleterious effects of reactive oxygen species (ROS) produced mainly in mitochondria during respiration. The mechanism of bioluminescence varies from organism to organism, since it has evolved several times. The different mechanisms do, however, have something in common: they all require oxygen at some stage.

As in all other bioluminescent organisms, in bioluminescent fungi also luciferases act on a relatively low molecular organic compound called luciferin (fungal luciferin) in the presence of oxygen, resulting in an excited state of a pigment, which either emits light directly or transfers excitation energy to another emitter (Björn & Ghiradella 2008). In fungi, both the luciferin and the luciferases involved remain largely unidentified. However, Isobe *et al*. (1994) elucidated the chemical structure of the light emitter, lampteroflavin, of the luminescent mushroom *Lampteromyces japonicus* (Kawam.) Singer.

As the bioluminescent property of a fungus decreases with certain toxins, bioluminescent analysis is used as a rapid method for environmental monitoring for the detection of toxic organic and inorganic compounds including heavy metals (Vydryakova *et al*. 2011). Weitz *et al*. (2002) carried out bioassays using *Mycena citricolor* (Berk. & M.A. Curtis) Sacc. as test object to assess the toxicity of 3, 5-dichlorophenol (3, 5-DCP), pentachlorophenol (PCP), copper and zinc.

Economic importance

The genus *Mycena* has rather limited practical importance. Some species (*M. aschi* Henn., *M. bipindiensis* Henn., *M. flavescens*) are edible (Boa 2004), but are not economically important. *Mycena pura* is said to cause poisoning of the muscarine and epimuscarine types (Singer 1986). Epimuscarine has been found in *M. pelianthina* (Fr.) Quél. as well (Singer 1986).

The American leaf spot of coffee or *ojo de gallo* is a disease of serious economic concern in Latin America (Tewari *et al*. 1984; Singer 1986; Rao & Tewari 1987, 1989). It is caused by *Mycena citricolor* that has a wide host range. It incites brownish spots on coffee leaves and causes extensive defoliation resulting in severe yield losses. *Mycena theobromicola* (Murrill) Dennis is associated with cocoa pod rot (Singer 1987).

Fossil studies

Only a few fossils of agaricoid fungi have been discovered so far. These include *Coprinites dominicanus* Poinar & Singer (Poinar & Singer 1990), *Protomycena electra* Hibbett, D. Grimaldi & Donoghue (Hibbett *et al*. 1997a), *Aureofungus yaniguaensis* Hibbett, Manfr. Binder & K.D. Wang (Hibbett *et al*. 2003), all from the Miocene amber (15–20 million years old) of the Dominican Republic, and *Archaeomarasmius leggetti* Hibbett, D. Grimaldi & Donoghue (Hibbett *et al*. 1997a) from the mid-Cretaceous amber (90–94 million years old) of New Jersey. Among them

Archaeomarasmius leggetti resembles the extant genera *Marasmius* and *Marasmiellus* Murrill. *Protomycena electra* is similar to the extant genus *Mycena* in having convex, slightly campanulate pileus with translucent-striate margin, and the absence of veils. The ages of these fossils lend support to hypotheses that the cosmopolitan distributions of certain mushroom taxa could be due to fragmentation of ancestral ranges via continental drift and the striking similarity of these fossils to the extant forms suggests that the gilled mushroom morphology has been maintained in certain lineages for tens of millions of years (Hibbett *et al*. 1997a, b).

Geographical distribution

Mycena is almost cosmopolitan in distribution (Singer 1986). Major floristic studies on *Mycena* have been conducted in the following regions: North America (Beardslee & Coker 1924; Smith 1947), Europe (Kühner 1938; Robich 2003), Great Britain (Emmett 1992a, b, c, 1993a, b, c), Madagascar (Métrod 1949), East Africa (Pegler 1977), the Lesser Antilles (Pegler 1983), Sri Lanka (Pegler 1986), Papua New Guinea and New Caledonia (Maas Geesteranus & Horak 1995), Malaysia (Corner 1994), Brazil (Maas Geesteranus & de Meijer 1997) and South-Eastern Australia (Grgurinovic 2003). Maas Geesteranus (1992a, b) has done an excellent monographic work on *Mycena* species known from the Northern Hemisphere.

Information on mycenas of the following regions of the world are also available in the literature: Amazonia (Desjardin & Braga-Neto 2007), Argentina (Niveiro *et al*. 2012), Australia (Bougher 2009), Austria (Robich & Hausknecht 2008; Robich 2009), Azores islands (Dennis *et al*. 1977), Brazil (Pegler 1990), California (Perry & Desjardin 1999), Canada (Redhead 1984), China (Zheng 1986), Colorado (Mitchel & Smith 1978), Costa Rica (Maas Geesteranus & Ovrebo 1997), Denmark (Smith 1937), Dominican Republic (Lodge *et al*. 2004), Ecuador (Lodge 1996), Europe [(Netherlands, Norway and Switzerland) Maas Geesteranus 1995; Halama *et al*. 2014], Finland (Bonsdorff & Aronsen 2011), France (Courtecuisse 1985, 1986a, b; Courtecuisse & Guinberteau 1985; Bon & Chavassut 1989), Germany (Maas Geesteranus & Münzmay 1997; Robich *et al*. 2005; Miersh *et al*. 2006), Hungary (Babos 1979), Isle of Rhum (Dennis 1964), Italy (Antonin & Maas Geesteranus 1998; Robich 2006b, Rosa *et al*. 2012), Japan (Miyamoto *et al*. 1996, 1998; Takahashi 1999, 2000, 2007; Tanaka & Hongo 2003), Korea (Han *et al*. 2010), La Réunion (Maas Geesteranus & Hausknecht 1995, 1996; Miersch & Rödel 2011), Massachusetts (Bigelow 1976), Mauritius (Robich & Hausknecht 2009), the Netherlands (Maas Geesteranus 1992c; van den Berg *et al*. 2000), New York (Desjardin & Bessette 1997), New Zealand (Stevenson 1964; Segedin 1991), North America (Murrill 1912, 1916a; Davidson 1930; Smith 1944), Northeastern North America (Bigelow & Barr 1969), Norway (Bendiksen 1987; Eckblad & Gulden 1974; Aronsen 1994, 1996, 2009; Aronsen & Maas Geesteranus 1997; Aronsen & Gulden 2007; Aronsen & Perry 2011), Poland (Ronikier 2003; Ronikier *et al*. 2006), Puerto Rico (Lodge 1988), Scotland (Dennis 1955), Solomon Islands (Corner 1969), Spain (Robich 1996; Moreno & Heykoop 1998; Moreno *et al*. 1999; Villarreal *et al*. 1998, 1999, 2002; Villarreal & Esteve-Raventós 1999, 2000; Esteve-Raventós *et al*. 2001; Esteve-Raventós & Barrasa 2009; Zamora & Català 2012), Tennessee (Kauffman 1917), Texas (Thiers 1958), Taiwan (Shih *et al*. 2014) Thailand (Desjardin *et al*. 2004), Turkey (Kaya 2006; Sesli 2007; Servi *et al*. 2010), Ulster (Muskett 1934/1935), Venezuela (Dennis 1961).

Although several mycenas are widely distributed, some are endangered species included in Red Data Lists. *Mycena pelianthina* is reported to be vulnerable in Norway and endangered in Finland (Anonymous 1992; Rassi *et al.* 1992). The following species of *Mycena* are included in the Red Data List of British Fungi: *M. picta* (Fr.) Harmaja as extinct, *M. urania* (Fr.) Quél. as endangered, *M. purpureofusca* (Peck) Sacc., *M. rosella* (Fr.) P. Kumm., *M. seynii* Quél. and *M. rubromarginata* (Fr.) P. Kumm. as vulnerable and *M. renati* Quél. as rare (Ing 1992).

Very little information is available on the mycenas of India. Berkeley (1850, 1852) described a few species based on some Himalayan collections. Hennings (1901), Horak (1980a), Manjula (1983) and Maas Geesteranus (1992d) also described some species from different localities of India (Table 1). According to Natarajan *et al.* (2005), ten *Mycena* species are known from the Nilgiri Biosphere Reserve in the Western Ghats, but no details of the species were given by them.

4

A synopsis of the infrageneric taxa of *Mycena*

1. Section ***Aciculae*** Kühner ex Singer, Sydowia 15: 65 (1962b).

Basidiomata fairly small. Pileus pruinose, somewhat lubricous when wet, bright orange-red. Lamellae ascending, orange-yellow, edge whitish. Stipe fistulose, puberulous, somewhat viscid, orange-yellow. Basidiospores narrowly ellipsoid, inamyloid. Cheilocystidia versiform, smooth, more rarely apically forked. Pleurocystidia similar. Hyphae of the pileipellis densely branched or diverticulate.

Habitat – on woody debris.

This section, so far, incorporates only one species (*Mycena acicula* (Shaeff.) P. Kumm.) that has been recorded from Europe, northern Africa, the United States and Canada.

2. Section ***Adonideae*** (Fr.) Quél., Mémoires de la Société d'Emulation de Montbéliard II 5: 103 (1872).

Basidiomata fairly small to medium-sized. Pileus finely pruinose or often appearing glabrous, lubricous or not, brightly coloured, more rarely white. Lamellae ascending, adnate with a decurrent tooth, red, pink, cream or white with a paler edge. Stipe fragile, minutely puberulous all over, base covered with coarse, whitish fibrils. Basidiospores ellipsoid, inamyloid. Cheilocystidia mostly fusiform, smooth. Pleurocystidia similar. Hyphae of the pileipellis covered with much branched excrescences. Hyphae of the stipitipellis smooth. Caulocystidia clavate or fusiform.

Habitat – on the ground among grass and moss, on vegetable debris or on logs.

About eleven species belonging to this section have been reported from Europe, the United States, Algeria, Brazil, Australia, Papua New Guinea and India.

3. Section ***Adornatae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 140 (1997).

Basidiomata small. Pileus dry, pale greyish. Lamellae arcuate, white. Stipe fragile, dry, puberulous, with a pale ochraceous apex, insititious. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, with apical excrescences. Pleurocystidia absent. Hyphae of the pileipellis reticulately interconnected, smooth. Pileocystidia apically flaring, with excrescences. Hyphae of the stipitipellis smooth, non-gelatinised. Caulocystidia fusiform, smooth.

Habitat – on decaying leaves.

This is a monotypic section and the type species, *Mycena adornata* Maas Geest. & de Meijer, is known from Brazil.

4. Section ***Amictae*** A.H. Sm. ex Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 87: 134 (1984).

Basidiomata medium-sized. Pileus covered with a viscid, separable pellicle, when young either entirely or only marginally blue or bluish-green. Lamella-edge not formed by a tough thread. Stipe pruinose to puberulous, at first and at least partially blue to bluish-green. Basidiospores ellipsoid or globose, amyloid. Cheilocystidia cylindrical to subfusiform, simple. Pleurocystidia absent. Hyphae of the pileipellis embedded in a gelatinous layer, very much branched. Caulocystidia subfusiform to sublageniform. Clamp connections present.

Habitat – on decaying wood or other debris.

Two species belonging to this section are currently known from Europe and North America.

5. Section ***Aspratiles*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 44 (1997).

Basidiomata small-sized. Pileus with depressed centre, dry, white or pale grey. Lamellae arcuate, little ventricose. Stipe covered with a thick, hyaline slimy layer, smooth, base subinsititious or surrounded by a thin plaque of gelatinous matter. Basidiospores ellipsoid to cylindrical, amyloid. Cheilocystidia deep seated, thick-walled, with dense excrescences. Pleurocystidia scarce, similar. Hyphae of the pileipellis more or less gelatinised, diverticulate. Hyphae of the pileipellis embedded in a gelatinous matter, smooth for the greater part, diverticulate towards the stipe apex. Caulocystidia thick-walled, with excrescences.

Habitat – on decaying leaves.

Presently, this section contains only two species, known only from Brazil.

6. Section ***Basipedes*** (Fr.) Quél., Mémoires de la Société d'Emulation de Montbéliard II 5: 109 (1872).

Basidiomata small to medium-sized. Pileus covered with a separable, gelatinous pellicle, glabrous or pruinose or centrally hispid or entirely covered with spinules, greyish white to pale grey brown. Odour unknown. Lamellae ascending, receding from the stipe and forming a pseudocollarium, with white edge. Stipe puberulous below, springing from a pubescent basal disc. Basidiospores ellipsoid to elongated, amyloid. Cheilocystidia obpyriform or clavate or more or less irregularly shaped, clamed or not, with few excrescences, more rarely without any. Pleurocystidia absent. Hyphae of the pileipellis smooth to diverticulate. Caulocystidia long and slender.

Habitat – on decaying leaves, fallen twigs, coniferous needles, dead culms of grasses and base of tree trunks.

So far, nine species belonging to this section have been reported from different parts of the world such as North America, Europe, North Africa, Sri Lanka, Madagascar, Malaysia and Thailand.

7. Section ***Bulbosae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 86 (3): 414 (1983).

Basidiomata small. Pileus covered with a separable, gelatinous pellicle, initially pruinose. Lamellae ascending, seceding stellately from the stipe, forming a pseudocollarium, lamella-edge a tough-elastic, gelatinous thread. Basidiospores elongated ellipsoid to almost cylindrical, inamyloid. Cheilocystidia versiform, with one or more necks or with several, variously shaped excrescences. Hyphae of the pileipellis smooth, but becoming increasingly diverticulate towards the upper surface of the pileipellis and embedded in a gelatinous matter. Caulocystidia versiform.

Habitat – on herbaceous stalks.

This section contains only one species (*Mycena bulbosa* (Cejp) Kühner) known from Europe and North America.

8. Section ***Caespitosae*** (A.H. Sm. ex Singer) Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 83: 407 (1980).

Basidiomata densely caespitose. Pileus covered with a gelatinous, separable pellicle, viscid, pruinose or glabrous, white to orange. Lamellae ascending or arcuate, edge deep orange. Stipe pruinose to pulverulent above, viscid, covered with fibrils at the base. Basidiospores ellipsoid, amyloid. Cheilocystidia fusiform to clavate or subcylindrical, embedded in gelatinous matter or not, smooth or apically lobed or with a few coarse excrescences. Hyphae of the pileipellis embedded in gelatinous matter, diverticulate. Hyphae of the cortical layer of the stipe embedded in gelatinous matter, smooth, the terminal cells coarsely diverticulate to smooth.

Habitat – on wood of deciduous trees.

Three species are presently included in this section and they are known from the United States, Brazil, Canada, New Zealand, Papua New Guinea, Australia, Europe and New Zealand.

9. Section ***Calamophilae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 83: 409 (1980).

Basidiomata medium-sized. Pileus and stipe puberulous, glabrescent and becoming viscid. Lamellae arcuate-decurrent, somewhat elastic. Basidiospores elongate to almost cylindrical, amyloid. Cheilocystidia fusiform to clavate, smooth or forked to somewhat branched. Pleurocystidia absent. Cortical layer of the pileus an ixotrichoderm, forming a viscid, tough, separable pellicle.

Habitat – on *Phragmites* culms.

This section currently contains only one species (*Mycena belliarum* (Johnst.) P.D. Orton) known from Europe.

10. Section ***Calodontes*** (Fr. ex Berk.) Quél., Mémoires de la Société d'Émulation de Montbéliard Série II, 5: 102 (1872).

Basidiomata medium-sized to large. Pileus moist but not viscid, hygrophanous. Stipe fragile to firm or tough. Basidiospores ellipsoid to elongated, amyloid or inamyloid. Cheilocystidia versiform with broadly rounded apex. Hyphae of the pileipellis smooth.

Habitat – on vegetable debris, not on wood.

Subsection ***Marginatae*** J.E. Lange, Dansk Botanisk Arkiv Udgivet Af Dansk Botanisk Forening 1 (5): 13 (1914).

Lamella-edge more intensely coloured than the sides. Basidiospores amyloid.

This section contains a total of six species known from Europe, northern Africa, Japan, the United States, Papua New Guinea and East Africa.

Subsection ***Purae*** (Konrad & Maubl.) Maas Geest., Persoonia 11 (1): 112 (1980).

Lamellae-edge concolourous with the sides or paler. Basidiospores amyloid. Pleurocystidia present.

This subsection incorporates about fourteen species reported from the United States, Norway, Papua New Guinea, the Lesser Antilles, Mexico, Sri Lanka, Brazil, Australia, Austria, East Africa, Malaysia and India.

Subsection ***Violacellae*** Singer ex Maas Geest., Persoonia 11 (1): 112 (1980).

Lamellae-edge concolourous with the sides or paler. Basidiospores inamyloid. Pleurocystidia absent.

Two species belonging to this subsection are known from Europe, Brazil and the Lesser Antilles.

Subsection ***Generosae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 109 (1997).

Basidiospores amyloid. Pleurocystidia absent.

This subsection contains two species known from Brazil.

11. Section ***Carolinenses*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 89: 95 (1986).

Basidiomata medium-sized. Pileus puberulous, glabrescent, more or less viscid but without a separable gelatinous pellicle, yellow. Odour and taste mild. Lamellae with pallid edge. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate to somewhat fusiform, a few with the apex attenuated to form a neck and thin, more or less lageniform, usually covered with coarse, variously shaped excrescences. Pleurocystidia lageniform, somewhat thick-walled, smooth. Hyphae of the pileipellis smooth to densely diverticulate.

Habitat – on decaying twigs.

Two species are presently included in this section and they are known from the United States and Brazil.

12. Section ***Cecidiophilae*** A.P. Berg, Berg-Block, Noordel. & Uljé, Persoonia 17 (3): 484 (2000).

Basidiomata small. Basidiospores amyloid. Cheilo- and pleurocystidia absent. Hyphae of the pileipellis inflated, diverticulate. Caulocystidia conical, smooth.

Habitat – on decaying knopper galls on *Quercus robur*.

Mycena cecidiophila known from the Netherlands represents this monotypic section.

13. Section ***Cerasinae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 101 (1997).

Basidiomata large. Pileus purple. Odour sweet. Lamellae ascending, ventricose, dark purple, edge concolourous. Stipe fragile, glabrous, purple. Basidiospores ellipsoid, amyloid. Cheilocystidia subutriform or clavate, smooth. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth, with rare, short excrescences. Caulocystidia very rare.

Habitat – on leaf litter.

This is a monotypic section and the type species, *Mycena cerasina* Maas Geest. & de Meijer, is known only from Brazil.

14. Section ***Cinerellae*** Singer ex Maas Geest., Persoonia 11 (1): 104 (1980).

Basidiomata medium-sized to fairly small, more or less omphaloid. Pileus dry or more or less lubricous, with dull colours. Lamellae ascending to arcuate. Stipe pruinose above, dry to viscous, the base covered with or seated on a whorl of coarse fibrils. Basidiospores ellipsoid to cylindrical, amyloid. Cheilocystidia clavate to more or less irregularly shaped, apically covered with shorter or longer, often variously shaped excrescences. Pleurocystidia lacking or rare. Hyphae of the pileipellis and of the stipitipellis as a rule diverticulate; terminal cells diverticulate.

Habitat – Terrestrial, among grass, mosses, or on vegetable debris.

This section currently has thirteen species known from the United States, Switzerland, Greenland, Finland, Norway, Denmark and Australia.

15. Section ***Clavulares*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 86 (3): 416 (1983).

Basidiomata small. Pileus covered with a separable, gelatinous pellicle, somewhat floccose to minutely pubescent, with greyish shades. Stipe fragile to somewhat elastic, sparsely puberulous. Basidiospores globose to subglobose, amyloid. Cheilocystidia clavate with central curved or flexuous excrescences. Pleurocystidia none. Hyphae of the pileipellis smooth, embedded in gelatinous matter. Caulocystidia more or less inflated at the base. Clamp connection absent.

Habitat – on the bark of various trees.

This section includes three species known from Europe, Australia and La Réunion.

16. Section ***Crocatae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 91: 398 (1988).

Basidiomata medium-sized. Pileus pruinose, glabrescent, coloured in various brown shades at the centre, more orange- to yellow-tinted towards the margin. Lamellae ascending, narrowly adnate, at first white or pink, then pale brownish, becoming orange-spotted when bruised; edge whitish. Stipe exuding an orange fluid when cut, white above, yellowish below, then turning orange, finally dark brown, covered with coarse fibrils at the base. Basidiospores ellipsoid and amyloid. Cheilocystidia clavate, apically covered with cylindrical excrescences. Pleurocystidia clavate, smooth or diverticulate. Hyphae of the pileipellis and the cortical layer of the stipe diverticulate.

Habitat – on debris of trees.

This section has only one species (*Mycena crocata* (Schrad.) P. Kumm.) known from Europe, northern Africa, the United States and Japan.

17. Section ***Cyanocephalae*** Singer, The Agaricales in Modern Taxonomy, 4th edition: 405 (1986).

Basidiomata small. Pileus with a distinctly gelatinous surface, blue-pigmented. Lamellae subventricose, edge blue. Stipe dry, white, white pruinose disc borne on a blue base. Basidiospores broadly ellipsoid, amyloid. Cheilocystidia filamentous, clavate or ovoid, smooth or with sparse excrescences. Pleurocystidia absent. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth.

Habitat – on wood.

Only one species, *Mycena interrupta* (Berk.) Sacc., is known in this section, which is known from Australia, Chile and New Zealand.

18. Section ***Dactylinae*** Maas Gesst. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 47 (1997).

Basidiomata medium-sized. Pileus glabrous, brown. Lamellae arcuate, edge dark brown. Stipe fragile, glabrous, grey brown. Basidiospores ellipsoid, amyloid. Cheilocystidia subcylindrical, with brown contents, and apical excrescences. Both the hyphae of the pileipellis and stipitipellis smooth.

Habitat – on decaying wood.

This is a monotypic section and the type species, *Mycena dactylina* Maas Gesst. & de Meijer, is known only from Brazil.

19. Section ***Detrusae*** Maas Geest. & E. Horak, Bibliotheca Mycologica 159: 203 (1995).

Basidiomata very small. Pileus depressed at the centre, pruinose, greyish white. Lamellae arcuate, entirely adnate, somewhat decurrent. Stipe solid, brittle, pruinose, dry. Basidiospores ellipsoid, inamyloid. Cheilocystidia ellipsoid to subglobose, densely covered with small excrescences.

Pleurocystidia absent. Hyphae of both the pileipellis and stipitipellis densely covered with small excrescences.

Habitat – on cupulae of *Lithocarpus* sp.

This section incorporates only the type species, *Mycena detrusa* Maas Geest. & E. Horak, which is known only from Papua New Guinea.

20. Section ***Diversae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 143 (1997).

Basidiomata medium-sized. Pileus glabrous, dry, greyish brown. Lamellae arcuate, white. Stipe fragile, dry, white to greyish brown. Basidiospores ellipsoid, amyloid. Cheilocystidia lageniform, smooth. Pleurocystidia absent. Hyphae of the pileipellis and of the stipitipellis smooth. Caulocystidia variously shaped.

Habitat – on decaying twigs and leaves.

The two species belonging to this section are known only from Brazil.

21. Section ***Dunicolae*** M. Villarreal, Esteve-Rav., Barrasa & A. Ortega, Mycotaxon 80: 308 (2001).

Basidiomata small or medium-sized. Pileus lubricous, yellowish orange to olivaceous. Lamellae arcuate to decurrent, olivaceous yellow, edge concolourous. Stipe fragile, lubricous, paler than the pileus, finely pruinose, fibrillose at the base. Basidiospores subglobose, amyloid. Cheilo- and pleurocystidia smooth, ampullaceous. Hyphae of the pileipellis smooth or with isolated diverticulations. Pileocystidia ampullaceous, smooth. Hyphae of the stipitipellis smooth or with lateral isolated projections. Caulocystidia similar to cheilocystidia.

Habit – on soil.

Mycena dunicola M. Villarreal, Esteve-Rav., Barrasa & A. Ortega, the only species in this section, is known only from Spain.

22. Section ***Euspeireae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 92: 355 (1989).

Basidiomata medium-sized. Pileus and stipe viscid, covered with a gelatinous, separable, pellicle, white to grey-brown. Lamellae ascending or arcuate, the edge not gelatinised. Basidiospores ellipsoid, amyloid. Cheilocystidia occurring mixed with basidia, not embedded in gelatinous matter, fusiform, smooth or diverticulate. Pleurocystidia similar. Hyphae of the subhymenium embedded in gelatinous matter. Hyphae of the pileipellis and the cortical layer of the stipe embedded in gelatinous matter. The former is smooth or diverticulate and the latter always smooth. Caulocystidia branched and diverticulate.

Habitat – on rotten logs.

This section contains six species known from Cuba, Brazil, Venezuela, the United States, and La Réunion.

23. Section ***Exiguae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 86 (3): 417 (1983).

Basidiomata small. Pileus covered with a (separable) gelatinous pellicle, minutely puberulous, whitish with brownish centre. Lamella-edge containing a gelatinous thread. Stipe pruinose above, finely villose below, with bulbous base. Basidiospores subglobose, amyloid. Cheilocystidia clavate or subfusiform, attenuated into a neck or with several coarse and flexuous excrescences. Pleurocystidia none. Hyphae of the pileipellis smooth, embedded in gelatinous matter, in the upper part of the pileipellis producing small, simple or branched side-branches and dermatocystidia. Dermatocystidia ampullaceous, protruding. Caulocystidia similar to the dermatocystidia. Clamp connection present or very probably present.

Habitat – on the bark of *Eucalyptus globulus*.

This section contains only one species, *Mycena marocana* Maas Geest., known from northern Africa.

24. Section ***Exornatae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 85 (4): 538 (1982).

Basidiomata medium-sized. Pileus covered with a gelatinous pellicle, pruinose, somewhat viscid. Lamellae tender, ascending, free or attached to a slight collar, stipe puberulous, not viscid, springing from a white pubescent basal disc. Basidiospores ellipsoid, amyloid. Cheilocystidia fusiform, smooth. Pleurocystidia absent. Hyphae of the pileipellis producing a dense growth of much branched side branches, which are embedded in gelatinous matter, covered with thorn-like excrescences, at the surface of the pileus terminated by clavate, diverticulate pileocystidia. Hyphae of the stipitipellis smooth, not embedded in gelatinous matter. Caulocystidia fusiform. Both pileus and lamellae bluish-green luminescent.
Habitat – on woody debris in forests.
A total of four species have so far been reported from Japan, Sri Lanka, Papua New Guinea, Brazil, Madagascar and India.

25. Section ***Filipedes*** (Fr.) Quél., Mémoires de la Société d'Émulation de Montbéliard Série II, 5: 106 (1872).

Basidiomata very small to fairly large. Pileus at first pruinose, glabrescent, typically dry. Lamella-edge always convex. Stipe elongate, narrow, fragile, never viscid, at the base covered with coarse fibrils. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, obovoid or obpyriform, more or less densely covered apically with warts or elongate excrescences. Pleurocystidia if present similar. Hyphae of the pileipellis and of the cortical layer of the stipe diverticulate.

Habitat – on vegetable debris, bark of trees, among grass and on herbs.

A total of twenty five species belonging to this section are known from the United States, Canada, the Netherlands, Sweden, Denmark, Austria, Norway, Germany, Algeria, Brazil, the Lesser Antilles, East Africa and Australia.

26. Section ***Fragilipedes*** (Fr.) Quél., Mémoires de la Société d'Émulation de Montbéliard Série II, 5: 105 (1872).

Basidiomata small to large. Pileus generally pruinose, glabrescent, sometimes lubricous, more or less hygrophanous, variously coloured. Odour indistinctive or absent, sometimes nitrous or raphanoid. Lamellae free or adnate with a decurrent tooth. Stipe fragile to firm or cartilaginous, dry or lubricous, base covered with coarse fibrils, sometimes rooting. Basidiospores ellipsoid, cylindrical, amyloid. Cheilocystidia variably shaped, smooth or covered with coarse excrescences. Pleurocystidia similar or absent. Hyphae of the pileipellis and of the stipitipellis smooth or diverticulate.

Habitat – on grass, humus, woody debris or on *Sphagnum*.

Around one hundred and twenty species are belonging in this section and they are distributed in the United States, Canada, Europe, Iceland, North and East Africa, Japan, Sri Lanka, India, La Réunion, Papua New Guinea, the Lesser Antilles and Brazil.

27. Section ***Fuliginellae*** (A.H. Sm. ex Singer) Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 83: 406 (1980).

Basidiomata medium-sized. Pileus covered with a separable, gelatinous pellicle, grey or grey brown. Lamellae ascending to arcuate, edge separable as an elastic tough thread. Stipe viscid, grey or grey brown, never yellow. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate to cylindrical, apically much branched excrescences. Pleurocystidia present. Hyphae of the pileipellis and of the stipitipellis diverticulate, embedded in a gelatinous, separable layer, terminal cells variously diverticulate.

Habitat – on coniferous wood or on fallen leaves.

A total of seven species belonging in this section are known from the United States, Canada, Papua New Guinea, Brazil and Norway.

28. Section ***Fuscoradiatae*** Maas Geest. & Hauskn., Österreichische Zeitschrift für Pilzkunde 7: 125 (1998).

Basidiomata small. Pileus convex, depressed at the centre, sulcate. Lamellae small, decurrent, white, edge concolourous. Stipe fragile, puberulous; base discoid with fine radiating fibrils. Basidiospores ellipsoid, amyloid. Cheilocystidia not numerous, pyriform or ellipsoid, rostrate. Pleurocystidia absent. Hyphae of the pileipellis smooth or with few cylindrical excrescences, becoming more frequent towards the terminal cells. Hyphae of the stipitipellis smooth, clamped. Caulocystidia subfusiform or ellipsoid, apically obtuse or narrowed, smooth.

Habitat – dead trunks and twigs of dicotyledonous trees.

Mycena fuscoradiata Maas Geest. & Hauskn., the only known species of the section, is recorded from La Réunion.

29. Section ***Galactopoda*** (Earle) Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 91: 396 (1988).

Basidiomata medium-sized to large. Pileus brownish flesh-colour, darker at the centre. Odour weak, taste bitter. Lamellae ascending, adnate, edge concolourous or blood red. Stipe pruinose, glabrescent for the greater part, exuding a blood red fluid when cut, blackening in the herbarium, base covered with coarse, whitish fibrils. Basidiospores ellipsoid, amyloid. Cheilocystidia fusiform, with slender neck, hyaline or with reddish brown contents. Pleurocystidia similar if present. Hyphae of the pileipellis covered with excrescences and diverticulate side branches. Hyphae of the stipitipellis smooth, terminal cells much branched, diverticulate, dissimilar to the cheilocystidia.

Habitat – on decaying wood.

A total of eight species of this section are known from Europe, the United States, Canada, Japan, New Zealand, Australia, Brazil and India.

30. Section ***Granuliferae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 121 (1997).

Basidiomata medium-sized. Pileus appearing as glabrous, yellowish white. Lamellae adnate, with decurrent tooth, edge white. Stipe fragile, appearing as glabrous, white, springing from a patch of radiating fibrils. Basidiospores subcylindrical, inamyloid. Cheilocystidia clavate, with few apical excrescences. Pleurocystidia clavate or subfusiform, smooth or absent. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth or sparsely diverticulate. Terminal cells diverticulate.

Habitat – on decaying leaves.

Currently, three species are known in this section, all reported only from Brazil.

31. Section ***Hiemales*** Konrad & Maubl., Icones Selectae Fungorum 6: 274 (1934).

Basidiomata fairly small to medium-sized. Pileus pruinose or glabrous, lubricous or not, grey brown to white, darker at the centre. Odour absent. Lamellae ascending or arcuate. Stipe white, pallid or brownish, base covered with coarse fibrils. Basidiospores ellipsoid to globose, inamyloid. Cheilocystidia variously shaped, simple or apically branched. Pleurocystidia similar or absent. Hyphae of both the pileipellis and the stipitipellis diverticulate or more rarely smooth. Caulocystidia generally present.

Habitat – on vegetable debris, wood, or moss-covered tree trunks.

Subsection ***Hiemales*** Maas Geest., Persoonia 11 (1): 114 (1980)

Lamellae ascending, edge convex.

Seven species of this subsection have been reported from the United States, Switzerland, France, Germany, North Africa and Brazil.

Subsection ***Omphaliariae*** Kühner ex Maas Geest., Persoonia 11 (1): 115 (1980).

Lamellae horizontal to arcuate, edge straight or concave.

Seven species belonging to this subsection are known from the United States, France, the Netherlands, Brazil and Papua New Guinea.

32. Section ***Hygrocyboideae*** (Fr.) Singer, Beihefte zur Sydowia 7: 49 (1973).

Basidiomata medium-sized. Pileus viscid, covered with a separable tough gelatinous pellicle. Variously coloured, never orange. Odour indistinctive or fragrant or iodoform. Lamellae ascending, decurrent with a tooth, edge separable as gel thread. Stipe viscid. Basidiospores ellipsoid, amyloid. Cheilocystidia embedded in gelatinous matter, generally clavate, apically with variously shaped excrescences. Pleurocystidia absent. Hyphae of the pileipellis embedded in a gelatinous matter, diverticulate. Hyphae of the stipitipellis embedded in a gelatinous matter, smooth. Caulocystidia or the terminal cells variously diverticulate.

Habitat – on vegetable debris and decayed wood.

This section contains eleven species and they are known from Europe, North America, Iceland, Japan, Australia and India.

33. Section ***Indutae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 68 (1997).

Basidiomata medium-sized. Pileus lubricous, slightly hygrophanous. Lamellae arcuate, decurrent, white, edge concolourous, somewhat glassy or glistening, viscid. Stipe dry, pruinose or puberulous all over. Basidiospores ellipsoid, amyloid. Cheilocystidia subcylindrical, apically strongly branched, the branches covered with excrescences, embedded in gelatinous matter. Pleurocystidia subfusiform. Hyphae of the pileipellis embedded in a gelatinous matter, with excrescences. Hyphae of the stipitipellis diverticulate, not embedded in a gelatinous matter.

Habitat – on decaying wood.

This monotypic section contains the type species, *Mycena gelatinomarginata* Lodge, known from Brazil and the United States

34. Section ***Infuscatae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 54 (1997).

Basidiomata medium- to large-sized. Pileus lubricous. Odour strongly fungoid. Lamellae numerous, ascending, edge dark brown. Stipe lubricous, pruinose. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, long-stalked, immersed in gelatinous matter, with brownish contents, with variously shaped excrescences. Both the hyphae of the pileipellis and of the stipitipellis smooth, embedded in gelatinous matter. Caulocystidia clavate, with coarse excrescences.

Habitat – on decaying wood.

Presently, this section contains only one species, *Mycena infuscata* Maas Geest. & de Meijer, known from Brazil.

35. Section ***Ingratae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 92: 353 (1989).

Basidiomata medium-sized. Pileus strikingly sulcate, viscid, glabrous, grey-brown. Odour unpleasant. Lamellae ascending, almost free, white, with concolourous edge. Stipe puberulous above, glabrescent farther below, white, reddish brown towards the base. Basidiospores ellipsoid, amyloid. cheilocystidia forming a sterile band, versiform, smooth. Pleurocystidia absent. Hyphae of the pileipellis embedded in gelatinous matter, smooth or locally covered with granular matter, apically somewhat broadened and covered with pigment grains. Hyphae of the cortical layer of the stipe not embedded in gelatinous matter, smooth. Caulocystidia clavate to fusiform.

Habitat – on vegetable debris.

This is a monotypic section and the type species, *Mycena chlorinosma* Singer, is known from North America.

36. Section ***Insignes*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 92: 343 (1989).

Basidiomata medium-sized to large. Pileus viscid, pruinose or glabrous, black-brown, grey-brown, whitish. Lamellae arcuate or ascending, broadly adnate, whitish; edge not gelatinised, concolourous with the pileus or puberulous above, viscid, concolourous with the pileus or whitish. Basidiospores ellipsoid, amyloid. Cheilocystidia not embedded in gelatinous matter, versiform, smooth or covered with a few coarse excrescences. Hyphae of the pileipellis and cortical layer of the stipe embedded in gelatinous mater, smooth or diverticulate. Caulocystidia smooth or somewhat branched.

Habitat – on vegetable debris, mostly on conifer needles.

About nine species belonging to this section are reported from the United States, Canada, Spain, Papua New Guinea, Brazil and the Caribbean region.

37. Section ***Intermediae*** Kühner ex Maas Geest., Persoonia 11 (1): 104 (1980).

Basidiomata greyish brown to dark coloured. Pileus lubricous when wet or covered with a partially detachable, gelatinous pellicle. Lamellae ascending or arcuate. Stipe apically pruinose, not lubricous when wet. Basidiospores, ellipsoid, amyloid. Cheilocystidia fusiform to lageniform or clavate, smooth or covered with warts or cylindrical excrescences. Pleurocystidia present, strongly protruding. Hyphae of the pileipellis with gelatinising cell-walls, smooth to diverticulate. Hyphae of the cortical layer of the stipe smooth to somewhat diverticulate.

Habitat – on fallen debris or decaying wood.

So far, four species belonging to this section have been reported from the United States, Canada, Algeria, Germany and Spain.

38. Section ***Lactipedes*** (Fr.) Quél., Mémoires de la Société d'Émulation de Montbéliard Série II, 5: 107 (1872).

Basidiomata fairly small to medium-sized. Pileus pruinose, glabrescent, becoming slightly viscid or lubricous when moist, more or less hygrophanous. Stipe dry, glabrous to pubescent, exuding a watery, milky or coloured juice when cut or broken, the base covered with coarse, whitish fibrils. Basidiospores ellipsoid to cylindrical, amyloid. Cheilocystidia versiform, smooth or covered with coarse excrescences. Hyphae of the pileipellis and of the stipitipellis covered with simple to furcate or branched excrescences, terminal cells smooth to diverticulate.

Habitat – on debris of various trees or on moss covered tree trunks.

A total of seven species belonging to this section are known from the United States, Canada, Europe, East Africa and Australia

39. Section ***Longisetae*** A.H. Sm. ex Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 86 (3): 418 (1983).

Basidiomata small. Pileus minute, pilose from erect setae, white to orangish white or grey. Lamellae ascending, narrowly adnate to free, sometimes attached to a pseudocollarium, white or pale greyish white. Stipe filiform, variously pruinose, or puberulous, typically arising from a circular, hispid basal disc, but sometimes merely subbulbous. Basidiospores ellipsoid, smooth, amyloid or rarely inamyloid. Pleurocystidia absent. Cheilocystidia present or absent, sometimes exudative (gloeocystidia). Pileipellis ranging from a hymeniform layer of acanthocysts to a cutis of spinulose hyphae with acanthocyst terminal cells, gelatinous or non-gelatinous, through which arise numerous thick-walled, hyaline or pigmented pileosetae; pileus margin often beset with densely spinulose marginal cystidia that may or may not have a smooth apical prolongation. Pileus and lamellar trama dextrinoid. Stipe cortical and medullary hyphae smooth, non-gelatinous, dextrinoid. Caulocystidia aculeate to acicular, smooth, thin- to thick-walled (setoid).

Habitat – on bark of trees or on decaying dicotyledonous leaves or on palms

Presently, this section contains seventeen species and they are reported from the United States, Europe, Indonesia, Sri Lanka, Thailand and India.

40. Section ***Luculentae*** Maas Geest., Persoonia 11 (1): 101 (1980).

Basidiomata medium-sized. Pileus without detachable, gelatinous pellicle, entirely or at least marginally brightly coloured. Lamellae, ascending, edge deeper colour. Stipe always with yellow, orange or pink shade. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, with coloured contents, covered with simple, cylindrical excrescences, rarely smooth. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth or diverticulate, terminal cells inflated.

Habitat – on debris of coniferous or deciduous trees.

Subsection ***Elegantes*** Singer ex Maas Geest., Persoonia 11 (1): 101 (1980).

With apically diverticulated pleurocystidia.

Two species belonging to this subsection are known from the United States, Europe, North Africa, and Canada.

Subsection ***Rosellae*** Singer ex Maas Geest., Persoonia 11 (1): 102 (1980).

With smooth pleurocystidia.

Mycena rosella, the only species of this subsection, is known from the United States, Europe and Canada.

41. Section ***Maldeae*** Grgur., Fungal Diversity Research Series 9: 210 (2003).

Basidiomata small. Pileus moist, silky, pale brown to white. Lamellae adnate, ascending. Stipe with sparse hairs attached to the substratum, whitish to pale brown. Odour nitric. Basidiospores elongate ellipsoidal to cylindrical, amyloid. Cheilocystidia of two distinct types. Pleurocystidia absent. Both the hyphae of the pileipellis and stipitipellis diverticulate. Pileocystidia and caulocystidia present, with basal cells.

Habitat – on litter under species of *Eucalyptus* and *Pinus*.

This section contains only one species, *Mycena maldea* Grgur., known only from Australia.

42. Section ***Metuloidiferae*** Grgur., Fungal Diversity Research Series 9: 215 (2003).

Basidiomata medium-sized to large. Pileus moist, brownish. Lamellae ascending, narrowly adnate to adnate. Stipe elongated, narrow, covered with coarse fibrils at the base. Basidiospores ellipsoid, smooth. Cheilocystidia clavate, obpyriform to sphaero-pedunculate, covered with nodulose to cylindrical excrescences. Pleurocystidia lamprocystidial, the apices often cornuate. Hyphae of both pileipellis and stipitipellis nodulose diverticulate.

Habitat – on litter.

Mycena cystidiosa (G. Stev.) E. Horak, the only known species of this section, is known from New Zealand and southeast Australia.

43. Section ***Monticola*** Singer ex Maas Geest., Persoonia 11 (1): 103 (1980).

Basidiomata medium-sized. Pileus moist to the touch, without detachable, gelatinous pellicle, red to pink. Lamellae ascending, with concolourous edge. Stipe pruinose above, pink, turning brownish from upward. Basidiospores ellipsoid, weakly amyloid. Cheilocystidia forming a sterile band, clavate, covered with unevenly spaced, simple to much branched excrescences. Pleurocystidia none. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth to diverticulate, terminal cells more or less inflated, diverticulate.

Habitat – on conifer needle beds.

This section contains only one species, *Mycena monticola* A.H. Sm., known only from the United States.

44. Section ***Mulawaestres*** Grgur., Fungal Diversity Research Series 9: 222 (2003).

Basidiomata medium-sized, caespitose. Pileus very glutinous, glabrous, blackish to dark brown. Lamellae adnate, ascending, edge brownish. Stipe glutinous to lubricous, base without strigose basal mycelium. Basidiospores ellipsoid, amyloid. Cheilocystidia form dense sterile band, clavate or cylindrical, with a few large apical excrescences, with brownish contents. Pleurocystidia absent. Pileocystidia fusoid, clavate or cylindro-clavate, with brown contents. Hyphae of the pileipellis and of the stipitipellis smooth, gelatinised. Caulocystidia cylindrical or cylindro-clavate occasionally with nodulose excrescences over length, brownish contents.

Habitat – on logs of species of *Eucalyptus*; rarely on *Schizomeria*.

This section presently contains only one species (*Mycena mulawaestris* Grgur.) and it is known from Australia.

45. Section ***Mycena*** (Pers.) Roussel, Flore du Calvados et des terreins adjacens, composée suivant la méthode de M. Jussieu, 2nd edition: 64 (1806).

Basidiomata fairly small to large. Pileus sometime lubricous when wet, mostly shades of grey, brown or black. Lamellae ascending, emarginate, or with decurrent tooth. Stipe usually elastic tough, concolourous with the pileus, base with fibrils or rooting. Basidiospores ellipsoid, amyloid. Cheilocystidia mostly forming a sterile band, generally clavate, covered with fairly few, coarse, simple to branched excrescences. Pleurocystidia none. Hyphae of the pileipellis and of the stipitipellis smooth or diverticulate

Habitat – on decaying wood, leaves or conifer needles.

Thirty species belong to this section and they are known from the United States, Canada, France, Switzerland, the Netherlands, North and East Africa, Australia, Papua New Guinea, India and the Lesser Antilles.

46. Section ***Nargan*** Grgur., Australian Systematic Botany 8: 535 (1995).

Basidiomata medium-sized. Pileus moist, with white scales at first, disappearing with age, brownish. Lamellae narrowly adnate, ascending, edge pallid. Stipe dry, with white scales disappearing with age, base without strigose hairs. Basidiospores ellipsoid to broadly ellipsoidal, amyloid. Cheilocystidia ventricose-rostrate, smooth. Pleurocystidia absent. Hyphae of the pileipellis smooth. Hyphae of the stipitipellis smooth or nodulose-diverticulate.

Habitat – on *Eucalyptus*, rarely on *Pinus*.

Only one species, *Mycena nargan* Grgur., belongs to this section and it is reported from Australia.

47. Section ***Nigrescentes*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 74 (1997).

Basidiomata small. Pileus dry, glabrous, reddish brown or dark brown. Lamellae arcuate, edge reddish brown or dark brown. Stipe fragile, glabrous, concolourous with the pileus or pale. The

whole basidiomata turns black when dry. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, short-stalked, with brownish contents, with apical excrescences. Pleurocystidia absent. Both the pileipellis and the stipitipellis hyphae partly smooth, densely diverticulated towards the tips, the terminal cells with excrescences which form intricate, coralloid masses.

Habitat – on decaying wood.

A total of three species are known in this section and all are from Brazil.

48. Section ***Nodosae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 134 (1997).

Basidiomata small. Pileus minutely puberulous, brownish. Lamellae ascending, pale greyish. Stipe fragile, glabrous, white. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, with apical small excrescences. Pleurocystidia absent. Hyphae of the pileipellis diverticulate, non-gelatinised. Hyphae of the stipitipellis smooth, non-gelatinised, terminal cells absent.

Habitat – on decaying wood.

So far, two species belonging to this section have been reported from Brazil.

49. Section ***Notabiles*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 125 (1997).

Basidiomata minute. Pileus dry, minutely pruinose. Lamellae ascending, adnate with a decurrent tooth. Stipe fragile, dry, glabrous, springing from a very small patch made of white fibrils. Basidiospores ellipsoid, inamyloid. Cheilocystidia cylindrical, densely spinulose. Pleurocystidia absent. Pileipellis hyphae diverticulate. Stipitipellis hyphae not gelatinised, diverticulated. Caulocystidia cylindrical, densely spinulose.

Habitat – on bark of trees.

Presently, this section contains only the type species, *Mycena notabilis* Maas Geest. & de Meijer, known only from Brazil.

50. Section ***Nubilae*** Maas Geest. & E. Horak, Bibliotheca Mycologica 159: 150 (1995).

Basidiomata large. Pileus glabrous, dry, at first dark brown. Lamellae ascending, narrowly adnate, decurrent with a tooth. Stipe fragile, apically puberulous, dry, grey-brown. Basidiospores globose or subglobose, amyloid. Cheilocystidia clavate, covered with excrescences. Pleurocystidia absent. Hyphae of the pileipellis smooth. Hyphae of the stipitipellis smooth, terminal cells clavate, with coarse excrescences.

Habit – on decaying wood.

Papua New Guinea is the only region harbouring the only known species, *Mycena nubila* Maas Geest. & E. Horak, of this section.

51. Section ***Obductae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 65 (1997).

Basidiomata medium-sized. Pileus, pruinose, dark brown. Odour fungoid. Lamellae ventricose, broadly adnate with a decurrent tooth. Stipe fragile, dry, concolourous with the pileus. Basidiospores ellipsoid, amyloid. Cheilocystidia subfusiform, smooth. Pleurocystidia similar densely filled with oil droplets. Hyphae of the pileipellis diverticulated. Hyphae of the stipitipellis smooth. Caulocystidia clavate, apically furcate, with excrescences.

Habitat – on decaying leaves.

This is a monotypic section containing *Mycena obducta* Maas Geest. & de Meijer, known only from Brazil.

52. Section ***Oregonenses*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen 93: 182 (1990).

Basidiomata medium-sized. Pileus without gelatinous, separable pellicle, bright yellow to orange-red. Lamellae ascending, pale yellowish or whitish, with bright yellow edge. Stipe yellowish-pruinose, not glutinous when wet, the base covered with yellow fibrils. Basidiospores ellipsoid, inamyloid. Cheilocystidia variously shaped, with rounded apex, with yellow contents. Pleurocystidia similar. Hyphae of the pileipellis diverticulate, terminal cells infrequent. Hyphae of the cortical layer of the stipe smooth. Caulocystidia variously shaped, with yellow contents.

Habitat – on fallen coniferous needles.

This is a monotypic section and the type species, *Mycena oregonensis* A.H. Sm., is known from the United States and Europe.

53. Section ***Phloginae*** Maas Geest. & E. Horak, Bibliotheca Mycologica 159: 197 (1995).

Basidiomata small. Pileus minutely velutinous, dry, red. Lamellae arcuate, broadly adnate, with decurrent tooth, pale orange, edge red. Stipe flexible, pruinose throughout, dry, red, orange towards the base. Basidiospores ellipsoid, inamyloid. Cheilocystidia clavate, obpyriform, with cylindrical excrescences, with red contents. Pleurocystidia absent. Hyphae of both pileipellis and stipitipellis diverticulated. Caulocystidia fasciculate.

Habitat – on rotten leaves and forest litter.

Only one species (*Mycena phlogina* Maas Geest. & E. Horak) belong to this section and it is known from Papua New Guinea.

54. Section ***Polyadelphia*** Singer ex Maas Geest., Persoonia 11 (1): 103 (1980).

Basidiomata small to minute. Pileus dry, not becoming lubricous when wet. Lamellae arcuate or ascending, generally with a decurrent tooth, edge white. Stipe pruinose, glabrescent, base insititious or with radiating hyphae. Basidiospores ellipsoid, cylindrical or subglobose, amyloid.

Basidia 2- or 4-spored. Cheilocystidia clavate, densely covered with simple excrescences. Pleurocystidia absent. Hyphae of the pileipellis more or less densely diverticulate.

Habitat – on decaying leaves, herbaceous stems, or fronds and rhizomes of ferns.

Thirty one species are included in this section and they are known from the Unites States, France, Spain, Norway, Madagascar, Brazil, Argentina and North Africa.

55. Section ***Pterigenae*** (Maas Geest.) Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 89: 92 (1986).

Basidiomata fairly small. Pileus dry, not becoming lubricous when wet, originally orange-red to pink, fading with age except at the margin. Lamellae ascending, decurrent with a tooth, or arcuate, edge concave, persistently orange-red to pink. Stipe variously coloured with glabrous base. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, with coloured contents, covered with generally simple, very narrow excrescences. Pleurocystidia absent. Hyphae of the cortical layer of the stipe diverticulate, terminal cells inflated.

Habitat – on decaying fern stalks.

This section incorporates only one species (*Mycena pterigena* (Fr.) P. Kumm.) and it is known from Europe, Canada and the United States.

56. Section ***Radiatae*** Singer, Sydowia 15: 65 (1962b).

Basidiomata medium-sized, without blue pigment. Pileus dry, plicate, centrally squamulose or not. Lamellae ascending, free, white with concolourous edge. Stipe pruinose or not, white, somewhat enlarged at the base, but without basal disc, insititious or not. Basidiospores ellipsoid, amyloid. Basidia clavate or subglobose. Cheilo- and pleurocystidia absent. Hyphae of the pileipellis smooth, decumbent or not. Hyphae of the stipitipellis smooth, with inflated terminal cells (caulocystidia).

Habitat – on decayed wood or on herbaceous root.

Seven species belong to this section and are known from Venezuela, the United States, the Lesser Antilles, Japan and Colombia.

57. Section ***Rarifoliatae*** Aronsen & Maas Geest., Persoonia 14 (2): 187 (1990).

Basidiomata minute. Pileus pruinose, glabrescent, with a separable, gelatinous pellicle, white. Lamellae very few reaching the stipe, sometimes poorly developed, broadly adnate or somewhat decurrent. Stipe pruinose all over, arising from a basal plaque. Basidiospores ellipsoid, amyloid. Cheilocystidia rather scarce, subcylindrical to subfusiform. Pleurocystidia absent. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth or sparsely diverticulate. Caulocystidia variously formed. Hyphae of the basal plaque firm-walled.

Habitat – on herbaceous culms.

This section contains only one species (*Mycena oligophylla*) known from Europe.

58. Section ***Rubescentes*** M. Villarreal, Esteve-Rav., Heykoop & Maas Geest., Persoonia 16 (4): 533 (1998).

Basidiomata medium-sized. Pileus yellow, and the margin staining strongly reddish orange in mature specimens. Smell raphanoid. Lamellae ascending, white, edge concolourous. Stipe dry, fragile, pruinose, yellow, and rooting. Basidiospores ellipsoid, inamyloid. Cheilocystidia fusiform to subutriform, smooth. Pleurocystidia absent. Hyphae of the pileipellis smooth with elongated terminal elements, embedded in gelatinous matter. Hyphae of the stipitipellis not embedded in gelatinous matter. Caulocystidia narrowly fusoid to subcylindrical, with slightly thick-walled.

Habitat – on humus.

So far, only one species (*Mycena rubescens* M. Villarreal, Esteve-Rav., Heykoop & Maas Geest.) has been included in this section and it is known from Spain.

59. Section ***Rubromarginatae*** Singer ex Maas Geest., Persoonia 11 (1): 106 (1980).

Basidiomata fairly small to medium-sized. Pileus pruinose or glabrescent, dry, more or less lubricous when wet, hygrophanous, variously coloured. Odour nitrous, raphanoid or indistinctive. Lamellae ascending, adnate with a decurrent tooth, edge pink, red-brown, purplish brown or dark violet. Stipe glabrescent below, not lubricous, base covered with coarse fibrils, sometimes rooting. Basidiospores ellipsoid, amyloid. Cheilocystidia variably shaped, with pink, reddish or violaceous contents, smooth or with coarse excrescences. Pleurocystidia absent or rare. Hyphae of the pileipellis and of the stipitipellis smooth or diverticulate.

Habitat – on humus, *Sphagnum*, decaying wood and fallen branches.

Currently, around twenty four species belonging to this section are known from the United States, Canada, Iceland, New Zealand, Holland, France, Germany, North Africa, Papua New Guinea and Sri Lanka.

60. Section ***Rufolimitatae*** Maas Geest. & E. Horak, Bibliotheca Mycologica 159: 188 (1995).

Basidiomata medium-sized. Pileus not lubricous, glabrous, grey. Lamellae ascending, adnate with decurrent tooth, grey, strewn with red-brown dots, edge red-brown. Stipe apically covered with scattered red-brown dots, farther down smooth, glabrous. Basidiospores globose, amyloid. Cheilocystidia variously shaped, smooth to branched, with red-brown contents. Pleurocystidia lageniform, with red-brown contents. Both the hyphae of the pileipellis and stipitipellis smooth. Caulocystidia clavate or lageniform, with red-brown contents.

Habitat – on decaying wood.

Mycena rufolimitata Maas Geest. & E. Horak, the only known species of this section, is recorded from Papua New Guinea.

61. Section ***Sacchariferae*** Kühner ex Singer, Sydowia 15: 65 (1962b).

Basidiomata small. Pileus obtusely conic or campanulate, expanding to broadly convex, seldom depressed, with a universal veil forming conic to pyramidal spines, flakes or granules; surface dull, dry or very slightly sticky, granulose, floccose or pulverulent, granules and flakes white, yellow,

grey, fulvous or brown, surface under ornamentation white, pale yellow or pale grey. Lamellae typically present, ascending, adnate to free with white lamella-edge. Basidiospores globose, ovoid, ellipsoid or cylindric, amyloid. Cheilocystidia typically present, variously shaped with the apex possessing dense or sparse spinulae, rarely non-spinulose. Pleurocystidia absent. Pileipellis ranging from a cutis with acanthocyst terminal cells to a subhymeniform layer of acanthocysts; hyphae smooth or spinulose, non gelatinous, non-incrusted. Acanthocysts globose, broadly clavate or irregular in outline, densely spinulose, hyaline or with dark brown contents. Universal veil formed of cherocytes or acanthocysts. Hyphae of the stipitipellis smooth, non-gelatinous. Caulocystidia smooth or densely spinulose.

Habitat – on leafy as well as woody debris, fern rhizomes, conifer wood, or monocotyledonous debris.

Stirps ***Amparoina*** Desjardin, Bibliotheca Mycologica 159: 14 (1995).

Basidiomata with cherocytes.

Globally, around fifteen species are known to belong to this stirps and they are known from Brazil, Argentina, Colombia, New Caledonia, Puerto Rico, Bolivia and India.

Stirps ***Alphitophora*** Desjardin, Bibliotheca Mycologica 159: 37 (1995).

Basidiomata without cherocytes, with spinulose caulocystidia.

So far, fourteen species belonging to this stirps are recorded from Argentina, Brazil, the Lesser Antilles, the Hawaiian Islands, Bermuda, the United States, Italy, Germany, Spain, Sri Lanka, Japan, and India.

Stirps ***Adscendens*** Desjardin, Bibliotheca Mycologica 159: 53 (1995).

Basidiomata without cherocytes, with smooth caulocystidia.

Twelve species belonging to this stirps are known globally and they are recorded from the United States, Europe, the Hawaiian Islands, Japan, Kenya, Madagascar, Chile, Brazil and Sri Lanka.

Stirps ***Fuscinea*** Maas Geest. & de Meijer, Persoonia 17 (1): 29 (1998).

Basidiomata without cherocytes, possess acanthocyst with coloured contents.

Two species are presently included in this stirps and they are known from Brazil.

62. Section ***Saetulipedes*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 89: 178 (1986).

Basidiomata small. Pileus pruinose to finely puberulous, glabrescent, covered with a non-detachable gelatinous pellicle, at first pink, then light reddish brown, fulvous. Lamellae pinkish to light reddish brown with concave, gelatinous-elastic whitish edge. Stipe narrowly fistulose, tenacious, pruinose all over, glabrescent, pinkish to light reddish brown. Basidiospores elongated ellipsoid, amyloid. Cheilocystidia forming a sterile band, embedded in gelatinous matter, covered

with cylindrical excrescences. Pleurocystidia absent. Hyphae of the pileipellis embedded in gelatinous matter, the majority smooth but the uppermost diverticulate. Hyphae of the cortical layer of the stipe diverticulate.

Habitat – on decaying leaf sheath of *Typha* and other riparian plants.

This section currently contains only one species (*Mycena tubarioides* (Maire) Kühner) and it is known from Europe and Canada.

63. Section ***Sanguinolentae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 91: 389 (1988).

Basidiomata fairly small to medium-sized. Pileus pruinose, glabrescent, dark reddish brown in various shades and at least at the centre. Lamellae ascending, at first whitish to pale dingy ochraceous, darkening with age, edge convex, dark red-brown or purplish brown. Stipe pruinose to puberulous at least above, glabrescent for the greater part, exuding a dull orange or reddish brown fluid when cut, dark reddish brown in various shades below. Basidiospores ellipsoid, amyloid. Cheilocystidia forming a sterile band, generally fusiform and smooth and apically narrowed to form a slender neck, with reddish brown contents. Pleurocystidia similar if present. Hyphae of the pileipellis covered with simple to branched excrescences. Hyphae of the cortical layer of the stipe covered with simple to furcate excrescences. Caulocystidia similar to cheilocystidia.

Habitat – on decaying plant debris and fallen branches.

Three species belonging to this section are known from the United States, Europe, Japan and Papua New Guinea.

64. Section ***Saniosae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 70 (1997).

Basidiomata medium-sized. Pileus glabrous, reddish brown. Context exuding a red-coloured juice when broken. Lamellae horizontal, broadly adnate or with a decurrent tooth, edge reddish brown. Stipe glabrous, paler than pileus. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate, with reddish brown contents, apically diverticulated. Pleurocystidia absent. Hyphae of the pileipellis and of the stipitipellis covered with sparse, obtuse excrescences.

Habitat – on decaying leaves.

This is a monotypic section and the type species, *Mycena saniosa* Maas Geest. & de Meijer, is recorded only from Brazil.

65. Section ***Seclusae*** Maas Geest. & Ovrebo, Persoonia 16 (3): 395 (1997).

Basidiomata small. Pileus centrally depressed, sulcate-striate, glabrous, dry. Odour chlorine-like. Lamellae numerous, ascending, white. Stipe fragile, dry, smooth, glabrous for the greater part, puberulous below, springing from an unobtrusive basal disc. Basidiospores ellipsoid, amyloid. Cheilocystidia clavate to fusiform, smooth. Pleurocystidia absent. Hyphae of the pileipellis sparsely

diverticulated with inflated terminal cells with dense excrescences. Hyphae of the stipitipellis smooth. Caulocystidia near the stipe base clustered, conical to lageniform, smooth.

Habitat – on bark of trees or decaying wood.

Mycena seclusa Maas Geest. & Ovrebo, the only known species of this section, was reported from Costa Rica.

66. Section ***Sejunctae*** Maas Geest. & de Meijer, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 40 (1997).

Basidiomata small. Pileus pruinose to minutely puberulous, pale grey, drying to white. Lamellae ascending, narrowly adnate or forming a pseudocollarium. Stipe fragile, white above, springing from a white basal patch made of fine radiating fibrils. Basidiospores almost cylindrical, more rarely ellipsoid, amyloid. Cheilocystidia clavate, apically covered with few excrescences. Hyphae of the pileipellis diverticulate. Hyphae of the stipitipellis smooth. Caulocystidia few, clavate, smooth. Terminal cells of the hyphae of the basal patch fusiform, clampless.

Habit – on dead leaves of dicotyledonous trees.

This section contains only one species (*Mycena sejuncta* Maas Geest. & de Meijer) known from Brazil.

67. Section ***Spinosae*** Aravind. & Manim., Mycosphere 4 (5): 931 (2013).

Basidiomata small to medium-sized. Pileus dry or viscid, sometimes with a separable pellicle, covered with fine pubescence, cream white, yellow, olivaceous, grey or greyish brown, translucent-striate. Stipe rarely insititious or rooting. Basidiospores ellipsoid, amyloid or inamyloid. Cheilocystidia clavate, cylindrical or fusoid, smooth or with excrescences. Pleurocystidia absent. Hyphae of the pileipellis diverticulate. Pileocystidia originating either from the pileipellis or from the pileus trama, thin-walled, hyaline, smooth. Hyphae of the stipitipellis smooth, rarely with excrescences. Caulocystidia absent or similar to pileocystidia if present.

Habitat – on decaying leaves, bark of trees, twigs and humus.

Seven species tentatively placed in this section are reported from India, Madagascar, Thailand and Sri Lanka.

68. Section ***Supinae*** Konrad & Maubl., Icones Selectae Fungorum 6: 274 (1934).

Basidiomata small to medium-sized. Pileus pruinose or puberulous to floccose, glabrescent, variously coloured. Odour insignificant or none. Lamellae few, usually horizontal to arcuate, broadly adnate, rarely ascending, edge paler to whitish. Stipe surface similar to pileus surface, base covered with white fibrils. Basidiospores globose to subglobose, amyloid. Cheilocystidia clavate to irregularly shaped, with short or very long and flexuous excrescences. Pleurocystidia absent. Hyphae of the pileipellis covered with warts. Hyphae of the stipitipellis diverticulate.

Habitat – on bark of deciduous and coniferous trees.

A total of ten species belonging to this section have been reported from Brazil, North America, the Netherlands, Norway, Italy, and North Africa.

69. Section ***Testudini*** Redhead & Norvell, Mycotaxon 46: 104 (1993).

Basidiomata small. Pileus with gelatinous pellicle, hymeniform, corticated by lentiform, pedicellate, diverticulate cells. Lamellae pseudocollariate, edge removed as gelatinous thread. Stipe glabrous. Basidiospores broadly cylindrical, amyloid. Cheilocystidia clavate, diverticulate. Pleurocystidia absent. Stipitipellis hyphae smooth, non-gelatinised. Caulocystidia absent.

Habitat – on decaying leaves.

Mycena gaultheri, the only known species of this section, is known from North America.

70. Section ***Viscipelles*** Kühner, Bulletin Bimensuel de la Société Linnéenne de Lyon 16: 125 (1931).

Basidiomata small to medium-sized. Pileus covered with a separable gelatinous pellicle, pruinose to minutely puberulous. Stipe entirely puberulous, with whitish or bright blue base, not discoid. Basidiospores ellipsoid or subglobose, amyloid. Cheilocystidia short, versiform, with comparatively few excrescences, embedded in gelatinous matter or not. Pleurocystidia absent. Hyphae of the pileipellis embedded in gelatinous matter, narrow, branched. Caulocystidia long, narrow, simple or branched.

Habitat – on bark of trees or on fallen twigs.

Three species are presently included in this section and they are known from Europe and Australia.

5
Taxonomic treatment

***Mycena* (pers.) Roussel, Flore du Calvados et des terreins adjacens, Edn 2: 64 (1806).**

Agaricus sect. *Mycena* Pers., Tentamen Dispositionis Methodicae Fungorum: 69 (1797).

Agaricus subgen. *Hiatula* Fr., Nova Acta Regiae Societatis Scientiarum Upsaliensis, Series 1: 27 (1851) [1855].

Bactroboletus Clem., The genera of Fungi: 109 (1909).

*Basidopu*s Earle, Bulletin of the New York Botanical Garden 5: 426 (1909).

*Collopu*s Earle, Bulletin of the New York Botanical Garden 5: 426 (1909).

*Corrugari*a Métrod, Les Mycènes de Madagascar: 127 (1949).

Eomycenella G.F. Atk., Botanical Gazette Crawfordville 34: 36 (1902).

Filoboletus Henn., Monsunia 1: 146 (1900).

Galactopus Earle, Bulletin of the New York Botanical Garden 5: 426 (1909).

Hiatula (Fr.) Mont., Annales des Sciences Naturelles Botanique, series 4 (1): 107 (1854).

Insiticia Earle, Bulletin of the New York Botanical Garden 5: 425 (1909).

Leiopoda Velen., Novitates mycologicae novissimae 4: 35 (1947).

Leptomyces Mont., Sylloge generum specierumque plantarum cryptogamarum: 128 (1856).

Linopodium Earle, Bulletin of the New York Botanical Garden 5: 427 (1909).

Mycenoporella Overeem, Icones Fungorm Malayensium 14-15: 4 (1926).

Mycenopsis Velen., Novitates mycologicae novissimae 4: 35 (1947).

Phlebomycena R. Heim ex R. Heim , Revue de Mycologie Paris 31 (2): 151 (1966).

Poromycena Overeem, Icones Fungorum Malayensium 14-15: 4 (1926).

Prunulus Gray, A Natural Arrangement of British plants 1: 630 (1821).

Pseudomycena Cejp, Publications de la faculté des sciences de l' université Charles 98: 25, 63, 80, 85 (1929).

Stereopodium Earle, Bulletin of the New York Botanical Garden 5: 426 (1909).

Zephirea Velen., Novitates mycologicae novissimae 4: 61 (1947).

Generic circumscription

Basidiomata very small to medium-sized, mycenoid, omphalinoid or more rarely collybioid. Pileus typically conical to campanulate; surface thin, pellucid, glabrous, granular, floccose, puberulous or pruinose, sometimes covered with a separable gelatinous pellicle. Lamellae ascending, horizontal or arcuate, almost free or narrowly adnate to decurrent. Stipe central, hollow, fragile to cartilaginous or elastic-tough; surface in part or entirely pruinose or puberulous or glabrous, dry to lubricous or viscid, the base sometimes dilated below to form a basal disc, often basally covered with long, coarse fibrils or insititious or with a pseudorrhiza**.** Latex rarely present. Spore print white to pale cream. Basidiospores usually ellipsoid, less frequently almost cylindrical or spherical, smooth, thin-walled, hyaline, amyloid or inamyloid. Basidia 2- or 4-spored, usually clavate. Cheilocystidia clavate, obpyriform, fusiform, lageniform or more rarely cylindrical, smooth, branched or with variously shaped, simple or branched excrescences. Pleurocystidia numerous, scarce or absent. Lamellar trama staining vinaceous to purplish brown in Melzer's reagent, in a few cases remaining unaltered. Both the hyphae of the pileipellis and stipitipellis nodulose-diverticulate or smooth, with infrequent terminal cells, sometimes gelatinising or embedded in a gelatinous matrix.

Habitat:—lignicolous, foliicolous or humicolous.

Type species:—*Mycena galericulata* (Scop.) Gray

Key to the sections of the genus *Mycena* seen in Kerala state

1. Hyphae of the pileipellis covered with fine excrescences and with either thick-walled pileosetae or thin-walled, smooth, hair-like pileocystidia.....2

- Hyphae of the pileipellis not covered with fine excrescences and with neither thick-walled pileosetae nor thin-walled, smooth, hair-like pileocystidia.....3

2. Pileipellis with thick-walled pileosetae.....9. Sect. ***Longisetae***

- Pileipellis with thin-walled pileocystidia.....14. Sect. ***Spinosae***

3. Lamella-edge forming a sterile band; hyphae of both the pileipellis and the stipitipellis embedded in a thick gelatinous matrix.....8. Sect. ***Hygrocyboideae***

- Lamella-edge not forming a sterile band; hyphae of both the pileipellis and the stipitipellis not embedded in a thick gelatinous matrix.....4

4. Stipe exuding a coloured juice when cut; taste bitter; basidiomata turning black when bruised.....6. Sect. ***Galactopoda***

- Stipe not exuding a coloured juice when cut; taste not bitter; basidiomata not turning black when bruised.....5

5. Pileus covered with a separable pellicle; hyphae of the pileipellis interconnected and embedded in a gelatinous matter.....6

- Pileus devoid of a separable pellicle; hyphae of the pileipellis not interconnected and not embedded in a gelatinous matter 7

6. Cheilocystidia clavate, with excrescences; hyphae of the pileipellis with short, conical or cylindrical excrescences ..... 2. Sect. ***Basipedes***

- Cheilocystidia fusoid, smooth; hyphae of the pileipellis with thorn-like excrescences ..... 4. Sect. ***Exornatae***

7. Basidiospores inamyloid 8

- Basidiospores amyloid 10

8. Basidiomata small; pileus pink-coloured at least when fresh ..... 1. Sect. ***Adonideae***

- Basidiomata not small; pileus not pink-coloured at least when fresh 9

9. Basidiomata greyish or reddish brown; lamellae intervenose, greyish red ..... 3. Sect. ***Calodontes***

- Basidiomata differently coloured; lamellae not intervenose and greyish red ..... 7. Sect. ***Hiemales***

10. Lamella-edge of a different colour ..... 12. Sect. ***Rubromarginatae***

- Lamella-edge concolourous with the sides 11

11. Pileus markedly granular or furfuraceous, pale greyish or whitish; hyphae of the pileipellis with detersile acanthocysts or with cherocytes ..... 13. Sect. ***Sacchariferae***

- Not with this combination of characters 12

12. Cheilocystidia and pleurocystidia absent; hyphae of both the pileipellis and the stipitipellis smooth ..... 11. Sect. ***Radiatae***

- Not with this combination of characters 13

13. Cheilocystidia clavate, covered with cylindrical excrescences 14

- Cheilocystidia not at the same time clavate and with excrescences ..... 5. Sect. ***Fragilipedes***

14. Hyphae of both the pileipellis and the stipitipellis smooth and with diverticulate terminal cells; basidiospores subglobose ..... 15. Sect. ***Supinae***

- Hyphae of both the pileipellis and of the stipitipellis diverticulate; basidiospores ellipsoid ..... 10. Sect. ***Polyadelphia***

I. ***Mycena*** section ***Adonideae*** (Fr.) Quél. Mémoires de la Société d'Emulation de Montbéliard II 5: 103 (1872).

Basidiomata fairly small to medium-sized. Pileus finely pruinose, often appearing glabrous, lubricous when moist or not, brightly coloured, more rarely white. Lamellae tender, ascending adnate, decurrent with a tooth, with paler edge. Stipe fragile, pruinose to minutely puberulous all over, the base covered with coarse, whitish fibrils. Basidiospores ellipsoid, inamyloid. Basidia clavate, 2-spored and clampless or 4-spored and clamped. Cheilocystidia mostly fusiform, clamped or clampless. Pleurocystidia similar. Hyphae of the pileipellis clamped or not, covered with simple or much branched excrescences. Hyphae of the stipitipellis clamped or not, terminal cells clavate or fusiform and cystidia-like.

Type species:—*Mycena adonis* (Bull.) Gray

Three species of section *Adonideae* were observed during the present study. Redhead *et al*. (2012) segregated *M. adonis*, the type specimen of sect. *Adonideae*, *M. aurantiidisca* (Murrill) Murrill and *M. flavoalba* (Fr.) Quél. from *Mycena* and placed in a new genus *Atheniella* Redhead, Moncalvo, Vilgalys, Desjardin & B.A. Perry based on both morphology and phylogeny. In this account, we prefer to assign the three new species to the traditionally recognised section *Adonideae* of *Mycena* as we have not verified the molecular phylogeny of new taxa.

Key to the species

1. Cheilocystidia fusoid, smooth; pleurocystidia present; basidiospores 7–9 × 4–6 µm..... ..... 1. ***Mycena rohitha***

- Cheilocystidia clavate or diverticulate; pleurocystidia absent 2

2. Caulocystidia and lamellulae absent; pileipellis hyphae slightly gelatinised and with distinct terminal cells; habitat on decaying twigs; basidiospores 6.5–8.5 × 3–4.5 µm..... ..... 2. ***Mycena kanika***

- Caulocystidia and lamellulae present; pileipellis hyphae non-gelatinised and without distinct terminal cells; habitat on the bark of a standing tree; basidiospores 5–7 × 3–4 µm ....3. ***Mycena kamala***

1. ***Mycena rohitha*** Aravind. & Manim., *sp. nov*. Pl. 1 A; Fig. 1 A–G

MycoBank MB811070

Diagnosis:—Characterised by fusoid, exudative cheilo- and pleurocystidia and subglobose to sphaero-pedunculate caulocystidia. Differing from *M. roseocandida* in having larger, ellipsoid basidiospores, exudative cheilocystidia and gelatinous hyphae of the pileipellis.

Holotype:—INDIA. Kerala State: Idukki District, Munnar, Anamudi Shola National Park, 17 August 2010, *D.M. Aravindakshan DM492*, K(M) 190591(K!).

Etymology:—*rohitha* (Sanskrit), reddish.

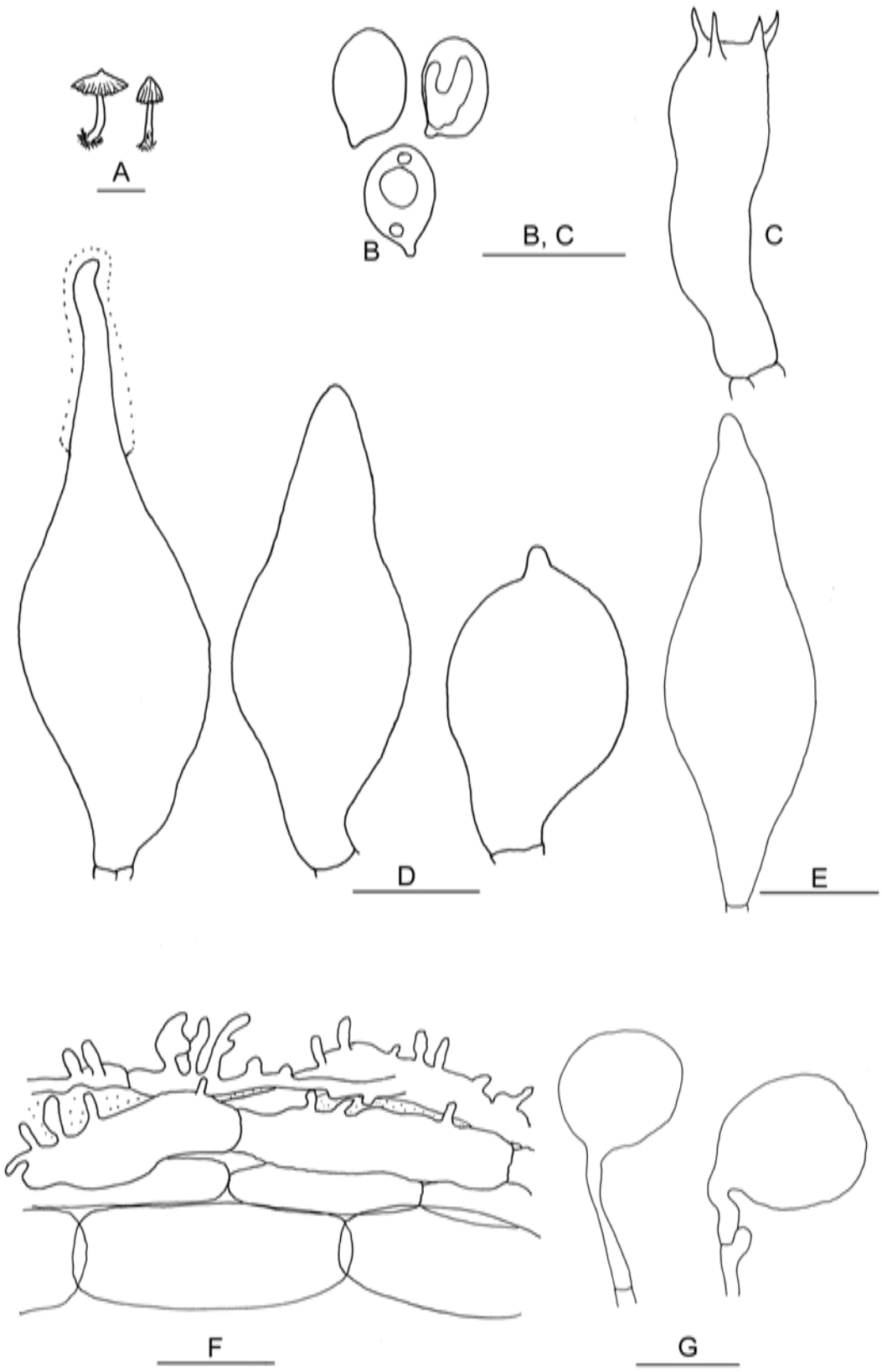


Figure 1. *Mycena rohitha*: A, basidiomata; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidium; F, hyphae of the pileipellis; G, caulocystidia. Scale bars: A = 5 mm; B-G = 10 µm.

Basidiomata very small. Pileus 3–6 mm diam., up to 2 mm high, hemispheric to conic when young, becoming broadly conic with an acute umbo; surface red (9B8) at the centre and on the striations and coral red (9B7) elsewhere when young, becoming scarlet red (9A8) at the apex and on the striations and yellowish red (9A7) elsewhere with age, translucent-striate, finely pruinose; margin straight and entire when young, becoming nearly plane and frequently fissile with age. Lamellae up to 13 reaching the stipe, emarginate, pinkish white (9A2) or whitish, 0.5 mm wide, subdistant, with lamellulae of 2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 5–25 × 0.5–0.75 mm, central, terete, almost equal or slightly tapering towards apex, hollow; surface translucent, pale orange (6A3) all over when young, retaining the colour at the apex and whitish elsewhere with age, finely pruinose towards the base; base with white basal mycelium. Context very thin and inconspicuous. Odour and taste not recorded.

Basidiospores (6.5) 7–9 × (3.5) 4–6 (8.05 ± 0.82 × 4.89 ± 0.59) µm, Q = 1.42–2, Q_m = 1.66, ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia 20–25 × 6–7.5 µm, clavate, bearing 4 sterigmata up to 5 µm long. Lamella-edge heterogeneous. Cheilocystidia 20.5–42.5 × 10.5–14 µm, fusoid, thin-walled, hyaline, smooth, sometimes with an amorphous exudation at the apex. Pleurocystidia similar to cheilocystidia in all features, scarce. Lamellar trama subregular; hyphae 2.5–26 µm wide, thin-walled, hyaline, inamyloid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 1.5–16 (26) µm wide, thin-walled, with pale pinkish contents that are easily removed by KOH, inamyloid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–12 µm wide, thin-walled, hyaline, with coarse excrescences (1.5–7 × 1–2.5 µm), slightly gelatinised. Stipitipellis a cutis; hyphae 2.5–7 µm wide, thin-walled, hyaline, smooth. Caulocystidia 15–37 × 12–16 µm, subglobose or sphaero-pedunculate, often with a terminal protrusion (11 × 2 µm), thin-walled, hyaline. Stipe trama inamyloid in Melzer's reagent. Clamp connections seen on the hyphae of the pileus trama and on the stipitipellis.

Habit, habitat and phenology:—Scattered, growing on the bark of a standing tree. August.

Notes:—The ellipsoid, inamyloid basidiospores, the pink pileus, the concolourous lamella-edge and the smooth hyphae of the stipitipellis lead this species to the sect. *Adonideae*. A total of eleven *Mycena* species had been included in sect. *Adonideae* before Redhead *et al.* (2012) transferred three of them to the new genus *Atheniella*. They include three European species (*M. adonis*, *M. flavoalba*, *M. leptophylla* (Peck) Sacc.), one American species (*M. aurantiidisca*), three Brazilian species (*M. aurorea* Maas Geest. & de Meijer, *M. chrysites* Maas Geest. & de Meijer and *M. mira* Maas Geest. & de Meijer), two New Guinean species (*M. digitata* Maas Geest. & E. Horak and *M. odora* Maas Geest. & E. Horak), one Australian species (*M. wubabulna* Grgur.), and one Indian species (*M. acrocephala* Maas Geest. & E. Horak).

Remarkably, a collection of *M. roseocandida* (Peck) Sacc. (A.H. Smith 32–471, MICH), a species that has been synonymised with *M. adonis* by Maas Geesteranus (1992b), has sphaero-pedunculate caulocystidia (see Maas Geesteranus, 1992b, p431, fig. 24) somewhat similar to those of *M. rohitha*. That collection, however, differs from *M. rohitha* in having somewhat smaller (6–8 × 3–3.5 µm), ovoid basidiospores, non-exudative cheilocystidia and non-gelatinous hyphae of the pileipellis.

2. ***Mycena kanika*** Aravind. & Manim., *sp. nov*. Pl. 1 B; Fig. 2 A–G

MycoBank MB811125

Diagnosis:—Characterised by arcuate-decurrent lamellae, ellipsoid to subamygdaliform basidiospores, clavate cheilocystidia with excrescences, slightly gelatinised hyphae of the pileipellis rarely with cystidioid terminal elements, and smooth hyphae of the stipitipellis with occasional small protrusions. Differing from *M. kamala* in having larger basidiomata and smaller cheilocystidia and in lacking lamellulae, caulocystidia and pale pinkish contents in the pileus trama.

Holotype:—INDIA. Kerala State: Thrissur District, Sholayar Dam site, 9 October 2009, *D.M. Aravindakshan DM338*, K(M) 190592 (K!).

Etymology:—*kanika* (Sanskrit), very small.

Basidiomata small, delicate. Pileus 1–2.5 mm diam., 1–2 mm high, parabolic when young, becoming convex with age; surface initially pinkish at the centre and on the striations and whitish elsewhere, becoming dark brown (9F8) or reddish brown (9E5) at the centre, dull red (9C4 or 9B4) towards margin and reddish brown (9D5) elsewhere with time, initially translucent-striate, becoming sulcate-striate, finely pruinose; margin straight, entire or crenate. Lamellae up to 7 reaching the stipe, arcuate-decurrent, whitish, up to 0.5 mm wide, distant, without lamellulae; edge finely torn under a lens, concolourous with the sides. Stipe 11–35 × 0.25–0.5 mm, central, terete, almost equal or slightly tapering towards the apex, hollow; surface translucent, initially whitish, becoming reddish white (8A2, 7A2) or orange white (6A2) at the apex and greyish brown (6D4) towards the base with time, finely pubescent; base slightly swollen. Context very thin and inconspicuous. Odour and taste not recorded.

Basidiospores (5) 6.5–8.5 × 3–4.5 (6.98 ± 0.68 × 3.7 ± 0.33) µm, Q = 1.33–1.86, $_{Qm}$ = 1.62, ellipsoid to subamygdaliform, thin-walled, hyaline, smooth, inamyloid. Basidia (12.5) 15–22 × (4.5) 6–9.5 µm, clavate, bearing 4 sterigmata up to 5 µm long. Lamella-edge heterogeneous. Cheilocystidia (8) 11–18 × (4.5) 5.5–7.5 µm, clavate, thin-walled, hyaline, with short, cylindrical excrescences (0.5–2.5 × 0.5–2 µm) at the apex. Pleurocystidia none. Lamellar trama subregular; hyphae 1.5–18.5 µm wide, thin-walled, with pale yellowish contents, very faintly vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 3–25 µm wide, thin-walled, with pale yellowish contents, very faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–6 µm wide, slightly gelatinised, thin-walled, hyaline, with short, cylindrical excrescences (0.5–8 × 1–2 (3) µm); occasionally with inflated cystidioid terminal elements 10–14 × 5–6.5 µm, clavate or fusoid, with short, cylindrical excrescences (0.5–4 × 1–2 µm). Stipitipellis a cutis; hyphae 1–5 µm wide, thin- to very slightly (0.25 µm) thick-walled, hyaline, smooth for the greater part, occasionally with small protrusions (6.5–8 × 3–4 µm). Stipe trama very faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

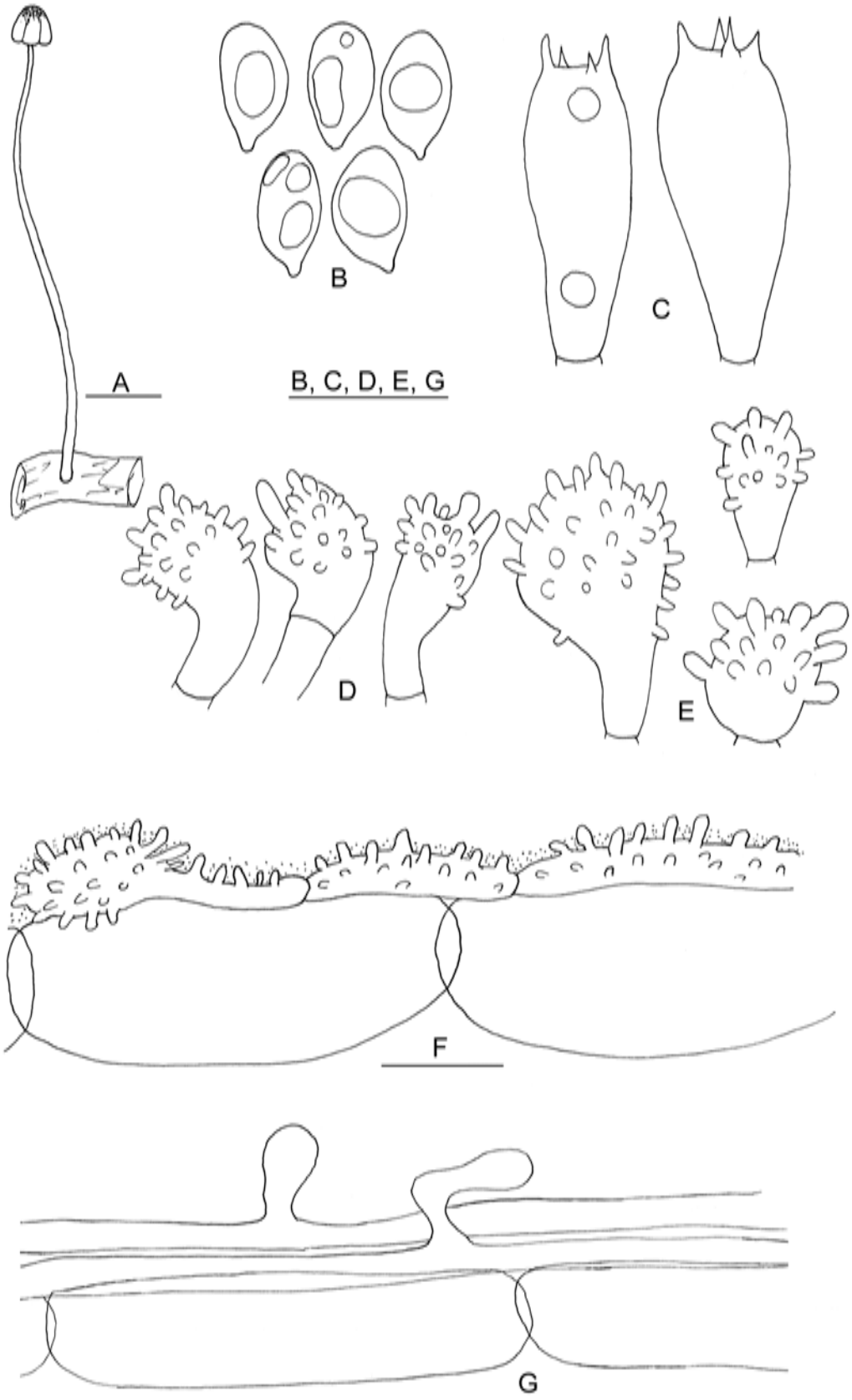


Figure 2. *Mycena kanika*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis with terminal cystidioid element; G, hyphae of the stipitipellis. Scale bars: A = 5 mm; B-G = 10 µm.

Habit, habitat and phenology:—Scattered, on decaying twigs or on partially burnt logs. October.

Additional collection examined:—INDIA. Kerala State: Eranakulam District, Iringole Kavu, 5 October 2009, *D.M. Aravindakshan DM337*.

Notes:—The ellipsoid, inamyloid basidiospores, the pink pileus, and the concolourous lamella-edge place *M. kanika* in sect. *Adonideae*. Except *M. monticola* and *M. kamala* described elsewhere in this dissertation, all other known species of sect. *Adonideae* have pleurocystidia and smooth, fusoid cheilocystidia (Smith 1947). *Mycena monticola*, a North American species, has a pink pileus and roughened cheilocystidia like the present species. But the former has somewhat larger basidiomata with numerous lamellae (up to 28 in number), somewhat larger basidiospores (7–10 × 4–5 µm), larger cheilocystidia (28–35 × 9–12 µm) and highly gelatinised pileipellis hyphae. Moreover, Maas Geesteranus (1992b) placed that species with weakly amyloid basidiospores in a distinct section *Monticola*. *Mycena kamala* differs from *M. kanika* in having minute basidiomata, lamellulae, slightly smaller basidiospores, slightly larger cheilocystidia (14–24 × 4.5–7.5 µm), pale pink contents within the pileal trama, and distinct, cylindrical or flexuous caulocystidia.

3. ***Mycena kamala*** Aravind. & Manim. *sp. nov*. Pl. 1 C; Fig. 3 A–G

MycoBank MB811071

Diagnosis:—Characterised by minute, corticolous basidiomata, a distinctly umbonate pileus with a pinkish hue, decurrent or emarginate lamellae, and cheilocystidia and caulocystidia with finger-like protuberances. Differing from *M. mira* in having smaller basidiospores, differently shaped cheilocystidia with excrescences, hyphae of the pileipellis with excrescences, and a hymenium devoid of pleurocystidia.

Holotype:—INDIA. Kerala State: Malappuram District, Vengara, Oorakamala, 27 July 2011, *D.M. Aravindakshan DM527*, K(M) 190594 (K!).

Etymology:—*kamala* (Sanskrit), rose-coloured.

Basidiomata very small. Pileus up to 2 mm diam., up to 1 mm high, convex with an umbo; surface dark pink at the centre, fading to pale pinkish towards margin, translucent-striate, finely pruinose; margin straight, entire. Lamellae up to 15 reaching the stipe, decurrent or emarginate, whitish, 0.5 mm wide, subdistant, with lamellulae of 1 length; edge finely torn under a lens, concolourous with the sides. Stipe 1–6 × 0.5 mm, central, terete, almost equal or slightly tapering towards apex, hollow; surface translucent, white, finely pubescent; base slightly swollen. Context very thin and inconspicuous. Odour and taste not distinctive.

Basidiospores 5–7 × 3–4 (5.98 ± 0.68 × 3.7 ± 0.33) µm, Q = 1.33–1.86, Q_m = 1.62, ellipsoid to subglobose, thin-walled, hyaline, smooth, inamyloid. Basidia 8–14 × 5.5–6.5 µm, clavate, bearing 4 sterigmata up to 5 µm long. Lamella-edge homogeneous. Cheilocystidia

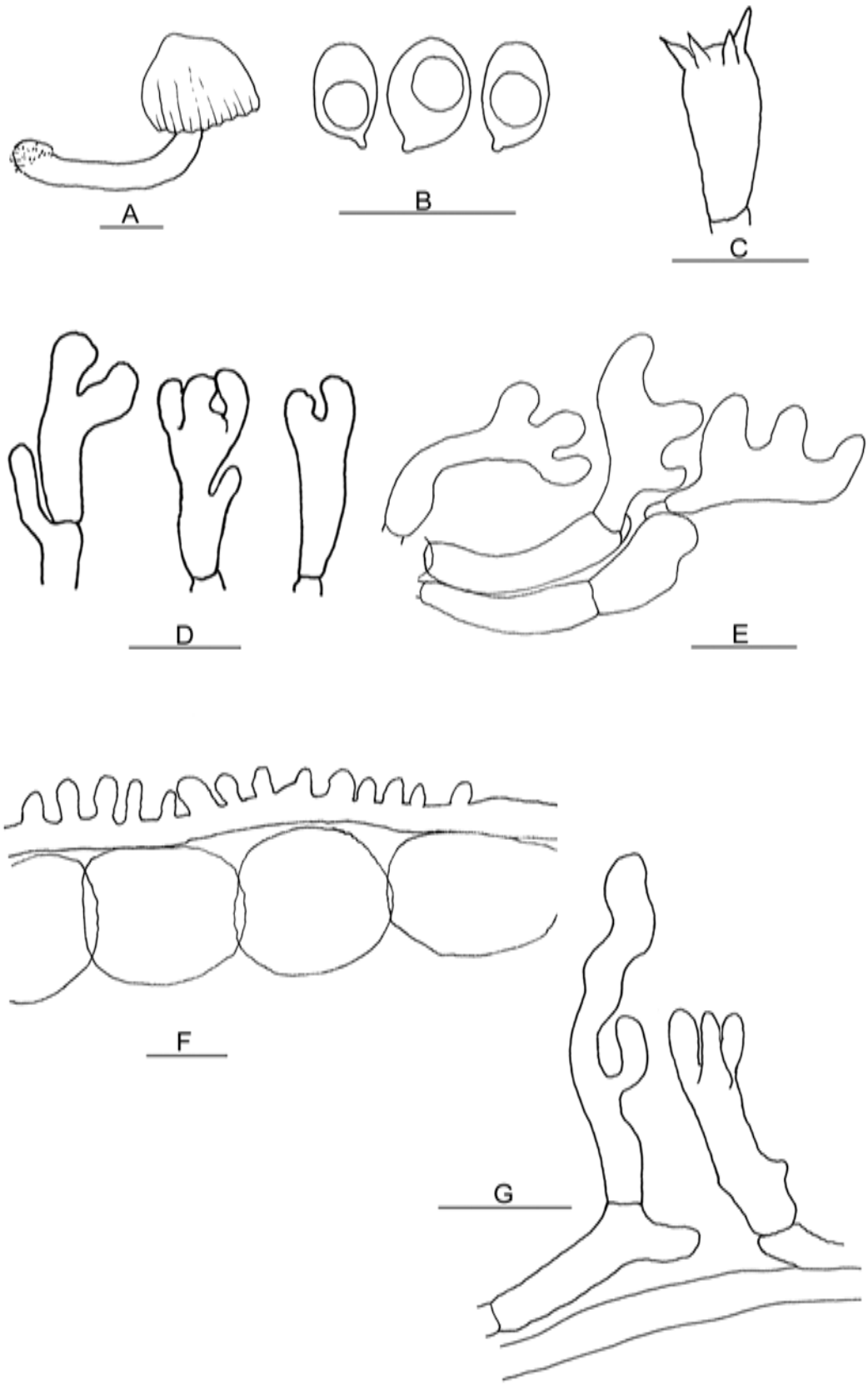


Figure 3. *Mycena kamala*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, hyphae of the stipitipellis with caulocystidia. Scale bars: A = 5 mm; B-G = 10 µm.

14–24 × 4.5–7.5 µm, clavate, thin-walled, hyaline, with a few (2–4) finger-like protuberances (1–6.5 × 1.5–3.5 µm) at the top. Pleurocystidia none. Lamellar trama subregular; hyphae 3.5–13 µm wide, thin-walled, hyaline, very faintly vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 4–26 µm wide, thin-walled, with pale pinkish contents that are easily removed by KOH, very faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–4.5 µm wide, thin-walled, hyaline, with coarse excrescences (1.5–7 × 1–3.5 µm). Stipitipellis a cutis of smooth hyphae with scattered or clustered caulocystidia; hyphae 1.5–3 µm wide, thin-walled, hyaline. Caulocystidia 10–26 × 2.5–4.5 µm, cylindrical or flexuous, thin-walled, hyaline, often with a few finger-like protuberances (1.5–5 × 1.5–3.5 µm) either at the apex or on the sides. Stipe trama weakly dextrinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on the bark of a standing tree. July.

Notes:—Characters such as the ellipsoid, inamyloid basidiospores, the non-gelatinous pellicle, the pink pileus, the smooth stipitipellis hyphae and the concolourous lamella-edge lead *M. kamala* to sect. *Adonideae*. *Mycena mira* is strikingly similar to *M. kamala* in having smaller basidiomata, white, decurrent lamellae and smooth hyphae of the stipitipellis. But that species differs in having somewhat larger basidiospores; smooth, larger, subfusiform or sublageniform cheilocystidia; pleurocystidia; and smooth hyphae of the pileipellis. *Mycena aurorea* has minute, reddish orange to pale pink basidiomata. But that species has globose to subglobose basidiospores; somewhat larger basidia; larger, smooth cheilocystidia; and pleurocystidia. *Mycena digitata*, *M. odora*, *M. wubabulna* and *M. acrocephala* have coral red or pink pileus. But their similarity to the present species ends there.

II. ***Mycena*** section ***Basipedes*** (Fr.) Quél., Mémoires de la Société d'Emulation de Montbéliard II 5: 109 (1872).

Basidiomata small to medium-sized. Pileus covered with a separable, gelatinous pellicle, glabrous or pruinose or centrally hispid or entirely covered with spinules, greyish white or greyish brown. Lamellae ascending, receding stellately form the stipe, forming a pseudocollarium, with white edge. Stipe glabrous for the greater part, puberulous below, springing from a pubescent basal disc. Basidiospores ellipsoid to elongated, amyloid. Basidia clavate, 4-spored. Cheilocystidia obpyriform to clavate or irregularly shaped, with few excrescences, more rarely without any. Pleurocystidia absent. Hyphae of the pileipellis smooth to diverticulate. Caulocystidia long, slender.

Type species:—*Mycena stylobates* (Pers.) P. Kumm.

Five species of section *Basipedes* were observed during the present study.

Key to the species

1. Habitat on *Chrysophyllum cainito* leaves; pileus pink; cheilocystidia with a subapical constriction; basidiospores 6–7.5 × 3–4 µm ..... 4. ***Mycena patala***

- Habitat different; pileus greyish brown or brownish grey; cheilocystidia without subapical constriction.....2

2. Pileus without spinules; pileipellis hyphae terminated by acanthophysoid element and diverticulate elements; basidiospores 5.5–7 × 3–3.5 µm .....
.....

..... 5. ***Mycena sukshma***

- Pileus with spinules; pileipellis hyphae without these characters 3

3. Spinules made of erect bundles of terminal cells of the hyphae of the pileipellis; basidiospores 6–7.5 × 3–3.5 µm..... 6. ***Mycena zikhara***

- Spinules made of hyphae of the pileipellis.....4

4. Pileus with a shallow central depression; cheilocystidia long-stalked; pileipellis with distinct cystidioid hyphal ends; basidiospores 6–7 × 3.5–4 µm ..... 7. ***Mycena kapotha***

- Pileus without a shallow central depression; cheilocystidia short-stalked; pileipellis without distinct cystidioid hyphal ends; basidiospores 7–9 × 3.5–4.5 µm.....8. ***Mycena nirbala***

4. ***Mycena patala*** Aravind. & Manim. *sp. nov*. Pl. 1 D; Fig. 4 A–F

MycoBank MB811072

Diagnosis:—Characterised by a pink to dull red, spinulose pileus; stellately seceding lamellae; ellipsoid, amyloid basidiospores; clavate cheilocystidia often with a subapical constriction; pileipellis hyphae that are embedded in a gelatinous matrix and with highly diverticulate elements; and caulocystidia with lateral protrusions or with coarse excrescences. Differing from all other species of section *Basipedes* in having a pink pileus, cheilocystidia with a subapical constriction and association with *Chrysophyllum cainito* leaves.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 15 July 2009, *D.M. Aravindakshan DM285b*, K(M) 180377 (K!).

Etymology:—*patala* (Sanskrit), pink.

Basidiomata very small, delicate. Pileus 0.5–2.5 mm diam., 0.5 mm high, parabolic when young, becoming broadly parabolic to hemispheric or convex with age; surface nearly pink (11A3) to nearly dull red (11B3) all over when very young, retaining the colour only on the disc and on the

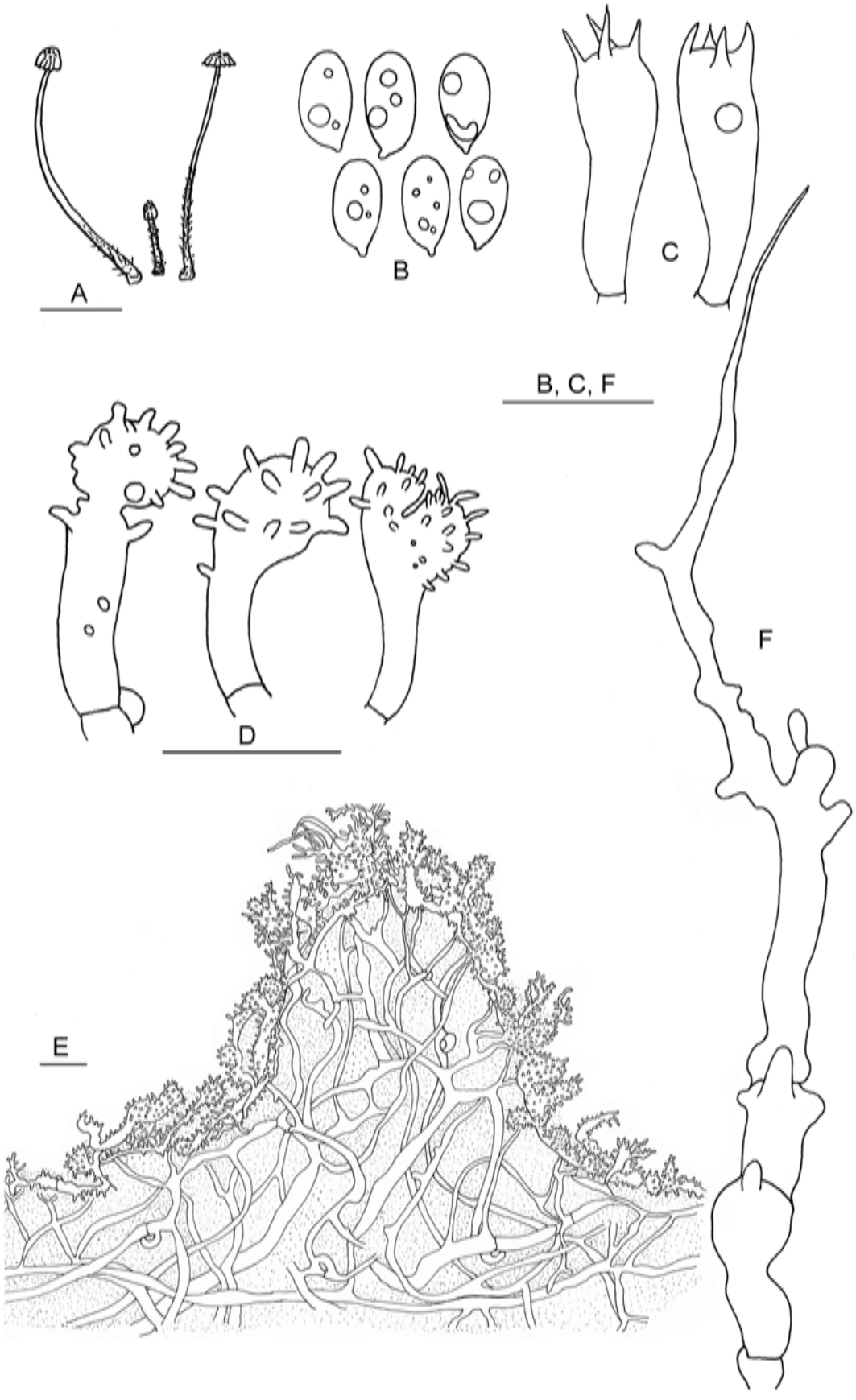


Figure 4. *Mycena patala*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, hyphae of the pileipellis; F, caulocystidium. Scale bars: A = 5 mm; B-F = 10 µm.

striations, whitish elsewhere with age, translucent-striate, densely spinulose on the disc when young, becoming less so with age; margin incurved and entire when very young, becoming straight and denticulate with age. Lamellae 7–9 reaching the stipe, adnexed, stellately seceding, whitish, 0.2 mm thick, distant to subdistant, with lamellulae of 1 length; edge very finely torn under a lens, concolourous with the sides. Stipe 3–15 (23) × 0.2–0.25 mm, central, terete, almost equal when young, becoming slightly tapering towards apex with age, hollow; surface translucent, whitish towards apex and pinkish towards base when young, becoming whitish all over with age, finely pubescent all over when young, becoming almost glabrous at the apex with age; base somewhat discoid at least when young, becoming swollen. Context not conspicuous, less than 0.5 mm thick, concolourous with the pileus surface. Odour not distinctive. Taste not recorded.

Basidiospores 6–7.5 × 3–4 (6.78 ± 0.41 × 3.38 ± 0.33) µm, Q = 1.63–2.5, Q_m = 2.02, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 15.5–18 × 5.5–7 µm, clavate, bearing 4 sterigmata up to 3 µm long. Lamella-edge heterogeneous. Cheilocystidia 6–23 × 5–10 µm, narrowly clavate to clavate or subcylindric, occasionally with a subapical constriction, thin-walled, hyaline, with excrescences (0.5–2 × 0.5–1 µm) confined to the apex. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 1.5–10 µm wide, thin-walled, hyaline, moderately vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 6.5–14.5 µm wide, thin-walled, pale brownish, moderately vinoid in Melzer's reagent. Pileipellis an epicutis; lower hyphae narrower, 1.5–4.5 µm, thin-walled, hyaline, smooth, reticulately interconnected, embedded in a gelatinous matter, with loop-like clamp connections; upper hyphae slightly broader, 1.5–7 µm, thin-walled, hyaline, locally slightly inflated, or with intercalary and terminal clavate or subglobose or globose, highly diverticulate (very rarely with protrusions up to 25 µm long) elements (2.5–10 µm wide). Stipitipellis a cutis; hyphae 3–5.5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 36–108 × 4–7.5 µm, cylindrical, thin-walled, hyaline, with tapering ends or with lateral protrusions (5.5–55 × 1–2 µm) and with coarse excrescences (1–6 × 1–3 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in group, on decaying *Chrysophyllum cainito* leaves. July.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 20 July 2006, *D.M. Aravindakshan DM48*; 11 July 2007, *D.M. Aravindakshan DM158*, K(M) 180379; 3 July 2009, *D.M. Aravindakshan DM285a*.

Notes:—Characters such as the ellipsoid, amyloid basidiospores, a stipe that do not bleed when cut, hyphae of the pileipellis that are both covered with much branched excrescences and embedded in a gelatinous matter, short cheilocystidia, and an almost discoid stipe base place *M. patala* in sect. *Basipedes*. Nine species of *Mycena*, so far, have been placed in this section: three European species (*M. mucor* (Batsch) Quél., *M. rhenana* Maas Geest. & Winterh. (recently Desjardin *et al*. (2007) suggested a transfer of this species to sect. *Exornatae*) and *M. tenuispinosa* J. Favre), two Madagascar species (*M. spinosa* Métrod and *M. quadratipes* Métrod), two Thailand species (*M. pseudoseta* Desjardin, Boonprat. & Hywel-Jones and *M. mimicoseta* Desjardin, Boonprat. & Hywel-Jones), one Malaysian species (*M. albitranslucens* Corner) and *M. stylobates* reported from Europe, North America, North Africa, and Sri Lanka. But none of those species have the combination of

characters such as an association with *Chrysophyllum cainito* leaves, pink pileus, and cheilocystidia with a subapical constriction.

5. ***Mycena sukshma*** Aravind. & Manim. *sp. nov*. Pl. 1 E; Fig. 5 A–G

MycoBank MB811075

Diagnosis:—Characterised by minute, pale greyish basidiomata that grow on *Acacia* leaves; obovoid or ellipsoid cheilocystidia with excrescences; hyphae of the pileipellis embedded in a gelatinous matter and with acanthophysoid terminal elements as well as diverticulate terminal elements; and smooth caulocystidia with a very long, gradually tapering apex. Differing from *M. mucor* in having smaller basidiomata and basidiospores, larger caulocystidia and loop-like clamp connections.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 5 July 2007, *D.M. Aravindakshan DM152*, K(M) 180091 (K!).

Etymology:—*sukshma* (Sanskrit), minute.

Basidiomata very small, delicate. Pileus 0.75–1.25 mm diam., 0.25–0.5 mm high, convexo-parabolic when young, becoming hemispherical, rarely somewhat umbonate; surface pale greyish at the centre and on the striations, pure white elsewhere, translucent-striate when young, becoming nearly sulcate at middle with age, finely pruinose; margin straight and finely torn under a lens. Lamellae 8–9 reaching the stipe, free or adnexed, pure white, less than 0.5 mm wide, subdistant, with lamellulae of one length; edge finely torn under a lens, concolourous with the sides. Stipe 5–7 × 0.25 mm, central, terete, almost equal or slightly tapering towards apex, hollow; surface translucent, white, pubescent, more so towards base; base somewhat discoid with a patch of radiating fibrils. Context not conspicuous. Odour and taste not distinctive.

Basidiospores (5) 5.5–7 × (2.5) 3–3.5 (6.26 ± 0.51 × 3.39 ± 0.21) µm, Q = 1.57–2.33, Q_m = 1.85, oblong-ellipsoid, thin-walled, hyaline, smooth, with a few guttules, strongly amyloid. Basidia 8.5–14 × 5–7 µm, clavate, bearing 4 sterigmata up to 2.5 µm long. Cheilocystidia 10.5–16.5 × 7.5–13.5 µm, obovoid, ellipsoid, subglobose or clavate, thin-walled, hyaline with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 3–12 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 7–25 µm wide, thin-walled, hyaline or with pale greyish contents, vinoid in Melzer's reagent. Pileipellis composed of two types of hyphae; uppermost hyphae 1–7.5 µm wide, embedded in a gelatinous matter, thin-walled, hyaline, smooth, with loop-like clamp connections, with acanthophysoid terminal elements 8–40 × 6.5–28 µm, obovoid to clavate, thin-walled, hyaline, with excrescences (0.5–1.5 × 0.5–1 µm); lower hyphae similar in all aspects but have narrow, diverticulate terminal elements. Pileus marginal cells 12.5–17 × 10–12.5 µm, similar to pileocystidia. Stipitipellis a cutis; hyphae 2–5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 28.5–203.5 × 6–11 µm, sinuoso-cylindric with a very long, gradually tapering apex, thin-walled, hyaline, smooth. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

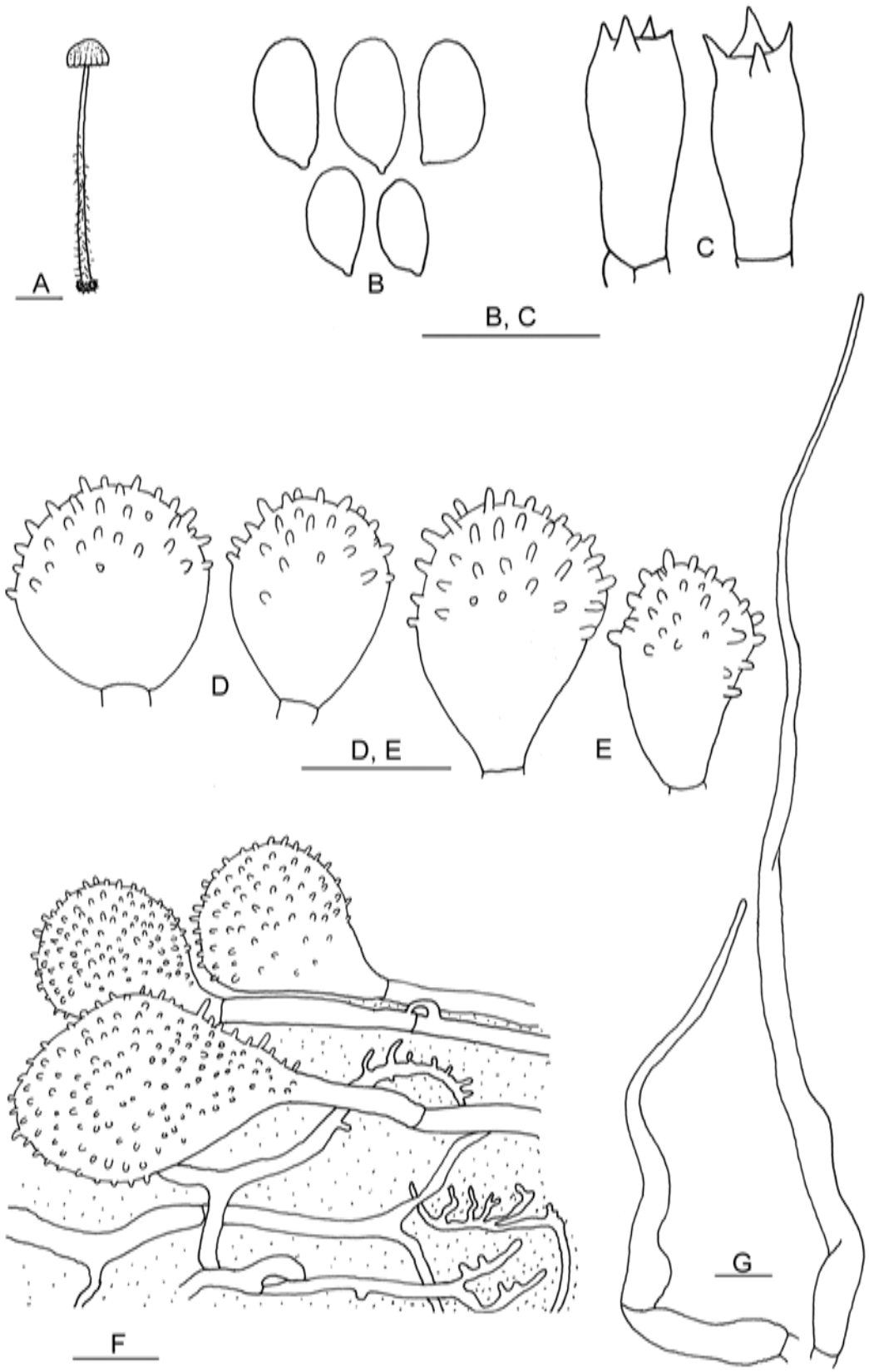


Figure 5. *Mycena sukshma*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, caulocystidia. Scale bars: A = 1 mm; B-G = 10 µm.

Additional collection examined:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 26 July 2007, *D.M. Aravindakshan DM152b*.

Notes:—Characters such as the oblong-ellipsoid, basidiospores, the gelatinised pileipellis, the sessile or short stalked cheilocystidia, the concolourous lamella-edge, the whitish stipe arising from a basal patch of radiating fibrils and the smooth caulocystidia of *M. sukshma* are indicative of sect. *Basipedes*.

Of the many species of the sect. *Basipedes*, only *M. mucor* and *M. rhenana* have non-spinulose pileus. Recently Desjardin *et al*. (2007) suggested a transfer of the latter species to sect. *Exornatae* because of its overall phenetic similarity with the species of the latter section. *Mycena mucor* is very similar macroscopically in having a very small, greyish pileus, ascending lamellae, a puberulous stipe, similar type of cheilocystidia, smooth hyphae of the pileipellis embedded in a gelatinous matter and smooth caulocystidia. But that species differs in having a much longer stipe (2.5 cm long), larger basidiospores (9–11.5 × 3–4 µm), and small caulocystidia (up to 65 µm long) and in lacking both distinct acanthophysoid terminal elements in the pileipellis hyphae and loop-like clamp connections.

6. ***Mycena zikhara*** Aravind. & Manim. *sp. nov*. Pl. 1 F; Fig. 6 A–G

MycoBank MB811076

Diagnosis:—Characterised by minute basidiomata; a greyish brown pileus with fine, erect spinules that are made of agglutinated terminal cells of the hyphae of the pileipellis; and a discoid stipe base with hymenial impression on it. Differing from *M. tenuispinosa* in having smaller basidiospores, broader hyphae of the pileipellis, and differently shaped caulocystidia.

Holotype:—INDIA. Kerala State: Palakkad District, Ottappalam, Pozhathil Mana, 8 July 2010, *D.M. Aravindakshan DM457*, K(M) 180073 (K!).

Etymology:—*zikhara* (Sanskrit), spiked.

Basidiomata very small, delicate. Pileus 1–2 mm diam., up to 1.25 mm high, parabolic when young, becoming convex with age; surface greyish brown (5E4) at the centre and on the striations, off-white elsewhere, translucent-striate or almost sulcate-striate towards the margin, beset with scattered spinules that are more on the disc; margin straight, crenate or finely torn. Lamellae 9–10 reaching the stipe, adnexed, seceding, off-white, about 0.25 mm thick, subclose, with lamellulae of one length; edge very finely torn under a lens, concolourous with the sides. Stipe 8–17 × 0.25–0.5 mm, central, terete, almost equal, hollow; surface translucent, off-white, finely pubescent, more so towards the base; base discoid with hymenial impression on it. Context not conspicuous, less than 0.5 mm thick, concolourous with the pileus surface. Odour and taste not recorded.

Basidiospores 6–7.5 × 3–3.5 (6.78 ± 0.41 × 3.38 ± 0.33) µm, Q = 1.63–2.5, Q_m = 2.02, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 7–10 × 6–6.5 µm, very difficult to recover, obovoid, bearing 4 sterigmata up to 2 µm long. Lamella-edge sterile. Cheilocystidia 14–27.5 × 10–14.5 µm, clavate to sphaero-pedunculate, thin-walled, hyaline, with apical, cylindrical excrescences (2–8 × 1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 3.5–20 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus

trama subregular; hyphae 4.5–29 µm wide, thin-walled, with a pale greyish contents that dissolves in KOH, vinoid in Melzer's reagent. Pileipellis a cutis; upper hyphae broader, 1.5–11 µm wide, thin-walled, hyaline, with excrescences (0.5–3.5 × 0.5–1 µm); lower hyphae narrower 1.5–5 µm wide, embedded in a gelatinous matter, thin-walled, hyaline, smooth, with both normal and loop-like clamp connections; terminal cells of the hyphae of the pileipellis 8–56 × 3–12 µm, clavate or cylindrical, thin-walled, with excrescences (0.5–3.5 × 0.5–1 µm). Spinules on the pileal surface formed of erect bundles of terminal cells of the pileipellis hyphae. Pileus marginal cells 16–20 × 10–14.5 µm, clavate or obovoid, thin-walled, hyaline, with excrescences (0.5–7 × 0.5–1 µm). Stipitipellis a cutis; hyphae 1.5–9 µm wide, thin-walled, hyaline, smooth. Caulocystidia 9.5–41 × 3–8.5 µm, basal half clavate or fusoid or cylindrical, upper half nodulose diverticulate, thin-walled, hyaline. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, growing on decaying leaves. July.

Additional collection examined:—INDIA. Kerala State: Palakkad District, Ottappalam, Pozhathil Mana, 8 July 2010, *D.M. Aravindakshan DM457b*.

Notes:—Characters such as the ellipsoid, amyloid basidiospores, the non-exudative stipe with a discoid base and the smooth caulocystidia lead *M. zikhara* to sect. *Basipedes*. *Mycena stylobates*, *M. spinosa*, *M. quadratipes*, *M. patala*, *M. kapotha*, *M. tenuispinosa*, *M. pseudoseta* and *M. mimicoseta* are the species of sect. *Basipedes* with fine pileal spines. In the first five species, the uppermost hyphae together with the lower gelatinous zone form the spine. Only the last three species have spines made exclusively of pileipellis hyphae. Out of those three species, *M. tenuispinosa* shows striking similarity to *M. zikhara* in having similar macromorphological characters, uppermost hyphae of the pileipellis that are with excrescences and often agglutinated forming spinules; lower hyphae of the pileipellis that are smooth and embedded in a gelatinous matter, similar type of cheilocystidia, and in the presence of caulocystidia. But *M. tenuispinosa* differs from *M. zikhara* in having larger basidiospores (8–12 × 5–6.5 µm), narrow hyphae with tapering ends constituting the spinules, and lanceolate or flexuous caulocystidia that form clusters.

Both *M. pseudoseta* and *M. mimicoseta* do not have a distinct zone of gelatinisation in the pileipellis. Instead, they have the entire pileipellis hyphae embedded in a gelatinous matter. However, *M. pseudoseta* is similar to the present species in having similar-sized basidiomata, a grey-coloured pileus, somewhat similar-sized basidiospores and agglutinated hyphae of the pileipellis forming the pileal spines. But that species additionally differs in having a glabrous stipe, narrower (7–9.5 µm wide) cheilocystidia, and narrower (less than 12 µm wide) tramal hyphae and in lacking caulocystidia. A hymeniform pileipellis composed of acanthocysts in combination with pileus spinules formed of agglutinated cylindrical hyphae, minute basidiomata and absence of both cheilo- and caulocystidia make *M. mimicoseta* distinct.

The bioluminescent species *M. nocticaelum* A.L.C. Chew & Desjardin, reported from Malaysia and tentatively placed in section *Basipedes* (Chew *et al*. 2015), has spines made exclusively of pileipellis hyphae as is the case in the present species. But the presence of slightly larger basidiospores, basidia, cheilocystidia and pileus marginal cells and the absence of both caulocystidia and gelatinised pileipellis make that species different.

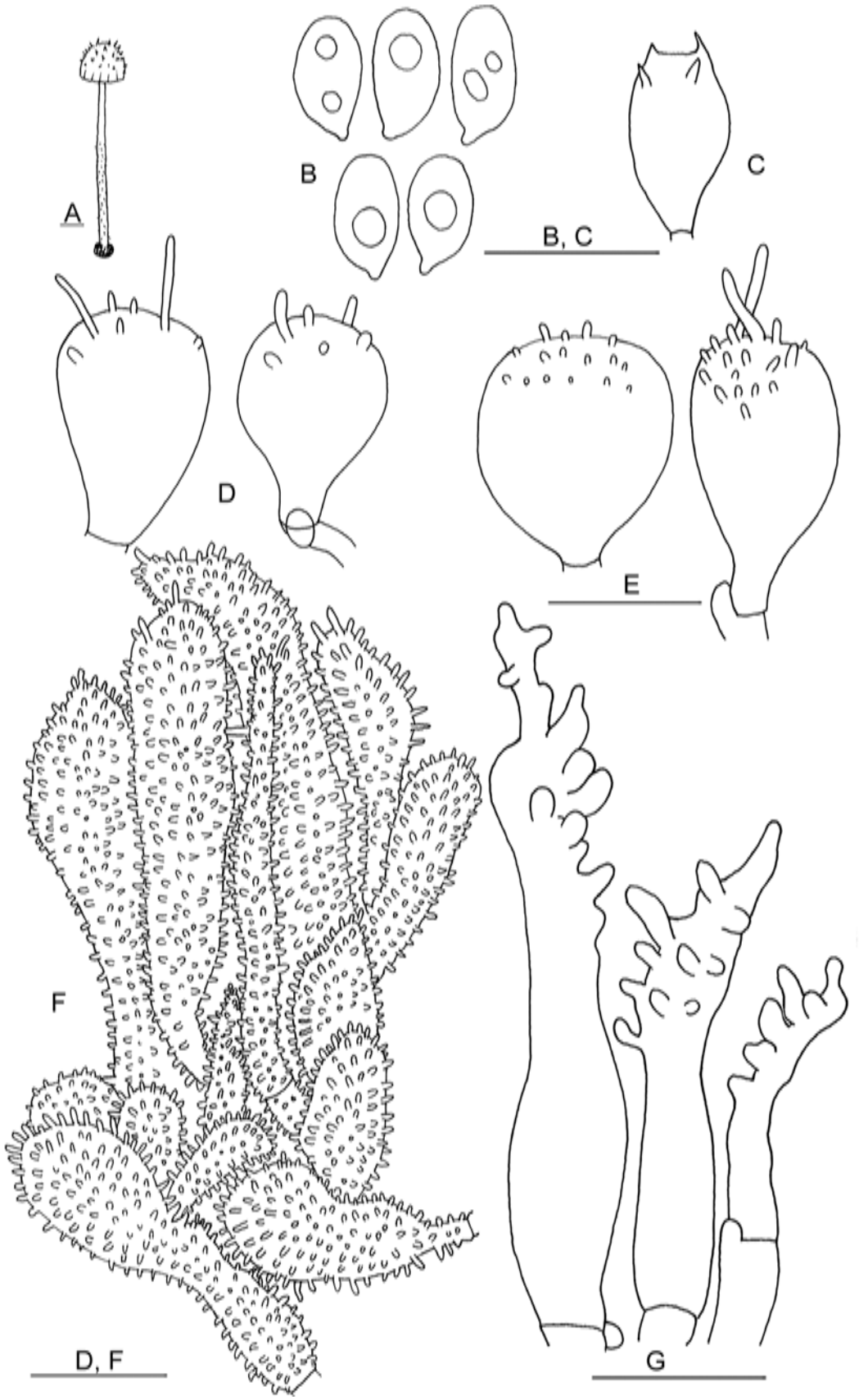


Figure 6. *Mycena zikhara*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, terminal cells of the pileipellis hyphae forming the spinule; G, caulocystidia. Scale bars: A = 1 mm; B-G = 10 µm.

7. ***Mycena kapotha*** Aravind. & Manim. *sp. nov*. Pl. 1 G; Fig. 7 A–H

MycoBank MB811077

Diagnosis:—Characterised by fine, persisting spinules on the pileus; clavate, long-stalked cheilocystidia with finger-like protuberances; hyphae of the pileipellis embedded in a gelatinous matter as well as with cystidioid terminal cells with excrescences; and fusiform, slightly thick-walled caulocystidia with simple or furcate excrescences. Differing from *M. stylobates* in having less number of lamellae, smaller basidiospores, and differently shaped cheilo- and caulocystidia.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 12 July 2007, *D.M. Aravindakshan DM159*, K(M) 180014 (K!).

Etymology:—*kapotha* (Sanskrit), greyish.

Basidiomata small. Pileus 4–5 (8) mm diam., 1–2 mm high, convex or hemispherical when young, becoming nearly campanulate with a shallow depression at the centre; surface initially brownish grey (5C2) at the centre and on the striations and off-whitish elsewhere, becoming mouse grey (5E3) at the centre and on the striations and off-whitish elsewhere, initially translucent-striate, becoming sulcate-striate, with fine, white persisting spines on the disc, less so towards margin, dry; margin straight and entire when young, becoming nearly plane and finely fissile with age. Lamellae 12–18 reaching the stipe, narrowly adnate or adnexed, stellately seceding, off-whitish, up to 1 mm wide, subdistant, with lamellulae of 2–3 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 9–10 (30) × 0.5–0.75 mm, central, terete, almost equal, hollow; surface translucent, brownish grey (5C2), or yellowish brown (5E4) when young, becoming off-white with age, densely pubescent all over when young, becoming almost glabrous at the apex with age; base discoid with a hymenial impression. Context narrow, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6–7 × 3.5–4 (6.45 ± 0.56 × 3.78 ± 0.96) µm, Q =1.38–1.88, Q_m = 1.61, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 17.5–22 × 6–8 µm, clavate, bearing 4 sterigmata up to 6 µm long. Lamella-edge sterile. Cheilocystidia crowded, 16–48.5 × 3–11.5 µm, clavate, thin-walled, hyaline, with finger-like protuberances (2–17.5 × 1.5–5.5 µm) at the apex. Pleurocystidia none. Lamellar trama subregular; hyphae 2.5–27.5 µm, thin- to very slightly (0.25 µm) thick-walled, hyaline, dextrinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 14–31.5 µm wide, thin-walled, with greyish contents, dextrinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 1.5–5 µm wide, embedded in a gelatinous matter, thin-walled, hyaline, typically smooth but uppermost hyphae often showing spiral thickening and locally inflated (16–30 µm wide) with excrescences (0.5–8 × 0.5–3 µm); hyphal ends cystidioid, 23–90 × 9.5–21 µm, thin-walled, hyaline, with excrescences (0.5–20 × 0.5–3.5 µm). Spinules on the pileal surface formed of erect bundles of pileipellis hyphae. Stipitipellis a cutis with clusters of caulocystidia; hyphae 1–8 µm wide, thin- to slightly (0.5 µm) thick-walled. Caulocystidia 20–70 × 4–11 µm, cylindrical or fusoid with acuminate or tapering apex, slightly (0.5 µm) thick-walled, with

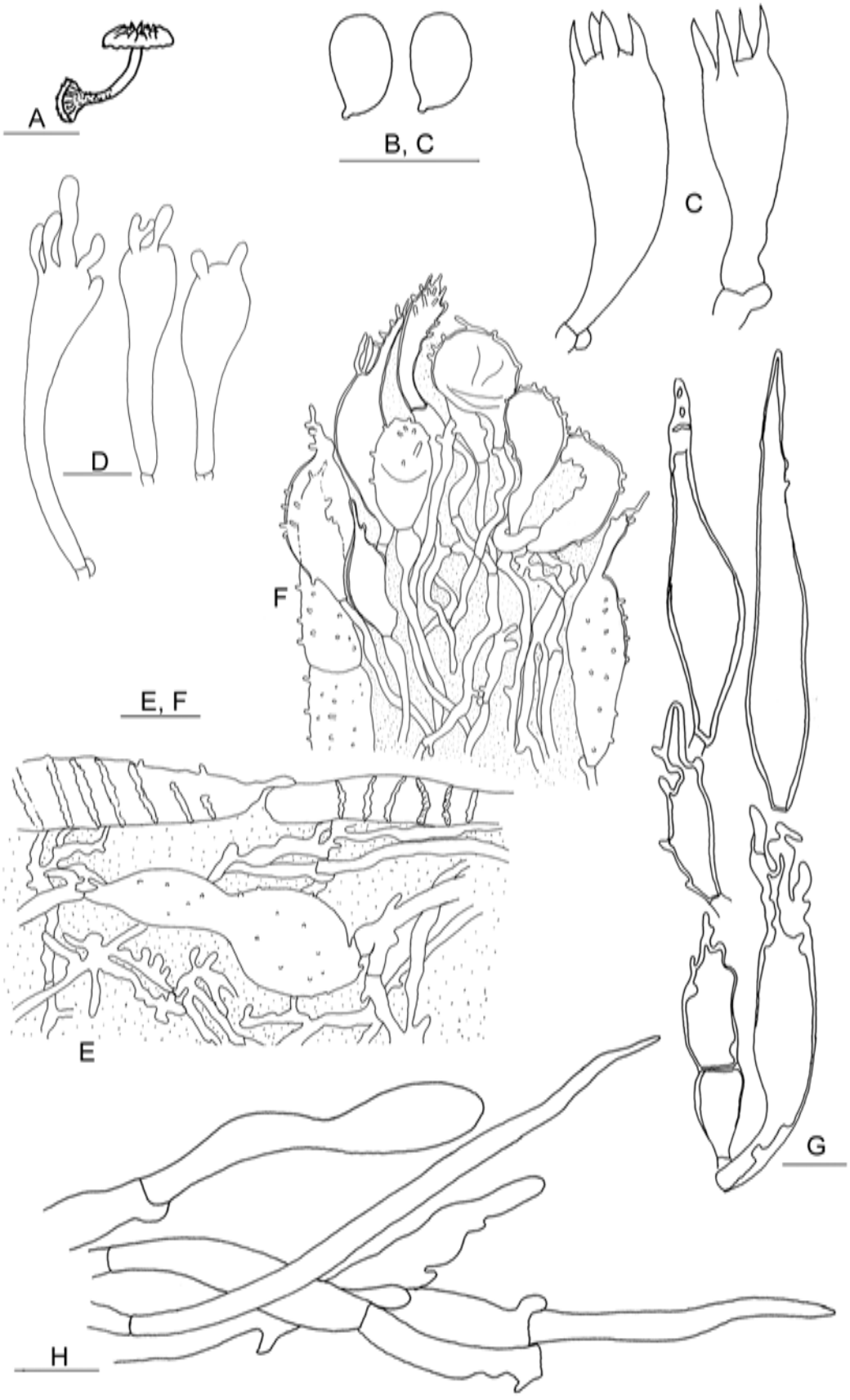


Figure 7. *Mycena kapotha*: A; basidioma; B, basidiospores; C, Basidia; D, cheilocystidia; E, hyphae of the pileipellis; F, spinule with cystidioid hyphal ends; G, caulocystidia; H, stipe basal cells. Scale bars: A = 5 mm; B-H = 10 µm.

simple or furcate excrescences (0.5–14 × 0.5–3 µm). Covering cells of basal disc 31–92 × 4–9.5 µm, cylindrical with pointed apex, smooth or with excrescences (0.5–14 × 0.5–3 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in group, on the bark of standing trees (*Phyllanthus emblica*) and woody climbers (*Calycopteris floribunda*), on decaying leaves and twigs. July-November.

Additional collection examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 26 November 2010, *D.M. Aravindakshan DM518*, K(M) 180037.

Notes:—Because of its pubescent basal disc, spinulose pileus and ellipsoid and amyloid basidiospores, *M. kapotha* belongs to sect. *Basipedes*. *Mycena stylobates*, especially the Sri Lankan collection described by Pegler (1986), shows striking similarity to the present one in having a pileus with minute spinules, similar-sized cheilocystidia and basidia, and a discoid stipe base with hymenial impression on it. But that species differs in having somewhat larger basidiomata (stipe up to 50 mm long), numerous lamellae (up to 24), larger basidiospores (7–10 × 2.7–4.5 µm), irregular or inflated-clavate cheilocystidia, and smooth caulocystidia.

Mycena spinosa differs from *M. kapotha* in having smaller basidiospores (4.5–5.5 × 3–3.5 µm), cheilocystidia with numerous short excrescences, and a different type of pileipellis hyphae. *Mycena quadratipes*, although having similar-sized basidiomata and basidiospores, differs from *M. kapotha* in having quadrate stipe base, smaller and narrower cheilocystidia with minute excrescences, and hyphae of the pileipellis of a different type. In *M. tenuispinosa*, *M. pseudoseta*, *M. mimicoseta* and *M. zikhara*, the spines are made of agglutinated, densely spinulose cylindrical hyphae and this feature makes them different from the present one.

It was observed that the specimens of *M. kapotha* growing on the bark of standing trees or climbers were much smaller than those growing on decaying litter. In all other macro- and microscopic features these two forms were similar.

8. ***Mycena nirbala*** Aravind. & Manim. *sp. nov*. Pl. 1 H; Fig. 8 A–G

MycoBank MB811078

Diagnosis:—Characterised by very small, delicate basidiomata; a greyish brown pileus beset with spinules that are formed of two types of hyphae; and clavate cheilo- and caulocystidia. Differing from *M. mucor* in having spinules on the pileus, smaller basidiospores, and cheilo- and caulocystidia of a different morphology.

Holotype:—INDIA. Kerala State: Thrissur District, Peechi Forest Area, 7 October 2009, *D.M. Aravindakshan DM336*, K(M) 180039 (K!).

Etymology:—*nirbala* (Sanskrit), delicate.

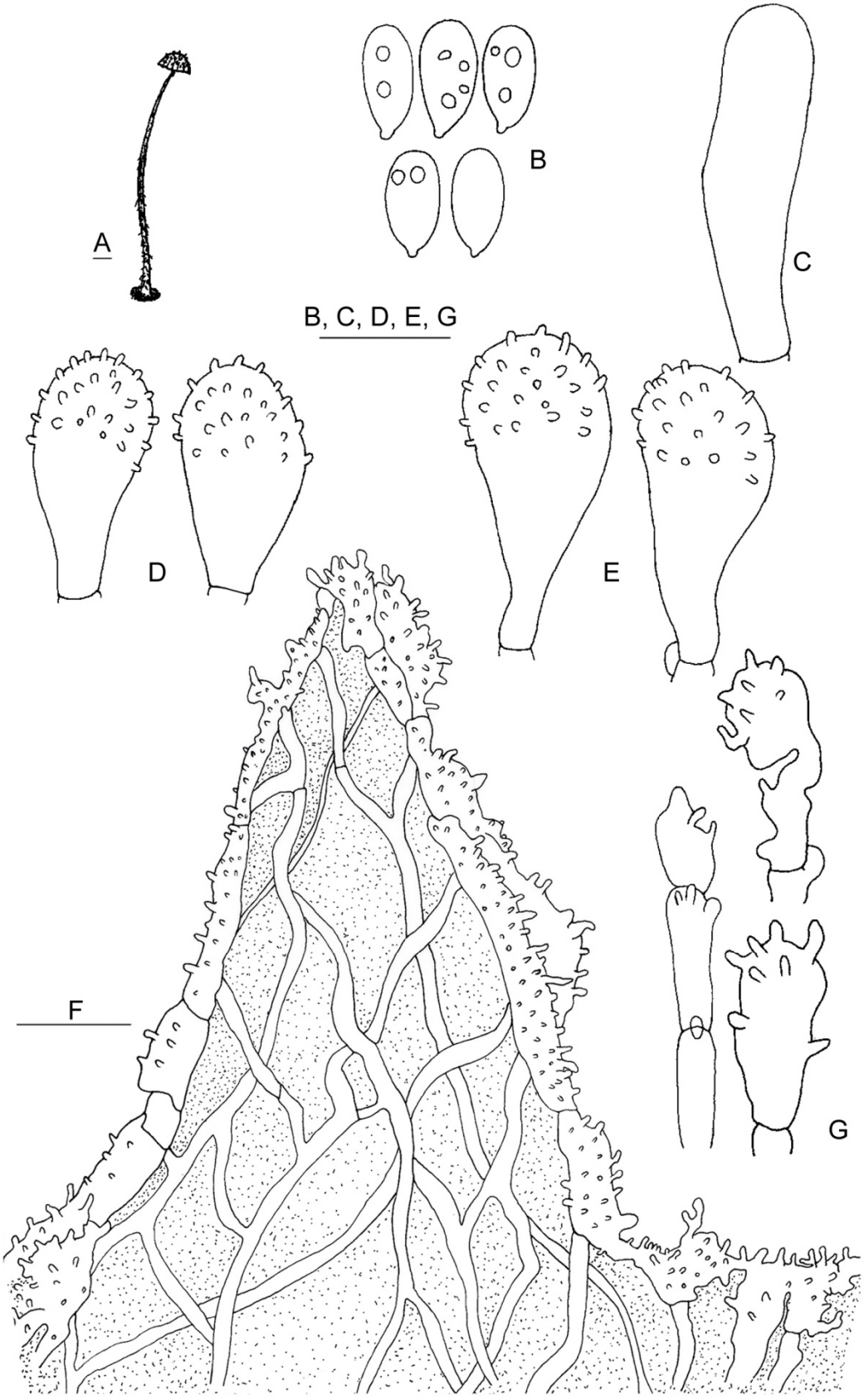


Figure 8. *Mycena nirbala*: A, basidioma; B, basidiospores; C, basidiole; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, caulocystidia. Scale bars: A = 1 mm; B-G = 10 µm.

Basidiomata very small, delicate. Pileus 1–2.5 mm diam., up to 1.25 mm high, parabolic to conic when young, becoming broadly conic with age; surface greyish brown (5E4) at the centre and on the striations, off-white elsewhere when young, becoming off-whitish all over with age, translucent-striate, beset with scattered spinules that are more on the disc; margin straight, entire when young, becoming crenate with age. Lamellae 8–10 reaching the stipe, adnexed, seceding, off-white, less than 0.25 mm thick, subdistant, with lamellulae of one length; edge very finely torn under a lens, concolourous with the sides. Stipe 4–12 × 0.25–0.5 mm, central, terete, almost equal when young, becoming tapering towards apex with age, hollow; surface translucent, off-white, finely pubescent, more so towards the base, less so or almost glabrous towards the apex; base discoid, with radial impression on it. Context thin, not conspicuous. Odour and taste not recorded.

Basidiospores 7–9 × 3.5–4.5 (8.1 ± 0.50 × 4.05 ± 0.32) µm, Q = 1.7–2.29, Q_m = 2.01, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidioles 20–22 × 6.5–7 µm, clavate, thin-walled, hyaline. Basidia not retrieved. Lamella-edge sterile. Cheilocystidia 13–20.5 × 8–10 µm, clavate, thin-walled, hyaline, with conical or cylindrical excrescences (0.5–2 × 0.5–1 µm) on upper half. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2.5–10 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 6–19 µm wide, thin-walled, with pale greyish contents that dissolve in KOH, vinoid in Melzer's reagent. Pileipellis a cutis; upper hyphae 1.5–11 µm wide, locally inflated, thin-walled, hyaline, with short, conical or cylindrical excrescences (0.5–3.5 (6) × 0.5–1 µm); lower hyphae narrower 1–4 µm wide, embedded in a gelatinous matter, thin-walled, hyaline, smooth, with both normal and loop-like clamp connections. Spinules on the pileal surface formed of erect bundles of hyphae of the pileipellis. Pileus marginal cells 14–23 × 8–11 µm, similar to cheilocystidia. Stipitipellis a cutis; hyphae 1–3 µm wide, thin-walled, hyaline, smooth. Caulocystidia 14–17 × 5–6.5 µm, clavate or rarely irregularly shaped, thin-walled, hyaline, with simple, cylindrical excrescences (1–3 × 0.5–1 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. October.

Notes:—The ellipsoid basidiospores, the pileus with a separable pellicle, the sessile cheilocystidia, the concolourous lamella-edge, the stipe with a basal disc and the caulocystidia that are not variously and coarsely diverticulate lead *M. nirbala* to sect. *Basipedes*. Clamp connections and cheilocystidia with very slender excrescences observed in *M. nirbala* are also observed in *M. mucor* reported from Europe and North America. Like the present species, *M. mucor* also has a grey-brown coloured pileus with whitish margin, ascending and seceding lamellae, similar-sized cheilocystidia, similar type of hyphae of the pileipellis and habitat on decaying leaves. But that species differs in lacking spinules on the pileal surface and in having larger basidiospores, cheilocystidia with a few, long (18 µm), curved to flexuous excrescences, and much elongated (65 µm), flexuous to kinky caulocystidia.

III**.** ***Mycena*** section ***Calodontes*** (Fr. ex Berk.) Quél., Mémoires de la Société d'Emulation de Montbéliard II 5: 102 (1872).

Basidiomata medium-sized to large. Pileus glabrous, usually somewhat lubricous when moist, frequently with purplish or violaceous tints. Lamellae ascending to almost horizontal or sometimes

decurrent, the edges more intensely coloured (subsect. *Marginatae*) or paler to white (subsect. *Purae* and subsect. *Violacellae*). Stipe fragile to firm or tough, frequently with purplish or violaceous tints, base covered with fine fibrils. Basidiospores ellipsoid to elongate, amyloid or inamyloid. Basidia clavate, 4-spored. Cheilocystidia often fusiform and apically broadly rounded with coloured or colourless contents, generally smooth. Pleurocystidia similar or absent. Hyphae of both the pileipellis and stipitipellis smooth. Caulocystidia smooth.

Type species:—*Mycena pura* (Pers.) P. Kumm.

Only a single species of section *Calodontes* was encountered during the present study.

9. ***Mycena sirayuktha*** Aravind. & Manim. *sp. nov*. Pl. 1 I ; Fig. 9 A–F

MycoBank MB811170

Diagnosis:—Characterised by a greyish red, shiny pileus surface; strongly intervenose lamellae; ellipsoid, inamyloid basidiospores; versiform cheilocystidia; gelatinised hyphae of the pileipellis with scattered excrescences, and a stipitipellis devoid of caulocystidia. Differing from *M. fenestrata* in having pleurocystidia and a stipitipellis devoid of caulocystidia.

Type:—INDIA. Kerala State: Munnar District, Mattupetti, 15 August 2010, *D.M. Aravindakshan DM477*, K(M) 180052 (K!).

Etymology:—*sirayuktha* (Sanskrit), striate.

Basidiomata medium-sized. Pileus 15–25 mm diam., conico-convex when young, becoming nearly applanate with age; surface greyish brown (8E3) at the centre and on the striations and greyish red (7B2) or orange white (6A2) elsewhere, translucent-striate, glabrous, shiny, wet; margin straight and entire when young, becoming nearly plane and undulate or fissile with age. Lamellae up to 20 reaching the stipe, strongly intervenose, adnate, horizontal, greyish red (7B2), up to 2 mm thick, subdistant, with lamellulae of 2 lengths; edge finely torn or serrate under the lens, concolourous with the sides. Stipe 54–56 × 1.5–2 mm, central, terete, almost equal, hollow; surface translucent, reddish brown (8E5) or brown (7E5) towards the apex, becoming pale brownish towards the base, glabrous; base slightly swollen, with scanty, white basal mycelium. Context not conspicuous, 0.75 mm wide, concolourous with the pileus. Odour and taste not distinctive.

Basidiospores 6–8 (9) × (3.5) 4–5 (7.1 ± 0.60 × 4.29 ± 0.39) µm, Q = 1.3–2, Q_m = 1.67, ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia 17–24 × 6–8 µm, clavate, bearing 4 sterigmata up to 9 µm long. Lamella-edge heterogeneous. Cheilocystidia crowded, 20–47 × 6.5–11 µm, gelatinised, versiform: lageniform or fusoid, clavate or utriform, thin-walled, hyaline, smooth or occasionally with apical narrow protrusions (1–5.5 × 1–1.5 µm). Pleurocystidia rare, 23–30 × 9–12 µm, cylindrical, thin-walled, hyaline, smooth. Lamellar trama subregular; hyphae 1.5–26 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 7–30 (39) µm wide, thin-walled, with pale purplish contents that are easily removed by KOH, faintly dextrinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1–7 µm wide, slightly gelatinised, thin-walled, hyaline, smooth or rarely with simple, finger-like excrescences (1–6 × 1 µm). Stipitipellis a cutis; hyphae 2–6 µm wide, thin-walled, hyaline, smooth.

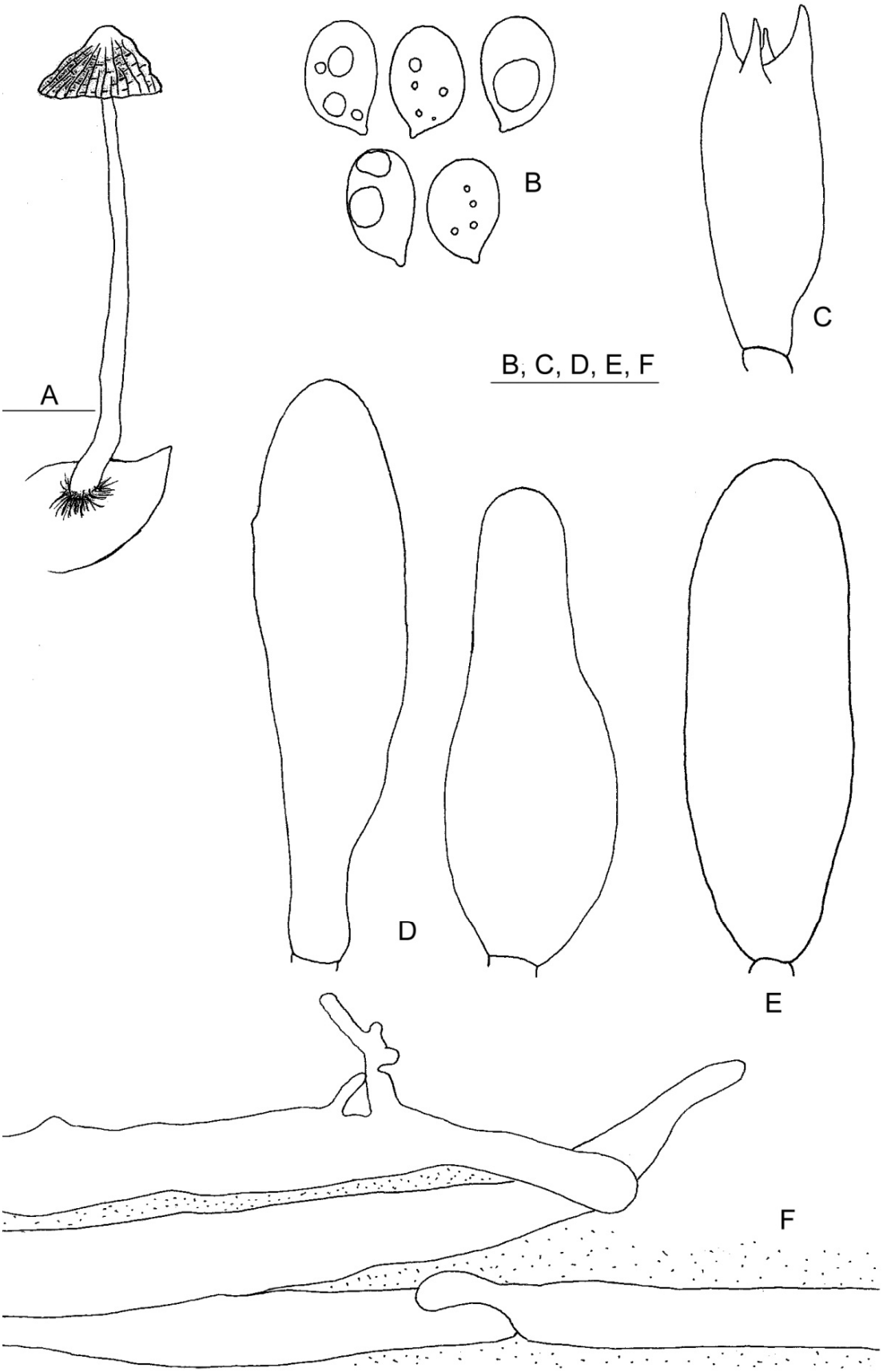


Figure 9. *Mycena sirayuktha*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidium; F, hyphae of the pileipellis. Scale bars: A = 1 cm; B-F = 10 µm

Stipe trama pale purplish in water, becoming hyaline in KOH, strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. August.

Additional collection examined:—INDIA. Kerala State: Munnar District, Mattupetti, 15 August 2010, *D.M. Aravindakshan DM469*, K(M) 180083.

Notes:—The inamyloid basidiospores, the horizontal lamellae and the lamellar trama that turns vinescent in Melzer's reagent are the characters leading *M. sirayuktha* to sect. *Calodontes*. Cheilocystidia and pleurocystidia with colourless contents place it in subsect. *Purae*. Maas Geesteranus (1992b) considered only two species with adnate, pale coloured lamellae, viz., *M. pura* and *M. rosea* in the subsect. *Purae*. *Mycena pura* has a stout stipe, a concentric depression around the umbo, much longer (up to 80 µm) cheilo- and pleurocystidia, non-gelatinised hyphae of the pileipellis and distinctly broader terminal cells of hyphae of the stipitipellis. Likewise, *M. rosea* also differs from *M. sirayuktha* in having numerous (40 or more) lamellae, much longer (up to 90 µm) cheilo- and pleurocystidia, non-gelatinised hyphae of the pileipellis and caulocystidia. Both *M. fenestrata* Maas Geest. & de Meijer and *M. proxima* Maas Geest. & de Meijer reported from Brazil (Maas Geesteranus & de Meijer 1997) have almost similar-sized basidiomata, basidiospores and cheilocystidia, conspicuously intervenose lamellae and somewhat gelatinised hyphae of the pileipellis. But those species differ from *M. sirayuktha* in having distinctly amyloid basidiospores and caulocystidia and in lacking pleurocystidia.

Mycena seminau A.L.C. Chew & Desjardin, recently described from Malaysia (Chew *et al*. 2014), shows striking similarity with *M. sirayuktha* in having almost similar-sized basidiospores and basidia, rarely occurring pleurocystidia, a pileus trama with coloured contents and frequent clamp connections, and in lacking caulocystidia. But that species differs in having slightly larger cheilocystidia and non-gelatinised hyphae in the pileipellis. Both *M. cahaya* A.L.C. Chew & Desjardin and *M. sinar* A.L.C. Chew & Desjardin (Chew *et al*. 2014) show similarity with the present species owing to the presence of similar-sized basidiospores and basidia, cheilocystidia and strongly intervenose lamellae, and in the absence of caulocystidia. But the former species differs from the present one in having larger cheilo- and pleurocystidia, a hyaline pileus trama and non-gelatinised hyphae of the pileipellis while the latter species differs in having differently shaped cheilocystidia, a hyaline pileus trama and non-gelatinised hyphae of the pileipellis and in lacking pleurocystidia.

IV. ***Mycena*** section ***Exornatae*** Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 85 (4): 538 (1982).

Basidiomata medium-sized. Pileus covered with a gelatinous pellicle, pruinose, somewhat viscid. Lamellae ascending, free or attached to a slight collar. Stipe hollow puberulous, not viscid, springing from a white, pubescent basal disc. Basidiospores ellipsoid, amyloid. Basidia 4-spored, clamped. Cheilocystidia fusiform, clamped. Pleurocystidia absent. Hyphae of the pileipellis clamped, producing dense growth of much branched side branches which are embedded in a gelatinous matter, covered with thorn-like excrescences and at the surface of the pileus terminated by clavate, diverticulate pileocystidia. Hyphae of the stipitipellis smooth, not

embedded in a gelatinous matter, caulocystidia fusiform, clamped. Basidiomata mostly luminescent.

Type species:—*Mycena chlorophos* (Berk. & M.A. Curtis) Sacc.

Two species of this section were observed during this study.

Key to the species

1. Detersile elements over the primordium present; mycelium bioluminescent; caulocystidia with a long protrusion; basidiospores 6.5–9 × 3–5 µm..... 10. ***Mycena deeptha***

- Detersile elements absent; bioluminescence absent; caulocystidia without elongated protrusion; basidiospores 7–9 × 4.5–6 µm.....11. ***Mycena snigdha***

10. ***Mycena deeptha*** Aravind. & Manim., Mycosphere 3 (5): 557 (2012). Pl. 1 J; Fig. 10 A–I

Holotype:—INDIA. Kerala State: Kozhikode District, Beypore, 3 October 2009, *D.M. Aravindakshan DM334c*, K(M) 178331 (K!).

Basidiomata small, delicate. Pileus 1–9.5 mm diam., 0.5–0.75 mm high, parabolic to conic when young, becoming nearly applanate with a centrally flattened depression or rarely umbilicate with age; surface yellowish grey (4B2) or dark blonde (5D4) at the centre, tobacco brown (5F6) in the middle, and whitish or yellowish white (4B1) towards margin when young, becoming brownish orange (5C3) at the central depression, greyish brown (5D3) in the middle and brownish grey (5C2) to marble white (5B2) towards margin with age, translucent-striate when young, becoming plicato-sulcate with age, finely pruinose all over, dry; margin initially straight, becoming plane or upturned, fimbriate. Lamellae 15–18 (23) reaching the stipe, free or narrowly adnate and then seceding to form a pseudocollarium, pale greyish or whitish, thin, 0.25–0.5 mm wide, close, with lamellulae of 2–5 lengths; edge finely hairy under a lens, concolourous with the sides. Stipe 6–30 × 0.25–0.5 mm, central, terete, almost equal when very young, tapering towards apex with age, hollow; surface translucent, white to cream (4A3), becoming yellowish or greyish yellow (4B3) or yellowish grey (4B2), entirely densely pubescent when young, becoming almost glabrous towards apex with age; base discoid, of radiating mycelium, hairy. Context not conspicuous, less than 0.5 mm wide. Odour and taste not distinctive. Basidiomata not luminescent, but the mycelium (that on the natural substratum as well as that cultured on artificial media) shows very faint luminescence.

Basidiospores 6.5–9 (11) × 3–5 (5.5) (7.64 ± 0.62 × 3.87 ± 0.40) µm, Q = 1.5–2.67, Q_m = 1.99, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, strongly amyloid, with oil guttules. Basidia 14–19 × 6.5–9.5 µm, clavate, bearing 4 sterigmata up to 3.5 µm long. Lamella-edge homogeneous. Cheilocystidia 14–30 × 5.5–10 µm, vesiculose, smooth, thin-walled, hyaline, with rostrate or acute or acuminate apex, often with an apical protrusion (4.5–15 × 1–2.5 µm) that may rarely show some branching. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 3.5–17 (29) µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 6–30 µm wide, thin-walled, hyaline to pale greyish, faintly vinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 2–11 µm wide, thin-walled, hyaline, with

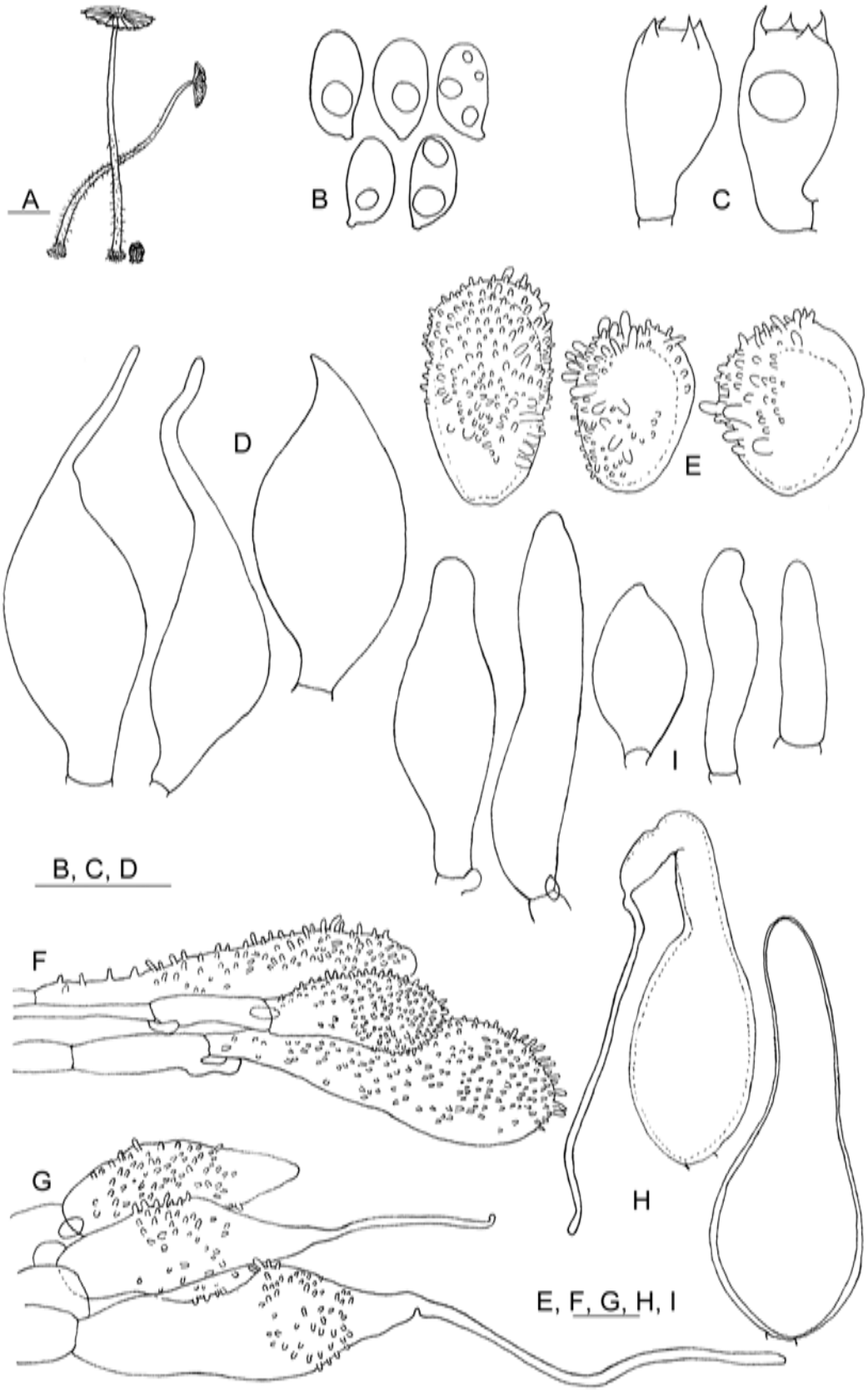


Figure 10. *Mycena deeptha*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, detersile element on the primordium; F, hyphae of the pileipellis with pileocystidia; G, pileus marginal cells; H, caulocystidia; I, stipe basal cells. Scale bars: A = 5 mm; B-I = 10 µm.

numerous lateral thorn-like protrusions (2.5–5 µm long), embedded in a gelatinous matrix, with prominent, loop-like clamp connections; pileocystidia 23–45.5 × 10–16 µm, elongated-clavate, thin-walled, with simple, conic or cylindrical excrescences (0.5–6 × 0.5–1 µm). Detersile elements over the pileus of primordium 17–35.5 × 14–25 µm, clavate or subglobose, thick-walled (up to 3.5 µm) towards apex, hyaline, with simple, conic or cylindrical or coarse excrescences (0.5–7 × 0.5–2 µm). Pileus marginal cells 17–60 × 9.5–19 µm, clavate or lageniform, seldom with hairy protrusion (29.5–118 µm long), with simple, conic or cylindrical excrescences at the middle or towards apex (0.5–6 × 0.5–1 µm). Stipitipellis a cutis of smooth hyphae; hyphae 1.5–8 µm wide, thin-walled, hyaline. Caulocystidia 25–73.5 × 10.5–16 µm, narrowly conic or narrowly lageniform, smooth, slightly (1.5 µm) thick-walled, often with a long protrusion (53–92.5 µm long). Stipe basal cells 13–93.5 × 5–20 µm, clavate, vesiculose or utriform or cylindrical, thin-walled, hyaline. Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, Habitat and phenology:—In group or scattered, on decaying fruits of *Vateria indica* and on decaying leaves of various plants. June-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 27 June 2006, *D.M. Aravindakshan DM31*; Kozhikode District, Beypore, 22 September 2009, *D.M. Aravindakshan DM334a*, K(M) 178332; 17 August 2009, *D.M. Aravindakshan DM334g*; Wayanad District, Thirunelli, 27 November 2009, *D.M. Aravindakshan DM365*, K(M) 178334; Kollam District, Kulathupuzha, 29 September 2010, *D.M. Aravindakshan DM517*.

Note:—In several features, this species is very similar to *M. rhenana* of sect. *Basipedes* that according to Desjardin *et al*. (2007) is best placed in sect. *Exornatae*. But that species has somewhat smaller basidiomata, numerous lamellae (20–26), and marginal cells, caulocystidia, and stipe basal cells of a different type. In addition, it has no cheilocystidia and its pileipellis is not gelatinised. Also, that species is not known to be luminescent. Aravindakshan *et al*. (2012) provided a detailed account of this species.

11. ***Mycena snigdha*** Aravind. & Manim., Mycosphere 4 (1): 147 (2013). Pl. 1 K; Fig. 11 A–H

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 28 July 2011, *D. M. Aravindakshan DM528*, K(M) 178335 (K!).

Basidiomata very small, delicate. Pileus 1.5–4.5 mm diam., 0.75–1 mm high, conico-parabolic to hemispherical when young, becoming plano-convex with a centrally flattened depression; surface brown (5E4) or greyish brown (7E3) at the centre and marble white (5B2) or brownish grey (7D2) towards margin when young, becoming brown (5E4) or greyish brown (5D3, 7F3) at the centre and brownish grey (5C3, 7C2) towards margin with age, translucent-striate when young, becoming nearly sulcate towards margin, finely pruinose, dry; margin slightly incurved and entire when young, becoming straight and finely torn with age. Lamellae 13–19 reaching the stipe, free or attached to a slight collar, pale grey or off-white, 0.5–1 mm thick, subclose, with lamellulae of 2 lengths; edge finely torn under a lens, paler than the sides. Stipe 2–10.3 × 0.25–1 mm, central, terete, almost equal when young, becoming slightly tapering towards apex with age, hollow; surface translucent, greyish to white when young, becoming marble white (5B2) with age, finely

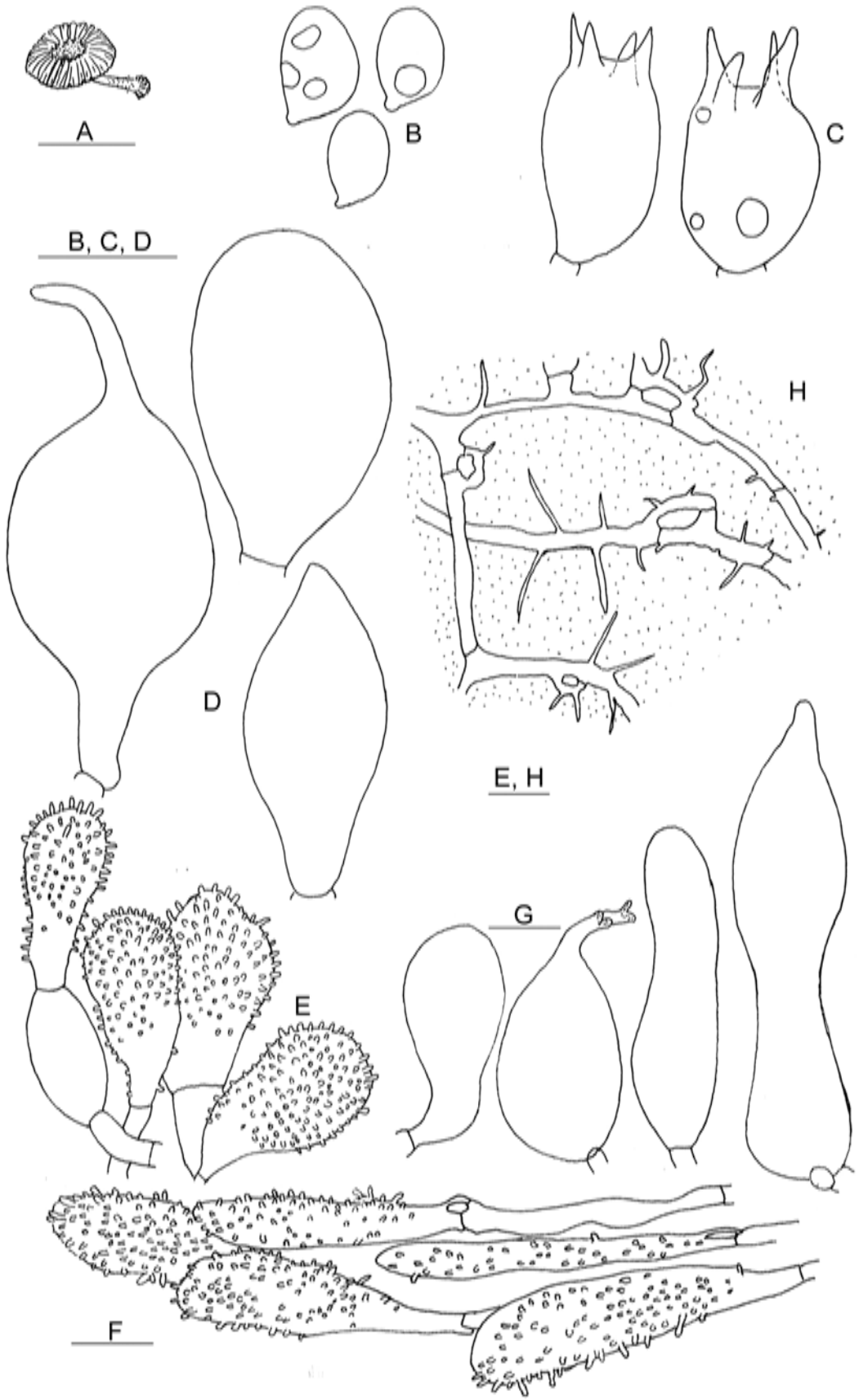


Figure 11. *Mycena snigdha*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis with pileocystidia; G, caulocystidia; H, hyphae of the pileipellis showing thorn-like excrescences. Scale bars: A = 1 mm; B-H = 10 µm

pubescent all over when young, becoming glabrous towards apex, more or less densely pubescent towards base with age; base discoid, of radiating mycelium, hairy. Context not conspicuous. Odour and taste not distinctive.

Basidiospores (6) 7–9 (10.5) × 4.5–6 (7.63 ± 0.77 × 4.86 ± 0.53) µm, Q = 1.3–1.85, Q_m = 1.57, ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia (10) 14–20 × 8.5–11 µm, narrowly clavate, bearing 4 sterigmata up to 5.5 µm long. Lamella-edge sterile. Cheilocystidia crowded, 18–40 × 9–20 µm, fusoid or broadly fusoid or vesiculose, thin- to slightly (0.5 µm) thick-walled, hyaline, often rostrate or with a very fragile, often curved, filamentous, rarely furcate protrusions (2–16 × 3–4 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2–29 µm wide, thin-walled, hyaline to pale greyish, faintly vinoid to moderately vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 3–34 µm wide, thin-walled, hyaline to pale greyish, faintly to moderately vinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 1.5–13 (20) µm wide, thin-walled, hyaline, with numerous lateral thorn-like protrusions (3–17 µm long), embedded in a gelatinous matrix, with prominent, loop-like clamp connections; pileocystidia 34.5–78 × 11–34.5 µm, clavate to narrowly clavate or obovoid, thin-walled, hyaline, with simple, cylindrical excrescences (0.5–6.5 × 0.5–1.5 µm). Pileus marginal cells 16–51.5 × 12–26.5 µm, clavate or ellipsoid or fusoid, thin-walled, hyaline, with simple, cylindrical excrescences (0.5–2.5 × 0.5–1 µm). Stipitipellis a cutis of smooth hyphae; hyphae 1.5–8 µm wide, thin- to very slightly (0.25 µm) thick-walled, hyaline. Caulocystidia (16) 27–146 × 7–23 (27) µm, ellipsoid, oblong or cylindrical or narrowly fusoid or lageniform, thin-walled, hyaline, pedicellate or not, occasionally mucronate or with an apical protrusion (4–10 × 1–2 µm). Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—On the bark of standing trees usually among mosses and also on decaying twigs, scattered, June-July.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 24 July 2007, *D.M. Aravindakshan DM184*, K(M) 178336; 4 July 2010, *D.M. Aravindakshan DM445*; 8 June 2011, *D.M. Aravindakshan DM523*.

Note:—Within the sect. *Exornatae,* this species is closely allied with *M. discobasis* Métrod sharing several macro- and microscopic features. However, unlike *M. discobasis*, *M. snigdha* has non-luminescent basidiomata, smaller pilei (less than 5mm broad), cheilocystidia often with a long apical prolongation, hyphae of the pileipellis with prominent thorn-like excrescences and loop-like clamp connections and a pileal margin composed entirely of acanthophysoid terminal cells. Also, no bioluminescence was observed when fresh basidiomata of *M. snigdha* with intact basal mycelium and supporting bark were observed in a dark room.

V. ***Mycena*** section ***Fragilipedes*** (Fr.) Quél., Mémoires de la Société d'Emulation de Montbéliard II. 5: 105 (1872).

Basidiomata fairly small to medium-sized. Pileus generally pruinose at first, glabrescent, in some species lubricous when wet, variously coloured. Lamellae ascending, free or adnate or somewhat decurrent, edge white or olive green or brownish. Stipe fragile to firm or cartilaginous, pruinose at least at the top, generally glabrescent, dry or lubricous when wet, the base covered with coarse

fibrils. Basidiospores ellipsoid to almost cylindrical, amyloid. Basidia 2- or 4-spored. Cheilocystidia versiform. Pleurocystidia similar or absent. Hyphae of both pileipellis and stipitipellis smooth or diverticulate.

Type species:—*Mycena zephirus* (Fr.) P. Kumm.

Seven species belonging to sect. *Fragilipedes* have been recorded during the present study.

Key to the species

1. Basidiomata minute; both pleurocystidia and clamp connections absent; basidiospores 7–9 × 3.5–4.5 µm .....12. ***Mycena lomaza***

- Basidiomata small to medium-sized; both pleurocystidia and clamp connections present 2

2. Hyphae of the pileipellis with distinct cystidioid terminal cells 3

- Hyphae of the pileipellis without distinct cystidioid terminal cells.....5

3. Both cheilo- and pleurocystidia exudative; oleiferous hyphae numerous in pileus trama; habitat on decaying leaves; basidiospores 8–11.5 (12) × 4.5–6 µm..... .....13. ***Mycena parnaja***

- Cystidia not exudative; oleiferous hyphae scanty or absent; habitat on bark of trees..... 4

4. Pileus with a prominent acute umbo; odour weakly alkaline; caulocystidia with excrescences; basidiospores 8.5–11 × 5–7.5 µm.....14. ***Mycena ziragra***

- Pileus without an umbo; odour not distinctive; caulocystidia smooth; basidiospores 6.5–8.5 × 4.5–5.5 µm.....15. ***Mycena rajatha***

5. Pileus reddish brown; hyphae of the pileipellis smooth for the greater part; hyphae of the stipitipellis smooth; basidiospores 6–8.5 × 3.5–4.5 µm .....16. ***Mycena aruna***
- Pileus brown to dark brown; hyphae of the pileipellis with dense excrescences; hyphae of the stipitipellis nodulose-diverticulate especially towards the stipe base 6

6. Caulocystidia absent; stipe base with strigose basal mycelium; basidiospores 8.5–11 × 4.5–6 µm..... 17. ***Mycena profusa***

- Caulocystidia present; stipe base with mycelial cords; basidiospores 8–12 × 4.5–6.5 µm ....18. ***Mycena kapila***

12. ***Mycena lomaza*** Aravind. & Manim. *sp. nov*. Pl. 2 A; Fig. 12 A–H

MycoBank MB811079

Diagnosis:—Characterised by minute, whitish basidiomata with a finely pubescent pileus and stipe; stellately seceding lamellae; prominent vesiculose basidia; smooth, apically tapering cheilocystidia and caulocystidia; hyphae of the pileipellis with both short, cylindrical

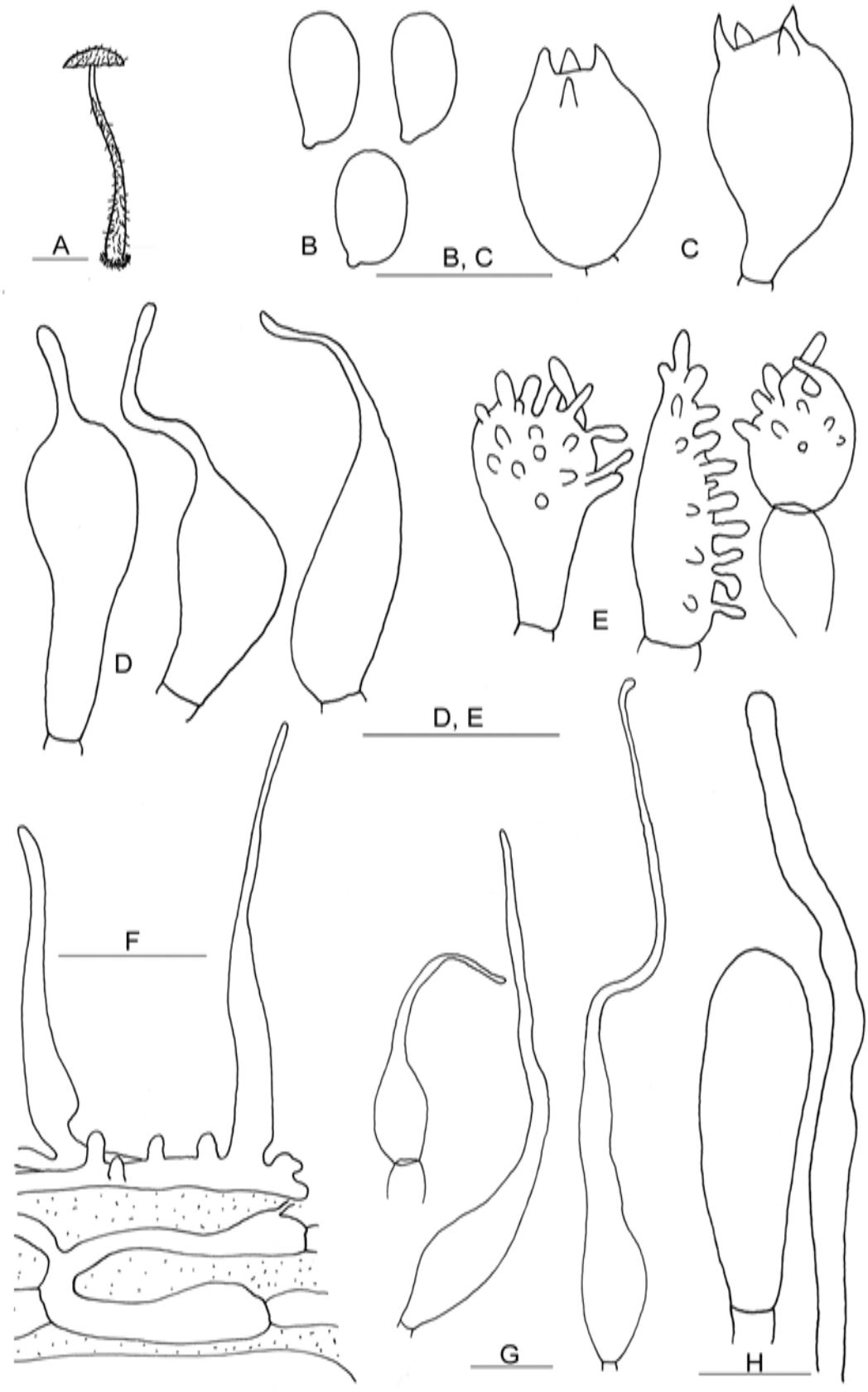


Figure 12. *Mycena lomaza*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, caulocystidia; H, stipe basal cells. Scale bars: A = 1 mm; B-H = 10 µm.

excrescences and long, gradually tapering protrusions; and hyphae devoid of clamp connections. Differing from *M. fallax* in having a finely pubescent pileus, smaller cheilocystidia, caulocystidia, and slightly gelatinised hyphae of the pileipellis.

Holotype:—INDIA. Kerala State: Kozhikode District, Kakkayam, 28 August 2009, *D.M. Aravindakshan DM330*, K(M) 179987 (K!)

Etymology:—*lomaza* (Sanskrit), pubescent.

Basidiomata very small, delicate. Pileus 0.45–1.1 mm diam., 0.2 mm high, initially parabolic to conic, then convex to broadly convex and finally becoming applanate; pale greyish at the centre and on the striations, whitish elsewhere, translucent-striate, becoming slightly sulcate towards the margin, very finely pubescent; margin straight and crenate, denticulate or finely torn when young, becoming upturned and frequently fissile with age. Lamellae 8–9 reaching the stipe, adnexed, seceding stellately and becoming psuedocollariate, pure white, less than 0.5 mm wide, distant, with lamellulae of one length; edge finely torn under a lens, concolourous with the sides. Stipe 1–5 × 0.15–0.2 mm, central, terete, almost equal when young, becoming slightly tapering towards apex, hollow; surface translucent, white, erect, thin, pubescent all over when young, becoming almost glabrous at the apex with age; base broad, with fine basal mycelium. Context thin, not conspicuous. Odour and taste not distinctive.

Basidiospores 7–9 × 3.5–4.5 (7.63 ± 0.51 × 3.79 ± 0.) µm, Q = 1.75–2.29, Q_m = 2.02, oblong-ellipsoid, thin-walled, hyaline, smooth, strongly amyloid, with a few guttules. Basidia 11–16 × 7.5–9.5 µm, obovoid to ellipsoid, bearing 4 sterigmata up to 3.5 µm long. Cheilocystidia 10–21 × 4–6 µm, fusoid or clavate, thin-walled, hyaline, with a beak-like apical protrusion (2–5 (16) × 1–2 (3) µm). Pleurocystidia none. Lamellar trama subregular; hyphae 5.5–16 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 9–25 µm wide, thin-walled, hyaline or pale brownish or greyish, distinctly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–5 µm wide, gelatinised, thin-walled, hyaline, with short, cylindrical excrescences (1–4 × 1–3.5 µm), and with long, gradually tapering protrusions (10–59 × 4–5 µm), thin-walled, hyaline. Stipitipellis a cutis of smooth hyphae with scattered or clustered caulocystidia; hyphae 2–5 µm wide, hyaline, thin-walled. Caulocystidia 17–73 × 3–9 µm, narrowly conic with a long, gradually tapering apical part, thin-walled, hyaline. Stipe basal hyphae 3–12 µm wide, cylindric or fusoid apex, non-gelatinised, thin-walled, hyaline. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections not seen in any tissue.

Habit, habitat and phenology:—Scattered, on decaying leaves. August.

Notes:—Characters such as the oblong-ellipsoid, amyloid basidiospores, the hyphae of the pileipellis embedded in a gelatinous matter and the non-gelatinised hyphae of the stipitipellis lead *M. lomaza* to sect. *Fragilipedes*. Key to the Northern Hemisphere species of this section (Maas Geesteranus 1992b) leads the present species to *M. fallax* A.H. Sm. as that species has minute, white basidiomata with radiating fibrils at the stipe base, diverticulate hyphae in the pileipellis, less than 10 lamellae reaching the stipe, similar-sized basidiospores, and smooth hyphae in the stipitipellis. But *M. fallax* has a glabrous, watery white pileus, a glabrous stipe, larger cheilocystidia

(up to 43 µm long), non-gelatinised hyphae of the pileipellis, clamp connections, and oleiferous hyphae, and it lacks caulocystidia.

13. ***Mycena parnaja*** Aravind. & Manim. *sp. nov*. Pl. 2 B; Fig. 13 A–H

MycoBank MB811171

Diagnosis:—Characterised by fusiform, exudative cheilo- and pleurocystidia; numerous oleiferous hyphae in the pileus trama; and diverticulate hyphae of the pileipellis embedded in a thick gelatinous matrix. Differing from *M. gladiocystis* in having dark brown to orange grey basidiomata, hyphae of both the pileipellis and the stipitipellis with excrescences, caulocystidia with excrescences, growth on decaying leaves, and a different geographical location.

Holotype:—INDIA. Kerala State: Idukki District, Eravikulam National Park, 16 August 2010, *D.M. Aravindakshan DM488*, K(M) 180084 (K!).

Etymology:—*parnaja* (Sanskrit), occurring on leaves.

Basidiomata medium-sized. Pileus 2.5–21 mm diam., up to 5 mm high, conico-convex when young, becoming campanulate with age; surface dark brown (6F7) at the centre, brown (6E5) on the striations, orange grey (6B2) towards margin and light brown (6D4) elsewhere when young, becoming cocoa brown (6E6) at the centre and light brown (6D4) on the striations, whitish towards margin and brownish grey (6C3) elsewhere with age, often hydrophanous and changing to orange grey (6B2) at the centre and on the striations and off-white elsewhere, translucent-striate, slightly scrobiculate at disc, shiny, wet, with a separable pellicle; margin straight and crenulate when young, becoming nearly plane and undulate, eroded or finely torn with age. Lamellae 13–16 reaching the stipe, adnate, often with small decurrent tooth, whitish, up to 2.5 mm wide, subdistant, with lamellulae of 1–2 lengths; both edge and sides finely hairy under a lens; edge concolourous with the sides. Stipe 20–66 × 0.75–2 mm, central, terete, almost equal or slightly tapering towards the apex, hollow; surface translucent, brown (6E4) at the apex and dark brown (7F5) towards base when young, becoming whitish towards the apex and fawn brown (7E4) towards base with age, finely pruinose all over when very young, becoming almost glabrous at the apex with age; base slightly swollen, with basal mycelium. Context not conspicuous, 0.5 mm wide, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 8–11.5 (12) × 4.5–6 (9.6 ± 1.03 × 5.05 ± 0.46) µm, Q = 1.58–2.3, Q_m = 1.90, ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia 21.5–32 × 9–11 µm, clavate, bearing 4 sterigmata up to 8 µm long, with guttules. Lamella-edge sterile. Cheilocystidia crowded, 34.5–64 × 10–15.5 µm, fusiform, often with a long stalk, sometimes with a mucronate apex, very rarely with 1–2 protuberances (3–5 × 2–2.5 µm) on the middle part, thin- to very slightly (0.25 µm) thick-walled, hyaline, smooth. Pleurocystidia 33.5–62.5 × 8.5–15.5 µm, similar to cheilocystidia in all aspects. The apex of both cheilocystidia and pleurocystidia covered with basidiospores indicating some sticky exudations. Lamellar trama subregular; hyphae 2.5–21 µm wide, rather swollen towards the base of the lamellae and narrower and compact towards edge, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular, with numerous

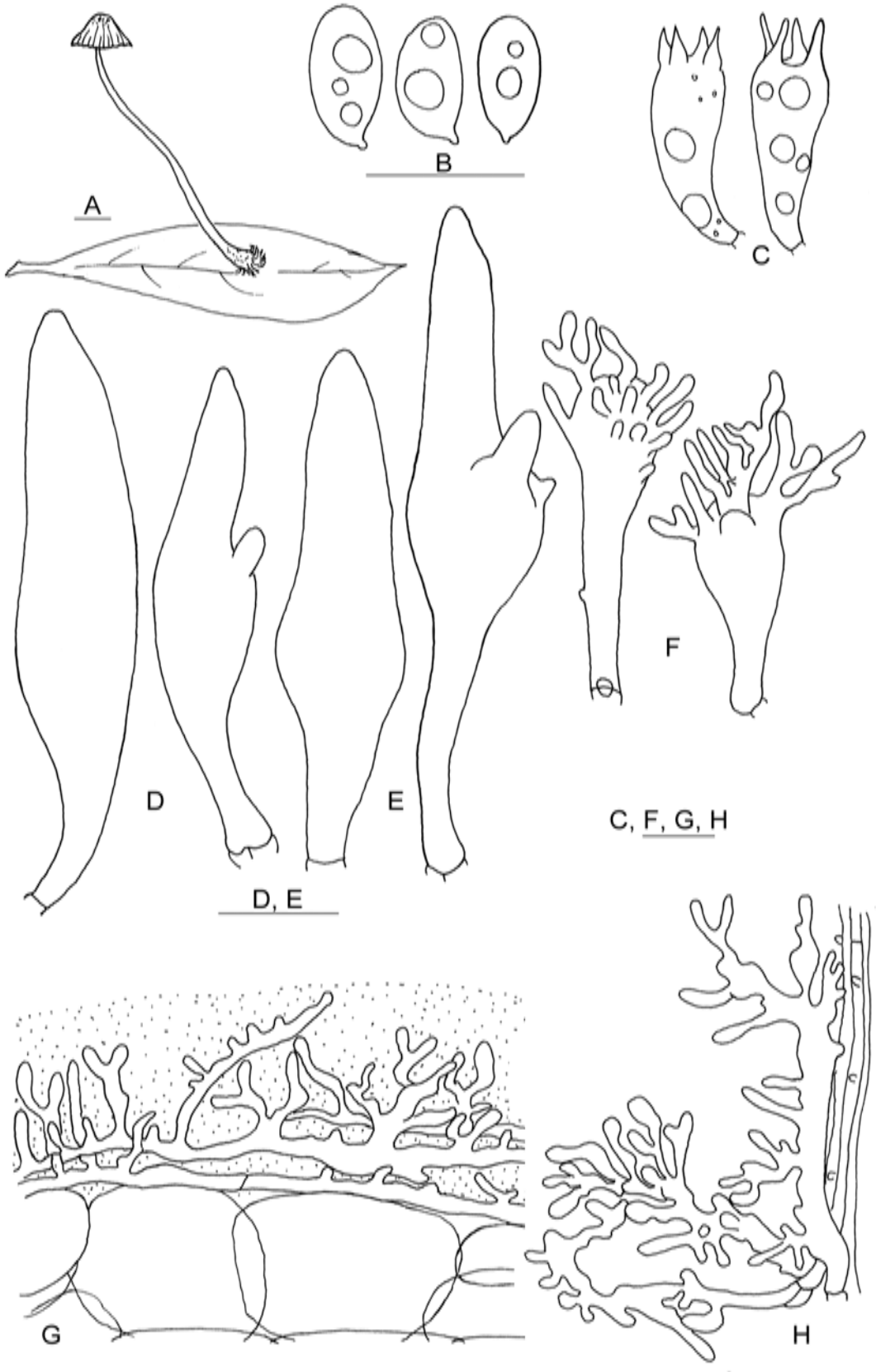


Figure 13. *Mycena parnaja*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pleurocystidia; F, pileus marginal cells; G, hyphae of the pileipellis embedded in gelatinous matrix; H, caulocystidia. Scale bars: A = 1 cm; B-H = 10 µm.

oleiferous hyphae; hyphae of the upper layers rather swollen, 19–28 µm wide, closely packed, thin-walled, with brownish contents; hyphae of the lower layers narrower, 3–9 µm wide, slightly gelatinous, thin-walled, vinoid in Melzer's reagent. Pileipellis an epicutis of hyphae with excrescences and with cystidioid terminal cells; hyphae 2–9 µm wide, embedded in a thick gelatinous matrix, thin-walled, hyaline, with simple or furcate digitate excrescences or protrusions (2–28 × 1–4.5 µm); terminal cells cystidioid 17–65.5 (95) × 6.5–13 µm, narrowly clavate or cylindrical, thin-walled, hyaline, with digitate excrescences (1–10 × 1–2 µm). Pileus marginal cells 31–80 × 10.5–15.5 µm, clavate to narrowly clavate, thin-walled, hyaline, with digitate or branched excrescences (2–15 × 1.5–4 µm) at the apex. Stipitipellis a cutis with terminal cells modified as caulocystidia; hyphae 1–4.5 µm wide, slightly gelatinised, thin-walled, hyaline, with excrescences (1–2 × 1–2 µm). Caulocystidia 24–120 × 5–7.5 µm, narrowly clavate or irregularly-shaped with simple or very complex excrescences (2–11.5 × 1.5–3.5 µm). Stipe trama with brownish grey contents, strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. August.

Notes:—When Maas Geesteranus's (1992b) key to the sections of *Mycena* is followed, characters such as the hyphae of the pileipellis covered with much branched excrescences and embedded in a gelatinous matter, the amyloid basidiospores and the concolourous lamella-edge lead *M. parnaja* to sect. *Insignes*. However, Villarreal *et al*. (1999) have restricted sect. *Insignes* for species with arcuate lamellae. Following this emended diagnosis of sect. *Insignes*, several *Mycena* species (four European species, *M. rubidofusca* M. Villarreal, Heykoop & Maas Geest., *M. mitis* Maas Geest. *M. corrugans* Maas Geest. and *M. gladiocystis* Esteve-Rav. & A. Ortega, and two American species, *M. quiniaultensis* Kauffman and *M. conspersa* Maas Geest. & de Meijer) previously included in this section got transferred to sect. *Fragilipedes*.

Mycena rubidofusca differs from *M. parnaja* in having a slightly umbonate, slightly viscid, dark reddish brown pileus with a non-separable pellicle, a rooting stipe, broadly ellipsoid basidiospores and a gelatinised stipitipellis and in lacking pleurocystidia. *Mycena mitis* has characters such as pale pink basidiomata, a nitrous odour, elongated pip-shaped or cylindrical basidiospores and absence of pleurocystidia making that species differ from the present one. *Mycena corrugans* has a watery greyish to white pileus and much larger basidiospores (12.5–16.1 × 7.2–9.4 µm). Although it has fusiform to lageniform cheilocystidia with a yellowish resinous material at the apex, *M. gladiocystis* is a distinct species with yellow or olivaceous basidiomata. *Mycena quiniaultensis* differs from *M. parnaja* in having a viscid, blackish brown pileus with a non-separable pellicle, narrower basidiospores, larger basidia and cheilocystidia, a gelatinised stipitipellis, smooth hyphae of pileipellis and stipitipellis, and curved to coiled terminal cells of the stipitipellis hyphae. *Mycena conspersa* has smaller basidiomata, a nitrous odour, narrower basidiospores, smaller cheilo- and caulocystidia, lamellae devoid of pleurocystidia, and the smooth hyphae of the pileipellis.

14. ***Mycena ziragra*** Aravind. & Manim. *sp. nov*. Pl. 2 C; Fig. 14 A–H

MycoBank MB811080

Diagnosis:—Characterised by a corticolous habitat, a conic to campanulate pileus with a prominent acute umbo, a faint nitrous odour, an appendiculate pileus margin, ellipsoid to subamygdaliform and amyloid basidiospores, narrowly or broadly fusiform cheilocystidia and pleurocystidia with mucronate apex, gelatinised pileipellis and stipitipellis hyphae with diverticulations, and fasciculate caulocystidia. Differing from *M. parnaja* in having a corticolous habitat and non-exudative cheilo- and pleurocystidia and in lacking a thick gelatinous matrix on the pileipellis.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 10 June 2010, *D.M. Aravindakshan DM402*, K(M) 180086 (K!).

Etymology:—*ziragra* (Sanskrit), umbonate.

Basidiomata small. Pileus 4–19 mm diam., 3–12 mm high, conic with a prominent, acute to acuminate umbo when young, becoming broadly conic, convex or campanulate with umbo persisting or very rarely without umbo with age; surface brown (6E4, 5E4) or light brown (6D4) or greyish brown (6C3, 5D3) towards the centre and on the striations, brownish orange (5C3) or grey (5E3) in the middle and grey (6C1) or orange grey (5B2) to whitish towards margin when young, becoming dark brown (6F6) or brown (6E5) or dark blonde (5D4) or brownish orange (5C4, 5C3) towards the centre and on the striations, pale yellow (4A3) in the middle and yellowish white (4A2) towards margin with age, translucent-striate, almost glabrous at disc, finely pubescent towards margin, shiny, slightly sticky when wet, with a separable pellicle; margin straight and denticulate or appendiculate when young, becoming nearly plane to slightly uplifted and eroded or finely fissile with age. Lamellae 10–16 reaching the stipe, adnate with a decurrent tooth or sinuate, easily seceding, occasionally very slightly intervenose or furcate, brownish grey (6C2) or pale greyish to whitish, thin, up to 2.5 mm wide, subdistant, with lamellulae of 1–3 lengths; edge very finely hairy or torn under a lens, concolourous or paler than the sides. Stipe 7–19 (30) × 0.5–1.5 (2) mm, central, terete, almost equal when young, becoming slightly narrow at the middle with age, hollow; surface translucent, white at the apex and pale greyish (6D3) or light brown (6D4) towards base when young, becoming orange grey (5B2) or brownish orange (5C3) at the apex and brownish grey (5D2, 6E2) towards base with age, thickly pruinose all over; base slightly swollen with white, cottony basal mycelium. Context thin, up to 2 mm thick, concolourous with the pileus surface. Odour weakly alcaline. Taste not distinctive.

Basidiospores (7.5) 8.5–11 (12) × 5–7.5 (9.89 ± 0.53 × 6.26 ± 0.43) µm, Q = 1.21–2.2, Q_m = 1.59, ellipsoid to subamygdaliform, thin-walled, hyaline, smooth, amyloid. Basidia (23.5) 29–40 × 6.5–12.5 µm, clavate to subcylindrical, hyaline, bearing 4 (very rarely 5–7) sterigmata up to 10 µm long. Lamella-edge heterogeneous. Cheilocystidia 27–56.5 × 11–20 µm, narrowly or broadly fusiform, often mucronate, thin- to slightly (0.25 µm) thick-walled, hyaline. Pleurocystidia 37–60 × 10–20.5 µm, similar to cheilocystidia in all aspects. Lamellar trama regular to subregular; hyphae 1.5–28 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular to almost interwoven; hyphae 2–30 (46) µm wide, thin-walled, hyaline or with greyish or brownish contents, vinoid in Melzer's reagent. Pileipellis an epicutis with cystidioid terminal cells; hyphae 1.5–13.5 µm wide, thin-walled, hyaline to yellowish or pale brownish,

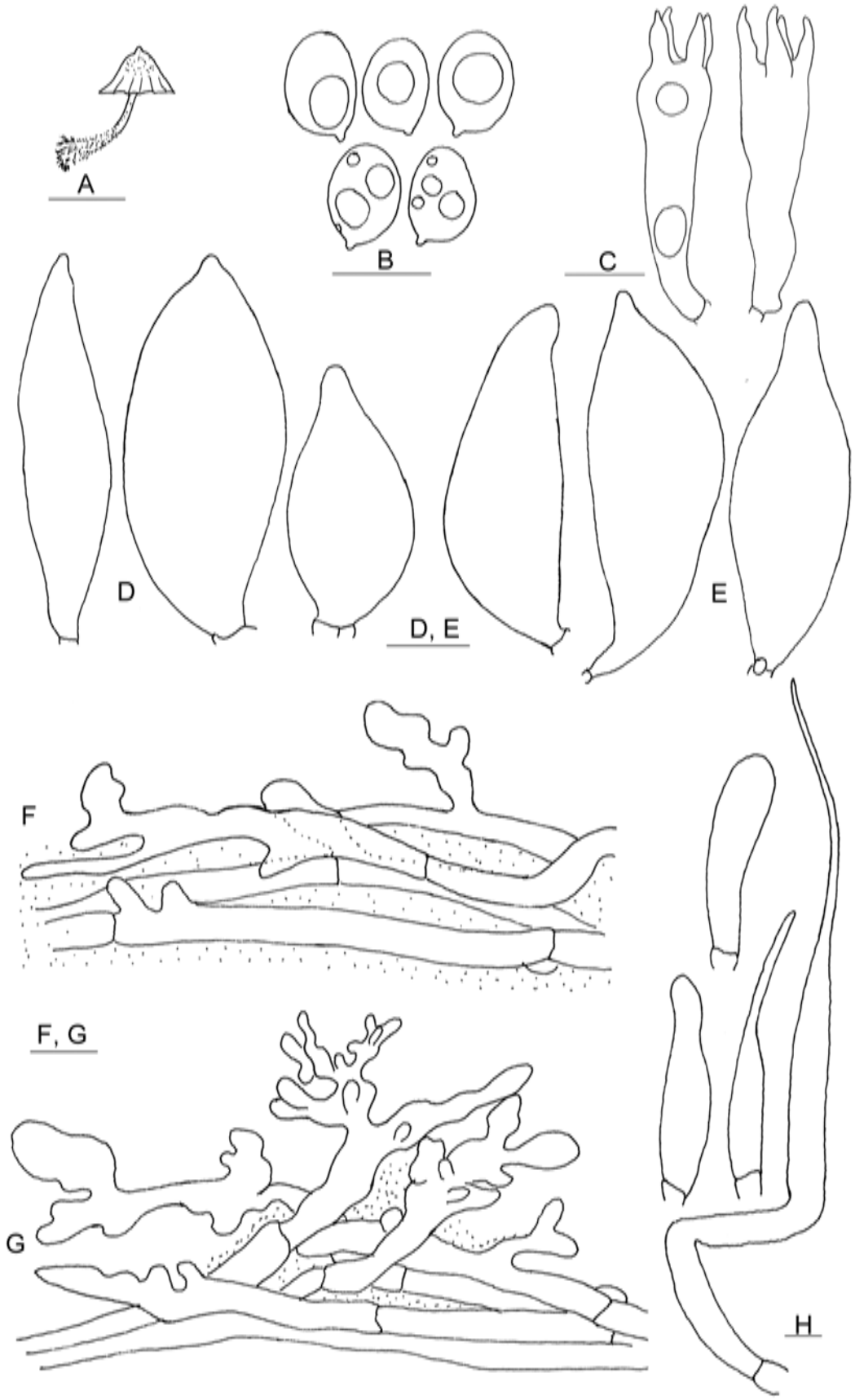


Figure 14. *Mycena ziragra*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pleurocystidia; F, hyphae of the pileipellis embedded in gelatinous matrix; G, caulocystidia; H, pileus marginal cells. Scale bars: A = 1 cm; B-H = 10 µm.

gelatinised, with diverticulations or coarse excrescences (1.5–14.5 × 1.5–11 µm); terminal cells cystidioid 61–121 × 9–15 µm, clavate or cylindrical, thin-walled, hyaline, with coarse excrescences (1.5–14.5 × 1.5–11 µm). Pileus marginal cells (8.5) 39.5–82 (135) × (5) 15–17.5 µm, clavate, fusoid, or hyphoid with long tapering ends. Stipitipellis a cutis of hyphae with terminal cells modified as caulocystidia; hyphae 1.5–8.5 µm wide, slightly gelatinised, thin-walled, hyaline, smooth for most parts and diverticulated (3–20 × 2–3.5 µm) towards hyphal ends. Caulocystidia 23–90 (124) × 5–18.5 µm, fasciculate, clavate to cylindrical or irregularly shaped, thin-walled, hyaline, with simple, rarely furcate or much branched, coarse excrescences (1–13.5 (25) × 2–9 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections present on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on the bark of standing trees (*Mangifera indica* and *Delonix regia*). June.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 5 June 2006, *D.M. Aravindakshan DM7*; 15 June 2007, *D.M. Aravindakshan DM124*; 9 June 2009, *D.M. Aravindakshan DM244*; 29 June 2009, *D.M. Aravindakshan DM281*; Palakkad District, Silent Valley National Park, 15 June 2010, *D.M. Aravindakshan DM404*, K(M) 180290.

Notes:—Maas Geesteranus's (1992b) key will lead this species to sect. *Insignes*. However, as discussed in the case of *Mycena parnaja*, sect. *Insignes* is presently limited to species with arcuate lamellae. Hence, *M. ziragra* also is placed in sect. *Fragilipedes* as its lamellae are not arcuate. *Mycena parnaja* differs from *M. ziragra* in having foliicolous and somewhat larger basidiomata, ellipsoid and somewhat longer basidiospores, fusoid cheilo- and pleurocystidia with a long stalk and with sticky exudations and pileipellis hyphae with long, digitate excrescences embedded in a thick gelatinous matrix.

15. ***Mycena rajatha*** Aravind. & Manim. *sp. nov*. Pl. 2 D; Fig. 15 A–H

MycoBank MB811081

Diagnosis:—Characterised by a black-dotted stipe surface, ellipsoid to amygdaliform and weakly amyloid basidiospores, utriform and smooth cheilo- and pleurocystidia, and gelatinised hyphae of the pileipellis with nodulose terminal cells. Differing from *M. arata* in having pleuro- and caulocystidia and much smaller basidiospores and cheilocystidia.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 8 July 2011, *D.M. Aravindakshan DM525*, K(M) 180090 (K!).

Etymology:—*rajatha* (Sanskrit), silvery.

Basidiomata small, delicate. Pileus 4–9 mm diam., 2–4 mm high, convex when young, becoming planoconvex with a deep central depression with age; surface greyish at the centre and on the striations and whitish towards margin, translucent-striate, finely pruinose or pubescent; margin straight and entire when young, becoming undulating or finely fissile with age. Lamellae up to 15 reaching the stipe, adnate with a decurrent tooth, whitish, 1.5 mm thick, subdistant, with lamellulae of 1–2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe

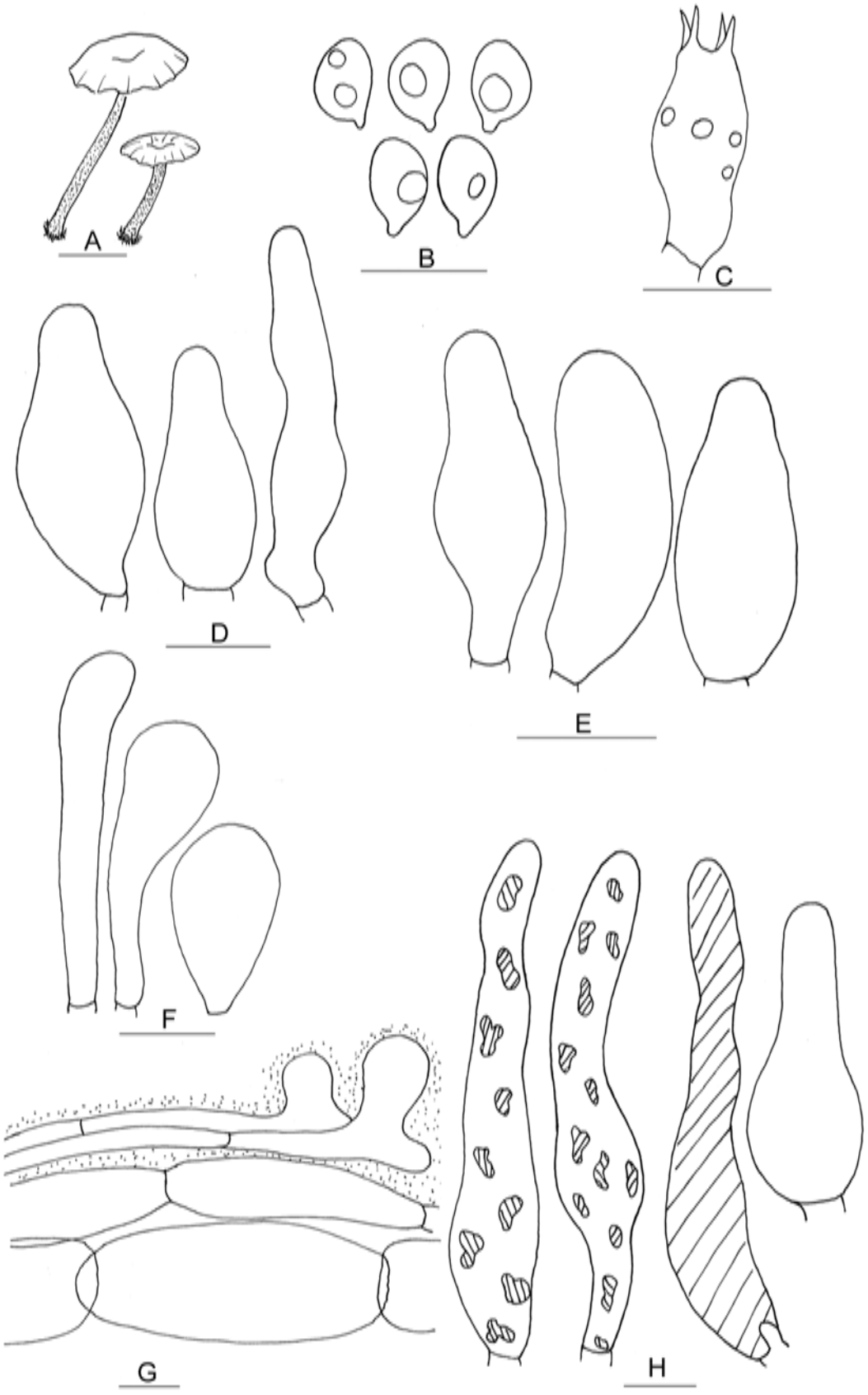


Figure 15. *Mycena rajatha*: A, basidiomata; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidia; F, pileus marginal cells; G, hyphae of the pileipellis; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

10–15 × 0.5–1 mm, central, terete, almost equal, hollow; surface translucent, white, finely pubescent, black-dotted under a stereo microscope; base slightly swollen, with a basal mycelial felt. Context not conspicuous. Odour and taste not distinctive.

Basidiospores 6–7.5 × 4–5.5 (6.83 ± 0.57 × 4.7 ± 0.33) µm, Q = 1.3–1.67, Q_m = 1.45, ellipsoid to amygdaliform, thin-walled, hyaline, smooth, weakly amyloid. Basidia 18.5–24 × 6–7.5 µm, clavate, bearing 4 sterigmata up to 4 µm long. Cheilocystidia crowded 20–41 × 4.5–17.5 µm, utriform to narrowly utriform, thin-walled, hyaline. Pleurocystidia 17–27 × 7.5–10 µm, fusoid, utriform or cylindrical, rarely flexuous. Lamellar trama subregular; hyphae 2.5–13 µm wide, thin-walled, hyaline, inamyloid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 5.5–23 µm wide, thin-walled, with greyish contents, inamyloid in Melzer's reagent. Pileipellis a cutis; hyphae 2–6 µm wide, gelatinised, thin-walled, hyaline, with terminal elements 27.5–98 × 7–15 µm, thin-walled, hyaline, with nodulose outgrowths (8–22 µm long). Pileus marginal cells 14–35 × 6.5–12.5 µm, narrowly to broadly clavate, thin- to slightly thick-walled (0.25–0.5 µm). Stipitipellis a cutis of smooth hyphae with scattered or clustered caulocystidia; hyphae 2–5 µm wide, thin-walled, hyaline. Caulocystidia 27.5–62 × 7.5–12 µm, cylindrical or flexuous, thin- to slightly (0.25–0.5 µm) thick-walled, with greyish contents. Stipe trama very faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on the bark of a dead cashew tree (*Anacardium oxidentale*). July.

Notes:—Characters such as the ellipsoid, amyloid basidiospores, the pileus devoid of a separable pellicle, the concolourous lamella-edge, the stipe arising from a basal mycelial felt, the hyphae of the pileipellis embedded in a gelatinous matrix, and the cheilocystidia not at the same time clavate and covered with excrescences lead the present species to sect. *Fragilipedes*. *Mycena arata* (Berk.) Sacc., an Indian species, has adnate lamellae with decurrent teeth similar to the present species. But that species differs in having much larger, caespitose basidiomata, a pink-tinged stipe, and much larger basidiospores and cheilocystidia and in not having pleurocystidia and caulocystidia.

16. ***Mycena aruna*** Aravind. & Manim. *sp. nov*. Pl. 2 E; Fig. 16 A–H

MycoBank MB811082

Diagnosis:—Characterised by a reddish-brown pileus, intervenose lamellae, slightly gelatinous lamellar and pileus trama, hyphae of the pileipellis with diverticulate side branches embedded in a gelatinous matter, and smooth, fusoid or cylindrical caulocystidia. Differing from *M. semivestipes* in having a foliicolous habitat, distinctly coloured basidiomata, and larger, variously shaped cheilocystidia.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 25 June 2009, *D.M. Aravindakshan DM279*, K(M)180085 (K!).

Etymology:—*aruna* (Sanskrit), reddish brown.

Basidiomata medium-sized. Pileus 12–28 mm diam., 2.5–3 mm high, broadly conic to broadly campanulate when young, becoming convex to nearly applanate with a shallow depression with

age; surface initially reddish brown (9D5, 8E5, 8D5) with a reddish white (8A2) margin, becoming greyish red (9C5, 7B3) or dull red (8C3) at the centre and on the striations, reddish white (9A2) elsewhere with age, hygrophanous, translucent-striate, glabrous, slightly sticky; margin straight and crenate when young, becoming plane or uplifted and fissile with age. Lamellae 18–27 reaching the stipe, adnate with a small decurrent tooth, intervenose, ascending, reddish grey (7B2), up to 3 mm thick, close with lamellulae of 2–3 (5) lengths; edge reddish white (7A2), paler than the sides, wavy, finely hairy under a lens. Stipe 23–85 × 1–4 mm, central or rarely excentric, terete, almost equal when young, becoming slightly tapering towards the apex, hollow; surface translucent, dull red (9B3, 8C3) all over when young, becoming reddish white (9A2) or greyish red (7B3) with age, fibrillose or finely pubescent towards the apex, glabrous below; base slightly swollen, with white basal mycelium. Context 0.5 mm thick, concolourous with the pileus. Odour nitrous or not distinctive. Taste not distinctive.

Basidiospores 6–8.5 × 3.5–4.5 (6.85 ± 0.52 × 3.75 ± 0.18) µm, Q = 2–2.66, Q_m = 2.33, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 18–26 × 5.5–7 (8.5) µm, clavate, bearing 4 sterigmata up to 6 µm long. Cheilocystidia crowded 17.5–68.5 × 5.5–13 µm, fusoid, thin-walled, smooth, hyaline. Pleurocystidia 26–42.5 × 6–11.5 µm, similar to cheilocystidia. Lamellar trama subregular; hyphae 2–27 µm wide, thin-walled, hyaline, slightly gelatinous, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular, two layered; upper hyphae 8.5–25 (40) µm wide, thin-walled, hyaline; lower hyphae 2.5–12 µm wide, gelatinised, thin-walled, with reddish-brown contents, vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 2.5–10 µm wide, gelatinised, thin-walled, hyaline, smooth or with somewhat diverticulate side branches. Pileus marginal cells 19–75 × 5–11 µm, versiform: narrowly clavate, cylindrical, fusoid or lageniform, thin-walled, smooth, hyaline. Stipitipellis a cutis of smooth hyphae with repent or ascending caulocystidia; hyphae 1.5–8 µm wide, thin-walled, hyaline. Caulocystidia 37–113 (163) × 5–10 µm, fusoid or cylindrical, often with subrostrate or mucronate apex, thin-walled, smooth, hyaline. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. June-September.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 25 June 2007, *D.M. Aravindakshan DM139*; 8 September 2007, *D.M. Aravindakshan DM211*, K(M) 180263; Nilambur, KFRI Regional Centre campus, 30 June 2007, *D.M. Aravindakshan DM139c*.

Notes:—Characters such as the ellipsoid and amyloid basidiospores, the pileus devoid of a separable pellicle, the concolourous lamella-edge, the hyphae of the pileipellis embedded in a gelatinous matter, and the hyphae of the cortical layer of the stipe not embedded in a gelatinous matter lead *M. aruna* to sect. *Fragilipedes*. Characters such as the intensely coloured pileus, the presence of clamp connections, the hyphae of the pileipellis with diverticulate side branches embedded in a gelatinous matter, the presence of pleurocystidia, the nitrous odour, and the almost similar-sized basidiospores are reminiscent of to the Northern Hemisphere species *M. semivestipes* (Peck) A. H. Sm. *Mycena semivestipes*, known from the United States and Canada, has

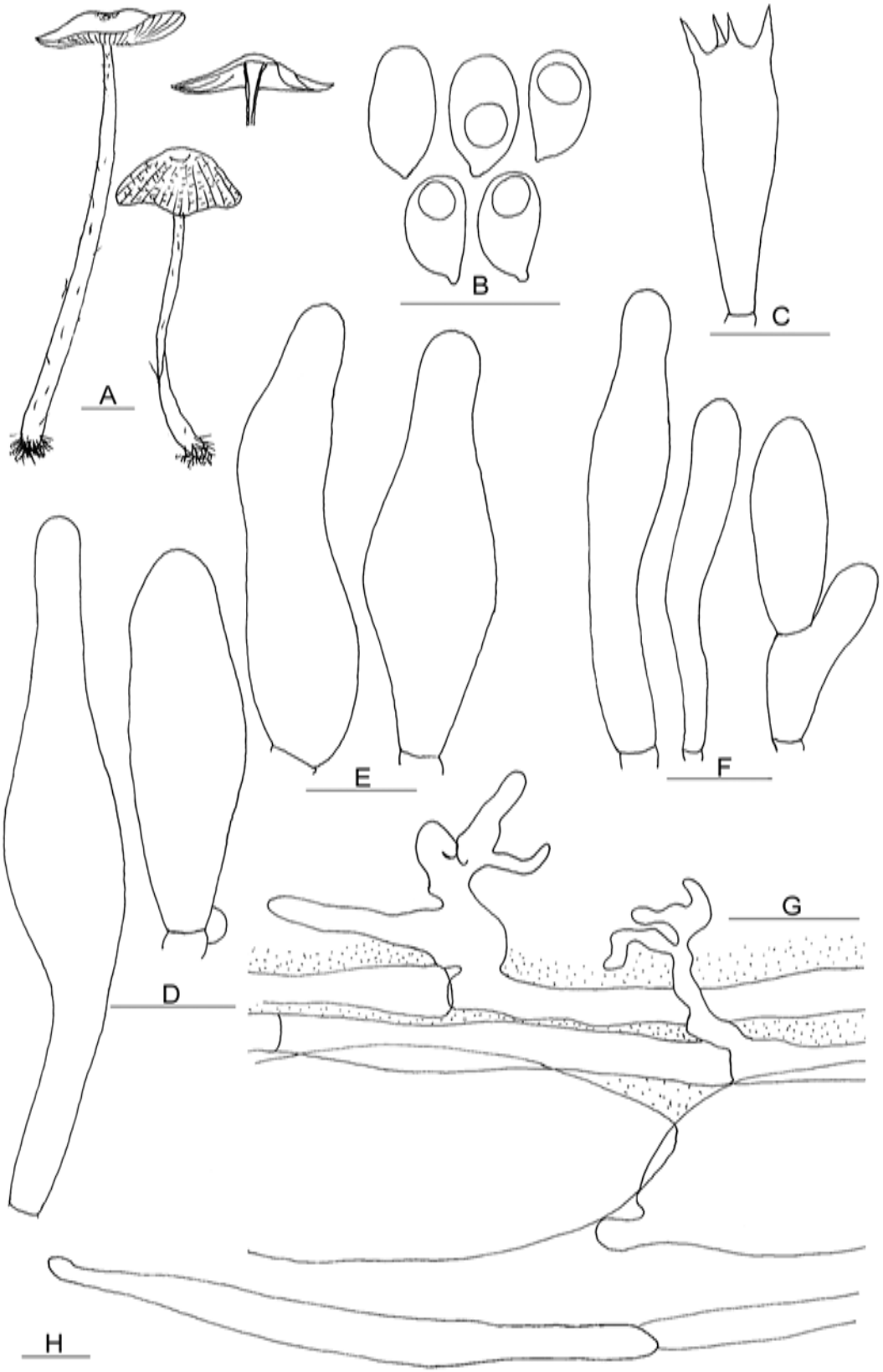


Figure 16. *Mycena aruna*: A, basidiomata; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidia; F, pileus marginal cells; G, hyphae of the pileipellis; H, caulocystidium. Scale bars: A = 1 cm; B-H = 10 µm.

additional similarity to the present species in having similar-sized basidiomata, almost similar number of lamellae that are intervenose and a glabrous stipe base. But that species differs from *M. aruna* owing to its black coloured immature basidiomata, white, tomentose stipe base, smaller (18–30 × 4.5–8 µm), variously shaped cheilocystidia sometimes with apical excrescences, hyphae of the stipitipellis with excrescences or warts and growth on decaying wood of deciduous trees.

Mycena auroricolor (Berk. & Broome) Petch of sect. *Calodontes*, reported from both Kerala (Manimohan *et al*. 1988) and Sri Lanka (Pegler 1986), is phenetically similar to *M. aruna*. But *M. auroricolor* has much smaller cheilocystidia and non-diverticulate and non-gelatinised hyphae of the pileipellis. In addition, *M. auroricolor* has no caulocystidia.

17. ***Mycena profusa*** Manim. & Leelav., Transactions of the British Mycological Society 91 (4): 575 (1988). Pl. 2 F; Fig. 17 A–G

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, Botanical Garden, 1 June 1985, *P. Manimohan M113*, K(M)180088 (K!).

Basidiomata medium-sized. Pileus 3.5–17 mm diam., 4–8mm high, parabolic when young, becoming conic or convex or convexo-campanulate with an umbonate or acute or scrobiculate disc with age; surface brown (7E5) or light brown (6D4) at the centre, orange grey (6C3) on the striations and reddish grey (7B2) or orange grey (6B3) at the margin, light brown (7D4) elsewhere when young, becoming brown (7E6) at the centre, greyish brown (6D3, 6D4) at margin and on the striations, and orange white (6A2) towards margin with age, initially translucent-striate, becoming sulcate-striate, finely pruinose; margin straight and entire when young, becoming upturned and undulate with age. Lamellae up to 15 reaching the stipe, adnate with a decurrent tooth, off-white, subdistant, with lamellulae of 1–2 lengths; edge finely hairy under a lens, concolourous with the sides. Stipe 38–79 × 0.5–1.5 mm, central, terete, almost equal or slightly tapering towards the apex, hollow; surface translucent, reddish white (7A2) or orange white (6A2) when young, becoming greyish red (7B3) or orange grey (6B3) with age, glabrous; base slightly swollen, with white, strigose basal mycelium. Context not conspicuous, about 0.75 mm wide, concolourous with the pileus. Odour and taste not distinctive.

Basidiospores 8.5–11 × 4.5–6 (7) (9.83 ± 0.63 × 4.6 ± 0.38) µm, Q = 1.7–2.5, Q_m = 2.15, ellipsoid to subamygdaliform, thin-walled, hyaline, smooth, strongly amyloid. Basidia (19) 23–27 × 7.5–9 µm, clavate, bearing 4 sterigmata up to 9 µm long. Lamella-edge heterogeneous. Cheilocystidia (26) 44–67.5 × (4) 7–10 µm, fusoid, thin-walled, hyaline, smooth or with apical, coarse excrescences (2–14 × 2–4.5 µm). Pleurocystidia 49–70 × 10–12 µm, fusoid, thin-walled, hyaline, smooth. Lamellar trama regular to subregular; hyphae 1.5–23 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 3–26.5 (32) µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 2–5 µm wide, gelatinised, thin-walled, with greyish contents, with densely arranged nodulose-diverticulate side branches. Stipitipellis a cutis; hyphae 2–5.5 (10) µm wide, thin-walled, hyaline, nodulose-diverticulate, more towards the base. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in group, on decaying leaves and twigs. June.

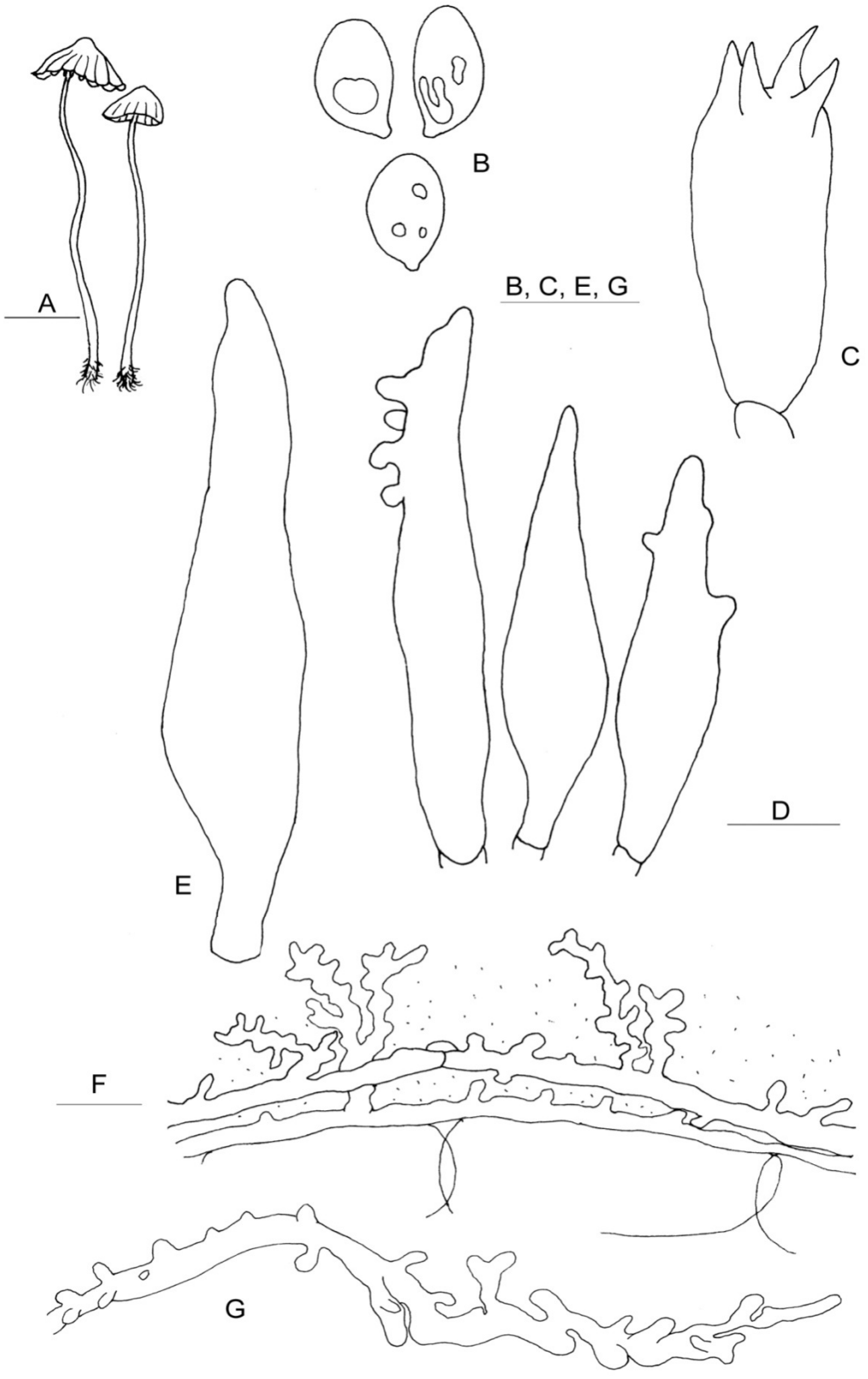


Figure 17. *Mycena profusa*: A, basidiomata; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidium; F, hyphae of the pileipellis; G, hyphae of the stipitipellis. Scale bars: A = 1 cm; B-G = 10 µm.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden; 14 June 2007, *D.M. Aravindakshan DM119*, K(M)180088; 18 June 2007, *D.M. Aravindakshan DM126*, K(M)180089.

Notes:—So far, *M. profusa* is known only from the type locality. Compared to the type collection, the present collection, also from the type locality, shows some differences such as a brown pileus (versus pinkish white pileus), strongly amyloid basidiospores (vs weakly amyloid basidiospores 8–10 × 4–5.5 µm), a heterogeneous lamella-edge (vs sterile lamella-edge), and gelatinised hyphae of the pileipellis. *Mycena profusa* grows on decaying twigs and leaves.

18. ***Mycena kapila*** Aravind. & Manim. *sp. nov*. Pl. 2 G; Fig. 18 A–G

MycoBank MB811083

Diagnosis:—Characterised by dark brown basidioma, prominent mycelial cords at the stipe base, fusiform and smooth cheilo- and pleurocystidia, and gelatinised hyphae of the pileipellis. Differing from *M. leptocephala* in having a solitary habit and smaller cheilo-, pleuro- and caulocystidia.

Holotype:—INDIA. Kerala State: Idukki District, Munnar, Mattupetti, 15 August 2010, *D.M. Aravindakshan DM474*, K(M) 180097 (K!).

Etymology:—*kapila* (Sanskrit), brown.

Basidioma rather medium-sized. Pileus 15 mm diam., 1.1 mm high, convexo-parabolic with a slight umbo, becoming broadly convex and finally applanate with persisting umbo; surface dark brown (8F8) at the centre and on the striations and brownish grey (6E3, 6C3) elsewhere, translucent-striate, dry; margin straight and entire. Lamellae 18 reaching the stipe, narrowly adnate, slightly intervenose and transvenose, greyish brown (6D3), up to 1.5 mm wide, subdistant, with lamellulae of 1–2 lengths; edge denticulate under a lens, paler than the sides or whitish. Stipe 140 × 2 mm, eccentric, terete, slightly tapering towards apex, hollow; surface dark brown (9F4) towards the apex and brownish grey (concolourous with the pileus) towards the base, finely pruinose over the entire stipe, lower part of the stipe buried in soil but not radicating; base slightly inflated with long, white, mycelial cords. Context up to 1.5 mm thick, concolourous with the pileus surface. Odour and taste not recorded.

Basidiospores (7) 8–12 (14.5) × (4) 4.5–6.5 (8.5) (9.98 ± 1.32 × 5.79 ± 0.82) µm, Q = 1.33–2, Q_m = 1.73, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 25–28.5 × 7.5–12 µm, clavate, hyaline, bearing 4 sterigmata up to 10 µm long. Lamella-edge sterile. Cheilocystidia 32–62 × 6–15 µm, narrowly or broadly fusiform, with or without a pedicel, slightly (0.25 µm) thick-walled, hyaline, smooth. Pleurocystidia 48–71.5 × 9.5–15 µm, similar to cheilocystidia in all aspects. Lamellar trama subregular; hyphae 5–21 µm wide, thin-walled, hyaline or with pale greyish contents, faintly vinoid in Melzer's reagent; subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 5.5–25.5 µm wide, thin-walled, with dark brownish contents, faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–7 µm wide, gelatinous, thin-walled, hyaline, with simple or much branched excrescences (1.5–10 × 1–2 µm). Stipitipellis a cutis; hyphae 2–8 µm

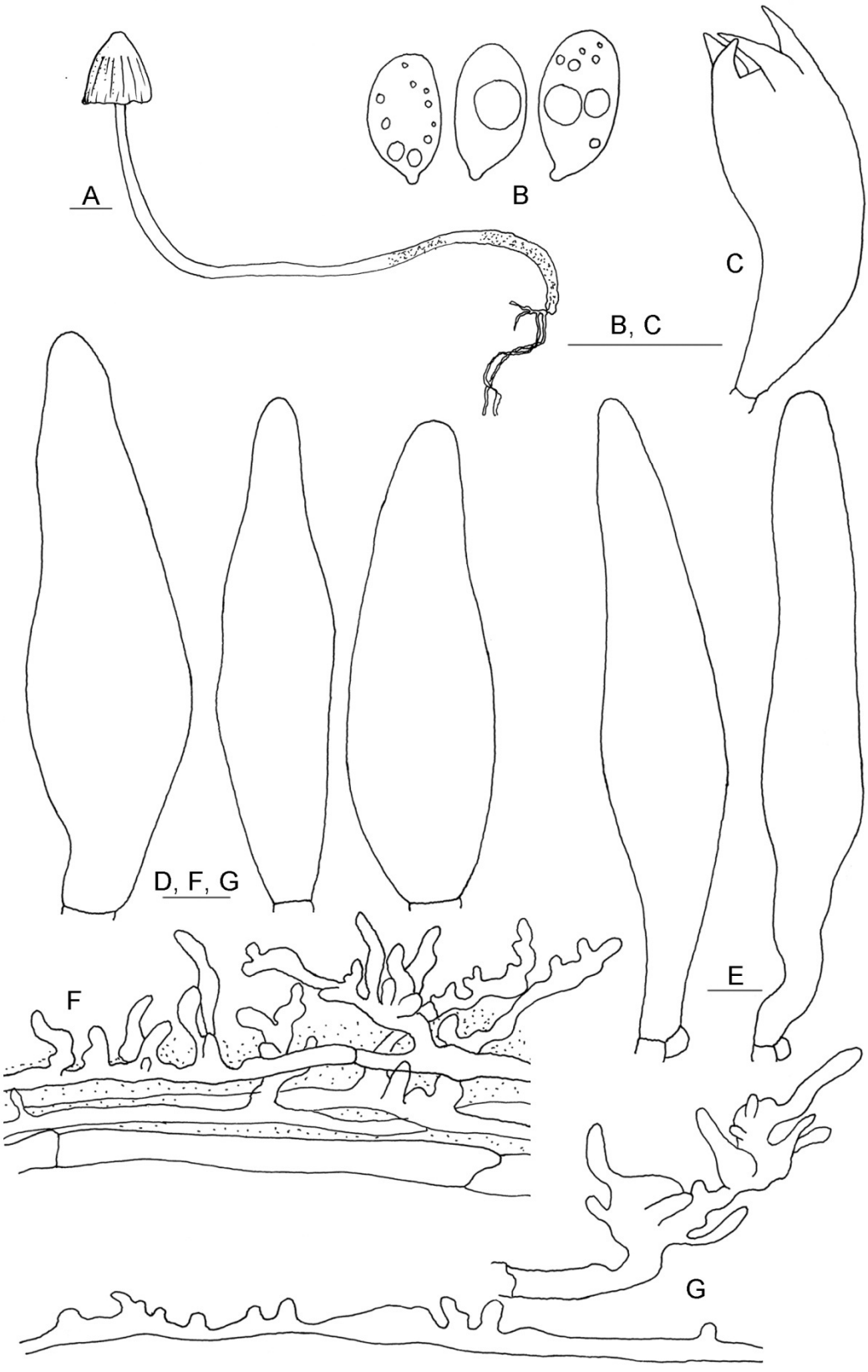


Figure 18. *Mycena kapila*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidia; F, hyphae of the pileipellis; G, hypha of the stipitipellis. Scale bars: A = 1 cm; B-G = 10 µm.

wide, somewhat gelatinised, thin-walled, hyaline, smooth towards the stipe apex, with nodulose-diverticulate towards the stipe base. Caulocystidia 26–55 × 4.5–10 µm, clavate or irregularly shaped, with nodulose-diverticulate. Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Solitary, emerging from a log buried in soil. August.

Notes:—Characters such as the ellipsoid and amyloid basidiospores, the non-separable pellicle, the concolourous lamella-edge, and the hyphae of the pileipellis not embedded in a gelatinous matrix lead *M. kapila* to the sect. *Fragilipedes* when the key to the sections of *Mycena* by Maas Geesteranus (1992b) is followed. When following the key to the species of sect. *Fragilipedes* (Robich 2006a), the present taxon keys out close to *M. leptocephala*, a species known from Europe, Iceland and North America, because of its dark brown, almost similar-sized basidiomata, gelatinised hyphae (1.8–7 µm wide) of the pileipellis and sparsely diverticulate hyphae of the stipitipellis. But characters such as the gregarious habit, the much larger, smooth or apically bifurcated cheilo- and pleurocystidia and the much larger caulocystidia of that species make it different from the present one. *Mycena maurella* Robich, another European species, has gelatinised hyphae of the pileipellis and longer basidiospores similar to *M. kapila*. But that species differs in its gregarious habit, somewhat smaller basidiomata, broadly ellipsoid or subglobose or subamygdaliform basidiospores and narrower (4–6 µm) cheilocystidia with protuberances.

VI. ***Mycena*** section ***Galactopoda*** (Earle) Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 91: 396 (1988).

Basidiomata medium-sized to large. Pileus densely pruinose, glabrescent, flesh-coloured, darker at the centre. Taste bitterish. Lamellae ascending, adnate; edge concolourous or blood red. Stipe fragile, pruinose, glabrescent for the greater part, exuding a blood red fluid when cut, blackening in the herbarium; base covered with coarse, whitish fibrils. Basidiospores ellipsoid, amyloid. Basidia clavate, 4-spored. Cheilocystidia forming a sterile band, fusiform, with colourless or with reddish contents. Pleurocystidia similar if present. Hyphae of the pileipellis covered with excrescences and diverticulate side branches. Hyphae of the stipitipellis smooth, clamped; terminal cells much branched and diverticulate, dissimilar to cheilocystidia.

Type species:—*Mycena haematopus* (Pers.) P. Kumm.

Two species belonging to this section were encountered during the present study.

Key to the species

1. Lamellae adnate; pleurocystidia present; basidiospores 8.5–11 × 4–5.5 µm ..... 19. ***Mycena lohitha***

- Lamellae decurrent to deeply decurrent; pleurocystidia absent; basidiospores 6–8.5 × 3.5–4 µm..... .....20. ***Mycena babruka***

19. ***Mycena lohitha*** Aravind. & Manim., Mycosphere 4 (4): 654 (2013). Pl. 2 H; Fig. 19 A–G

Holotype:—INDIA. Kerala State: Wayanad District, Meppadi, Thollayiram Forest, 21 June 2007, *D.M. Aravindakshan DM135*, K(M)178337 (K!).

Basidiomata small. Pileus 4–8 mm diam., up to 5 mm high, conic when young, becoming conico-campanulate with age; surface brownish red (9D8) at the centre and scarlet (9A8) elsewhere when fresh, soon changing to dark brown (8F8) at the centre as well as on the striations and margin and brown (8E6) or reddish brown (8D5) elsewhere, scrobiculate on disc, slightly sulcate at middle, translucent-striate, glabrous, dry; margin incurved and entire when young, becoming straight and undulate with age. Lamellae 12–14 reaching the stipe, adnate, pinkish white, up to 0.75 mm wide, subdistant, with lamellulae of 1–3 lengths; sides of the lamellae punctate with dark brown dots; edge finely hairy or eroded under a lens, dark brown (8F8). Stipe 16–33 × 1–1.5 mm, central, terete, slightly tapering towards apex, hollow; surface brownish red (9D8) to dark brown (8F4) towards apex, reddish white (8A2) towards base, pruinose at apex, glabrous towards base; base swollen, with strigose basal mycelium. Context not conspicuous, less than 0.5 mm wide, concolourous with the pileus. Odour and taste not recorded. The whole basidiomata turns blackish when dry.

Basidiospores 8.5–11 × 4–5.5 (9.7 ± 0.64 × 4.65 ± 0.46) µm, Q = 1.73–2.38, Q_m = 2.1, ellipsoid, thin-walled, hyaline, smooth, amyloid, with guttules. Basidia 20–29 × 8–9.5 µm, clavate, bearing 4 sterigmata up to 7 µm long. Cheilocystidia crowded, of two types: one type 31–70 × 7.5–14 µm, narrowly or broadly fusiform with acute or acuminate or mucronate apex, thin-walled, with greyish contents, smooth; other type 6–36 × 3–11 µm, clavate to cylindrical, thin-walled, with greyish contents, and with somewhat branched, straight or curved excrescences (2–18.5 × 1–4 µm). Pleurocystidia 26.5–53 × 10–14 µm, scattered, narrowly or broadly fusiform, thin-walled, smooth, hyaline or with brownish contents. Lamellar trama subregular; hyphae 2.5–16 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; upper hyphae 6.5–25 µm wide, thin- to slightly (0.5–0.75 µm) thick-walled, with reddish to blackish contents; lower hyphae 1.5–15 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 1–4.5 µm wide, thin-walled, with dark grey or reddish or blackish grey contents, with simple or furcate, straight, curved or flexuous excrescences (0.5–13 × 1–2 µm), slightly gelatinised. Stipitipellis a cutis; hyphae 2–6 µm wide, slightly gelatinised, thin-walled, with dark grey or reddish or blackish grey contents, smooth in most parts of the stipe but nodulose-diverticulate (0.5–6 × 1–4 µm) at the stipe apex. Caulocystidia absent. Stipe trama dextrinoid to vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. June.

Notes:—The Australian species *Mycena toyerlaricola* Grgur. and *M. kuurkacea* Grgur. are morphologically very close to *M. lohitha* in having a brownish red or brick red coloured pileus, a coloured lamella-edge, two types of cheilocystidia, and coloured contents in cheilocystidia, pileocystidia and pileus trama. But those species differ from *M. lohitha* in having somewhat larger basidiomata, lamellae that are not punctate with brown dots and non-gelatinised pileipellis and stipitipellis hyphae with coloured contents. Aravindakshan & Manimohan (2013b) provided a detailed account of this species.

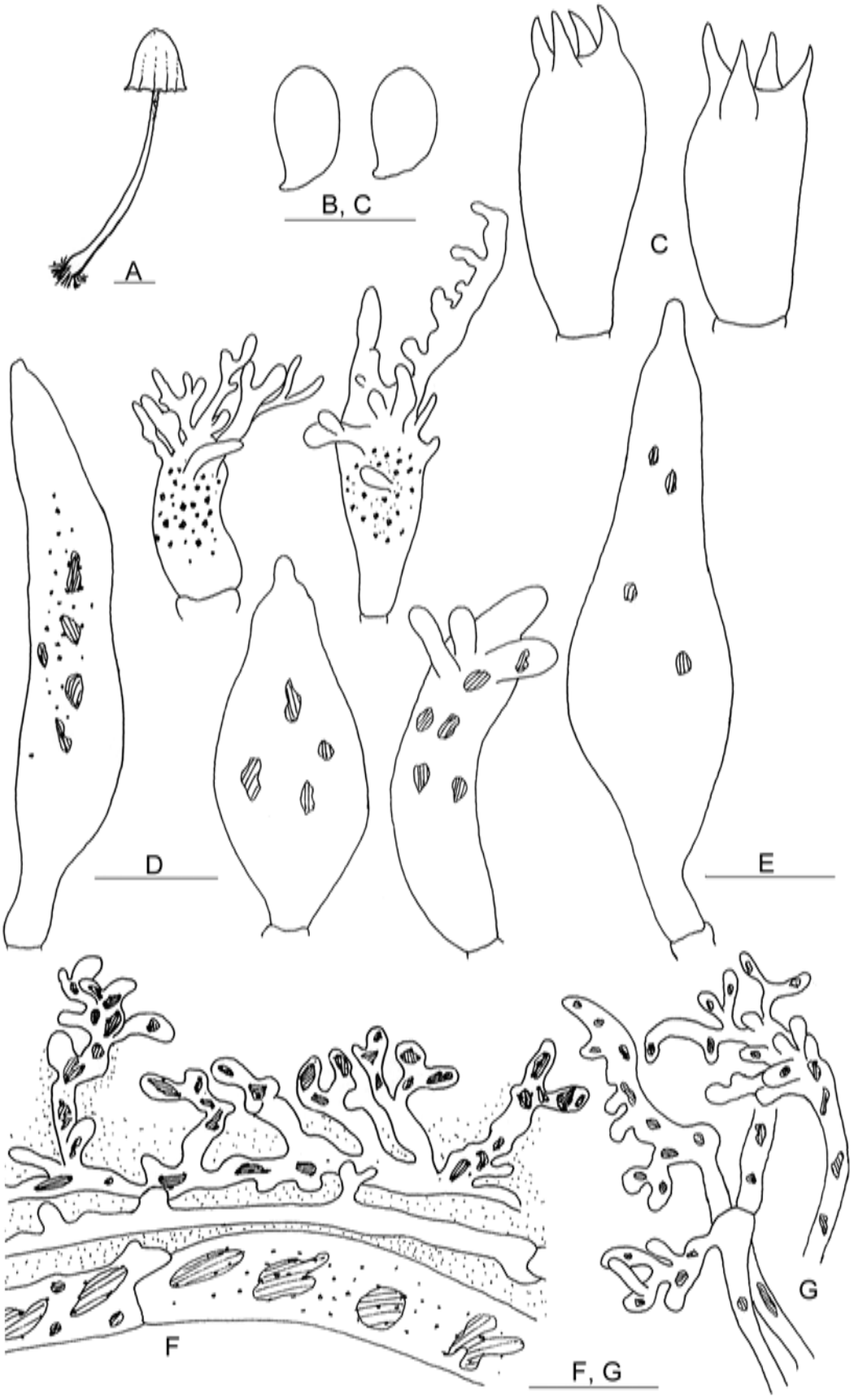


Figure 19. *Mycena lohitha*: A , basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidium; F, hyphae of the pileipellis with contents; G, hyphae of the stipitipellis with contents. Scale bars: A = 5 mm; B-G = 10 µm.

20. ***Mycena babruka*** Aravind. & Manim., Mycosphere 4 (4): 656 (2013). Pl. 2 I; Fig. 20 A–F

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 22 June 2009, *D.M. Aravindakshan DM253*, K(M) 178338 (K!).

Basidiomata small. Pileus 4.5–11 mm diam., 2–5 mm high, convex with a very slight central depression when young, becoming broadly convex or nearly applanate still with the central depression; surface dark brown (8F8) at the centre and on the striations and greyish orange (5B3) towards margin when young, becoming dark brown (7F8) at the centre and on the striations and light brown (6D4) or brownish orange (6C4) towards margin and brown (7E6) on margin with age, translucent- to sulcate-striate towards margin, glabrous; margin straight and entire when young, becoming upturned and undulating with age. Lamellae 11–15 reaching the stipe, decurrent to deeply decurrent, pinkish white (7A2) or reddish grey (7B2), thin, 1–1.5 mm wide, subdistant, with lamellulae of 1–3 lengths; edge finely pruinose under a lens, initially brown (7E6) or dark brown (7F8) or reddish brown (8F8) where the lamella meets the stipe and the pileus margin, gradually entire edge becoming coloured. Stipe 15–58 × 0.5–1 mm, central, terete, almost equal, hollow; surface translucent, brown (7E6) at the apex and on the base, yellowish brown (5D4) at the middle when young, becoming light brown (6D5 or 6D4) at base, reddish blonde (5C4) or greyish orange (5B3) elsewhere with age, glabrous; base slightly broad, with white, hispid basal mycelium. Context not conspicuous. Odour slightly alcaline. Taste bitter. Exudation dark brown (7F8, 8F8) when the stipe is cut. The whole basidiomata turns blackish when dry.

Basidiospores 6–8.5 (9.5) × 3–4 (7.5 ± 0.65 × 3.77 ± 0.31) µm, Q = 1.63–2.83, Q_m = 2, ellipsoid, thin-walled, hyaline, smooth, amyloid, with refractive guttules. Basidia 17–24 × 6–7.5 µm, clavate, bearing 4 sterigmata up to 7 µm long. Cheilocystidia 12–28 (44) × 5–16 µm, clavate or broadly clavate or irregularly-shaped, thin-walled, with dark brownish-red to blackish contents, with simple or branched coarse excrescences (1–6 (13.5) × 1–3 µm) at the top. Pleurocystidia none. Lamellar trama subregular; hyphae 2–19 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 6–34 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1–4 µm, slightly gelatinised, thin-walled, with reddish or reddish-brown contents, with simple or branched digitate excrescences (1–7 (12) × 1–2.5 µm). Stipitipellis a cutis; hyphae 1.5–7 µm wide, thin-walled, hyaline to pale brownish, with simple excrescences (2–8 × 2–3 µm) more towards the stipe apex. Stipe trama dark brown in water, vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves and twigs. June.

Additional collection examined:—INDIA. Kerala State: Kannur District, Neeliyarkotta, 17 June 2009, *D.M. Aravindakshan DM260*, K(M) 178339.

Notes:—*Mycena lohitha*, described earlier in this treatise, differs from *M. babruka* in having a reddish pileus, adnate lamellae with sides punctate with dark brown dots, dimorphic cheilocystidia, fusoid pleurocystidia, and larger basidiospores. A combination of features such as the dark brown pileus, decurrent lamellae, absence of fusoid cheilocystidia and the slight gelatinisation of the pileipellis hyphae makes *M. babruka* distinct from all other species of sect. *Galactopoda*.

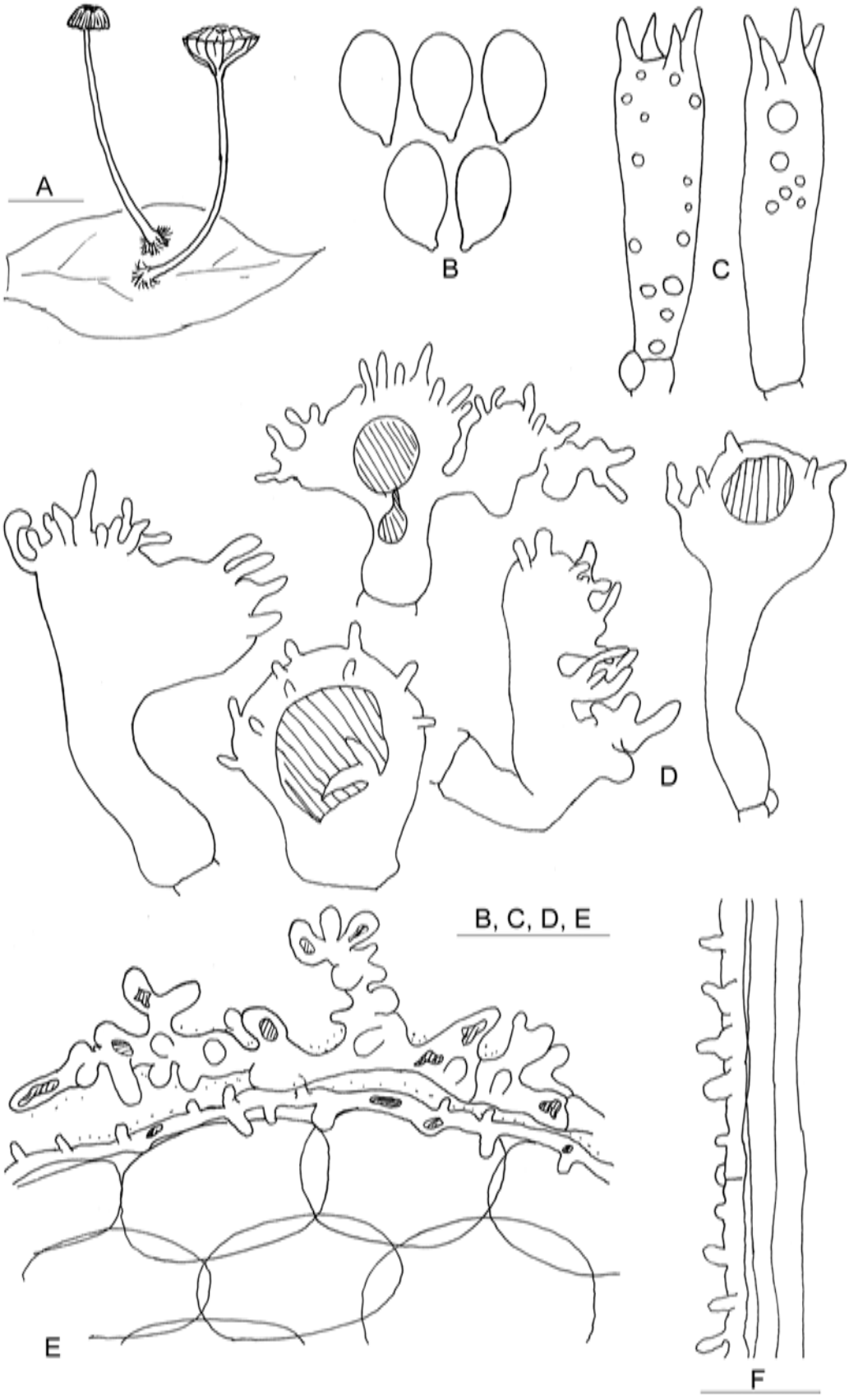


Figure 20. *Mycena babruka*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, hyphae of the pileipellis; F, hyphae of the stipitipellis. Scale bars: A = 1 cm; B-F = 10 µm.

VII. ***Mycena*** section ***Hiemales*** Konrad & Maubl., Icones Selectae Fungorum 6: 274 (1934).

Basidiomata fairly small to medium-sized. Pileus glabrous to pruinose, lubricous or not. Lamellae tender, white to greyish. Stipe pruinose to glabrous, white, pallid or brownish, the base as a rule covered with coarse fibrils. Basidiospores ellipsoid to subglobose, inamyloid. Basidia clavate, 2- or 4-spored, clampless or clamped. Cheilocystidia variously shaped, generally simple or apically somewhat branched. Pleurocystidia similar or absent. Hyphae of both the pileipellis and stipitipellis diverticulate or more rarely smooth. Caulocystidia generally present.

Six species belonging to sect. *Hiemales* were encountered during the present study.

Key to the species

1. Lamellae ascending.....(subsect. ***Hiemales***) 2

- Lamellae arcuate .....(subsect. ***Omphaliariae***) 5

2. Habitat on herbaceous roots; pleurocystidia absent; cheilocystidia with clavate excrescences; basidiospores 5.5–7.5 × 4–5.5 µm.....21. ***Mycena mulika***

- Habitat different; pleurocystidia present; cheilocystidia smooth 3

3. Habitat on decaying twigs, cheilocystidia exudative; subhymenium gelatinised; basidiospores 7.5–9 × 4–6 µm. .....22. ***Mycena sravaka***

- Habitat on bark of trees; cheilocystidia non-exudative 4

4. Caulocystidia with brownish contents; both cheilo- and pleurocystidia of two types; basidiospores 6.5–8.5 × 4.5–5.5 µm .....23. ***Mycena vamana***

- Caulocystidia without brownish contents; cheilo- and pleurocystidia of one type; basidiospores 8–10 × 5–7 µm .....24. ***Mycena sandra***

5. Basidiomata pale grey to whitish; cheilocystidia with excrescences; pileipellis without cystidioid terminal cells; basidiospores 6–7.5 × 3–4 µm .....25. ***Mycena niranjana***

- Basidiomata dark brown to brownish grey; cheilocystidia smooth; pileipellis with cystidioid terminal cells; basidiospores 6–8 × 4–6.5 µm.....26. ***Mycena nimna***

Mycena sect. ***Hiemales*** subsect. ***Hiemales*** Maas Geest., Persoonia 11 (1): 114 (1980b).

Basidiomata with features as in sect. *Hiemales*, but lamellae ascending and the edge convex.

Type species:—*Mycena hiemalis* (Osbeck) Quél.

21. ***Mycena mulika*** Aravind. & Manim. *sp. nov*. Pl. 2 J; Fig. 21 A–G

MycoBank MB811084

Diagnosis:—Characterised by basidiomata associated with plant roots, ellipsoid and inamyloid basidiospores, clavate cheilocystidia with apical digitate excrescences, cystidioid terminal

cells of pileipellis hyphae with long protrusions, and fusoid or nettle-shaped caulocystidia with long tapering ends. Differing from *M. atropapillata* in having a non-umbonate pileus, a non-rooting stipe, and smaller basidiospores.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, Botanical Garden, 27 November 2010, *D.M. Aravindakshan DM520*, K(M) 191757 (K!).

Etymology:—*mulika* (Sanskrit), living on root.

Basidiomata small. Pileus 6–13 mm diam., initially conico-campanulate or conico-convex with a slight umbo, becoming broadly convex and finally applanate with persisting umbo; surface greyish brown (8F3) at the centre and on the striations and brownish grey (6C2) elsewhere when young, becoming chocolate brown (6F4) around the disc and on the striations, greyish brown (6C3) on the disc and elsewhere with age, translucent-striate, finely pruinose, more so towards disc; margin straight and entire when young, becoming upturned and undulating with age. Lamellae 16–21 reaching the stipe, narrowly adnate, seceding to become psuedocollariate, rarely intervenose, very rarely transvenose, brownish grey (6D2), thin, up to 1.25 mm wide, close, with lamellulae of 1–3 lengths; edge very finely hairy under a lens, paler than the sides or whitish. Stipe 17–38 × 1–1.25 mm, central, rarely excentric, terete, rarely flattened, almost equal when young, becoming slightly tapering towards apex with age, hollow; surface translucent, white all over when young, becoming grey or orange grey (6B2) with age, glabrous towards the apex, finely hairy towards base; base slightly broad to almost discoid with white, thick, short basal mycelium. Context thin, up to 0.5 mm thick, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6–7.5 × 4–5.5 (6.63 ± 0.47 × 4.55 ± 0.44) µm, Q = 1.2–1.8, Q_m = 1.47, ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia (14) 17–24.5 × 6.5–12.5 µm, clavate to subcylindrical, hyaline, bearing 4 sterigmata up to 5.5 µm long. Lamella-edge homogeneous. Cheilocystidia 14–24 × 9–17.5 µm, clavate or subglobose, with or without a pedicel, thin-walled, hyaline, apically covered with a few digitate excrescences (2.5–11 × 1–2 µm). Pleurocystidia none. Lamellar trama subregular; hyphae 3.5–32 (40.5) µm wide, thin-walled, hyaline or with brownish grey contents, faintly but distinctly vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama regular to subregular; hyphae 2.5–35 µm wide, thin-walled, with greyish contents, faint but distinctly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 2–8 µm wide, thin-walled, hyaline, with cystidioid hyphal ends; cystidioid hyphal ends 40–179 × 10–20 µm, clavate with apical or lateral coarse excrescences (1–5 (8) × 0.5–1 µm) or smooth, or having very elongated projections (5–45 (88.5) × 2–4.5 µm). Stipitipellis a cutis; hyphae 2–7 µm wide, thin-walled, hyaline, smooth. Caulocystidia 37–217 × 6–13 µm, fusoid or cylindrical, often with long, hairy apex of up to 96 µm long, occasionally furcate, smooth or with apical excrescences (2–16 × 1.5–4 µm). Stipe trama distinctly vinoid in Melzer's reagent. Clamp connections seen on all hyphae, but often hard to locate.

Habit, habitat and phenology:—Scattered, always seen attached to small living roots of *Ficus elastica*. June-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, Botanical Garden, 26 June 2007, *D.M. Aravindakshan DM140*; 25 June 2009,

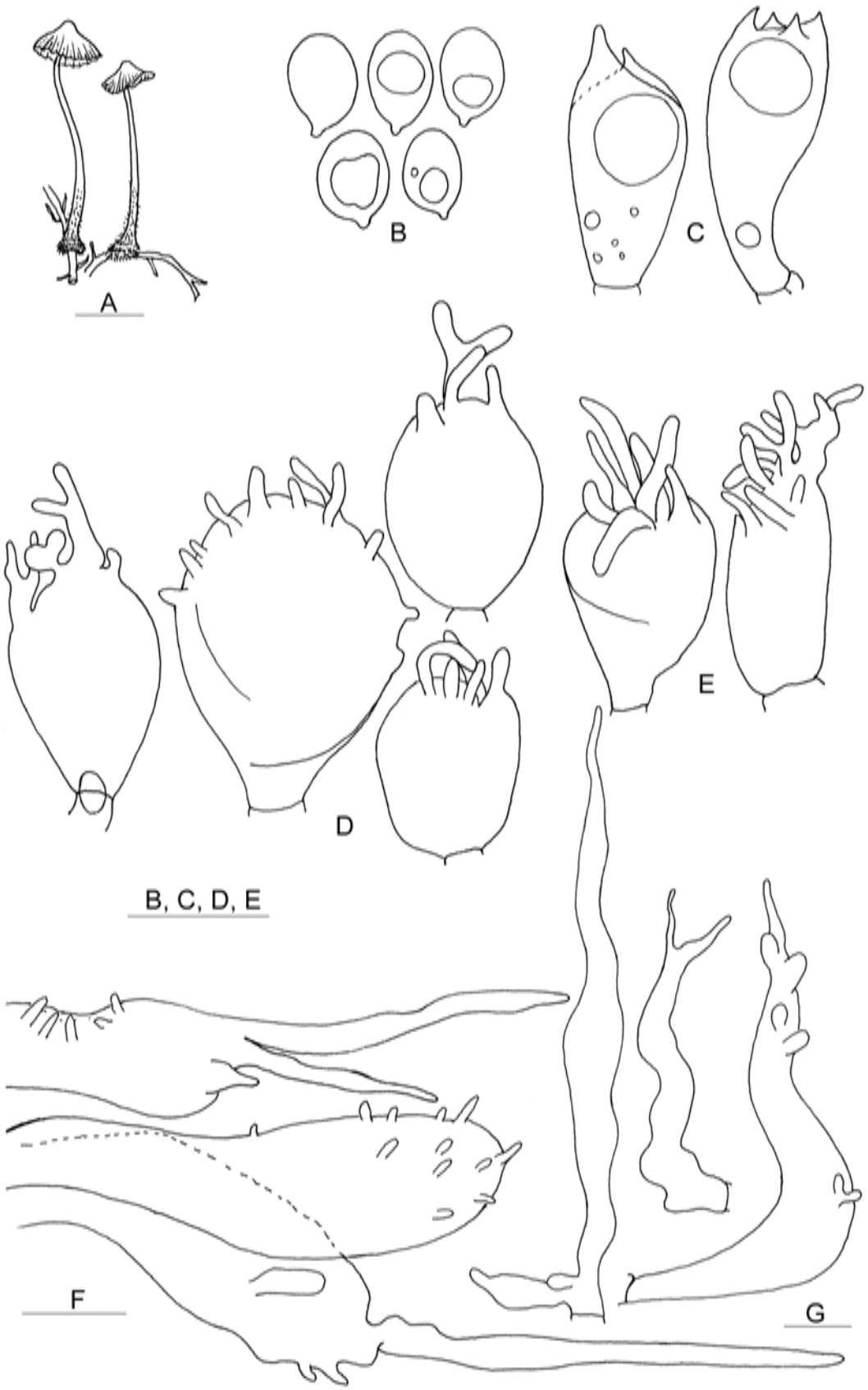


Figure 21. *Mycena mulika*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, cystidioid hyphal ends of the pileipellis; G, caulocystidia. Scale bars: A = 1 cm; B-G = 10 µm

D.M. Aravindakshan DM278; Kollam District, Sasthamkotta, 29 September 2010, *D.M. Aravindakshan DM515*.

Notes:—Characters such as the ellipsoid, inamyloid basidiospores, the non-separable pellicle, and the dark coloured pileus lead the present species to sect. *Hiemales* subsect. *Hiemales*. A total of seven species (*M. atropapillata*, *M. olida*, *M. globata* Maas Geest. & de Meijer, *M. grisellina* J. Favre, *M. hiemalis*, *M. radicifer* J. Favre and *M. exigua* Maas Geest. & de Meijer) of *Mycena* have been reported so far in sect. *Hiemales*. Of these, the first three species have smooth pileipellis hyphae and among them, *M. atropapillata* is the only dark-coloured species with grey-brown pileus. Both *M. olida* and *M. globata* are pale-coloured (whitish) species.

Mycena atropapillata, a European species, differs from the present species in having a prominent, pointed, black umbo; broad lamellae (3 mm wide); a rooting stipe base; somewhat larger, narrowly pip-shaped basidiospores; small, cylindrical, smooth cheilocystidia; inamyloid tramal hyphae; pileipellis hyphae with brown intracellular pigment; and basidiomata that grow among mosses in meadows. *Mycena olida*, known from Europe, North Africa and the United States, is a whitish species with a cream-coloured or pale yellowish disc; numerous (16–22) adnate lamellae with a decurrent tooth; 2-spored basidia; subclavate to subfusiform, clampless, smooth, much larger cheilo- and pleurocystidia; inamyloid lamellar trama; clavate or fusiform caulocystidia; and basidiomata that grow on vegetable debris, decayed wood or moss-covered bases of deciduous trees. *Mycena globata*, a Brazilian species, differs from the present species in having smaller, white basidiomata; much larger basidiospores, cheilo- and pleurocystidia; inamyloid lamellar trama; somewhat smaller caulocystidia; and basidiomata that grow on dead branch of dicotyledonous trees. *Mycena radicifer*, known from Germany and Switzerland, is very similar to the present species in having similar-sized basidiomata associated with plant roots and almost similar features of both pileus surface and lamellae and in lacking pleurocystidia. But that species differs in having a stipe that is pruinose above and glabrous below; a white basal mycelium extended to some length on the root; somewhat larger basidiospores; cylindrical to subfusiform, often apically branched, smooth, somewhat larger cheilocystidia; sparsely diverticulated pileipellis hyphae; and a stipitipellis lacking caulocystidia.

22. ***Mycena sravaka*** Aravind. & Manim. *sp. nov*. Pl. 2 K; Fig. 22 A–H

MycoBank MB811085

Diagnosis:—Characterised by pubescent lamella-edges and sides; versiform, smooth, exudative cheilocystidia and pleurocystidia; a gelatinised subhymenium; and hyphae of the pileipellis with nodulose-diverticulate terminal cells. Differing from *M. olida* in having a brown-coloured pileus, fusoid caulocystidia, and hyphae with clamp connections.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 27 November 2010, *D.M. Aravindakshan DM519*, K(M) 191758 (K!).

Etymology:—*sravaka* (Sanskrit), exuding.

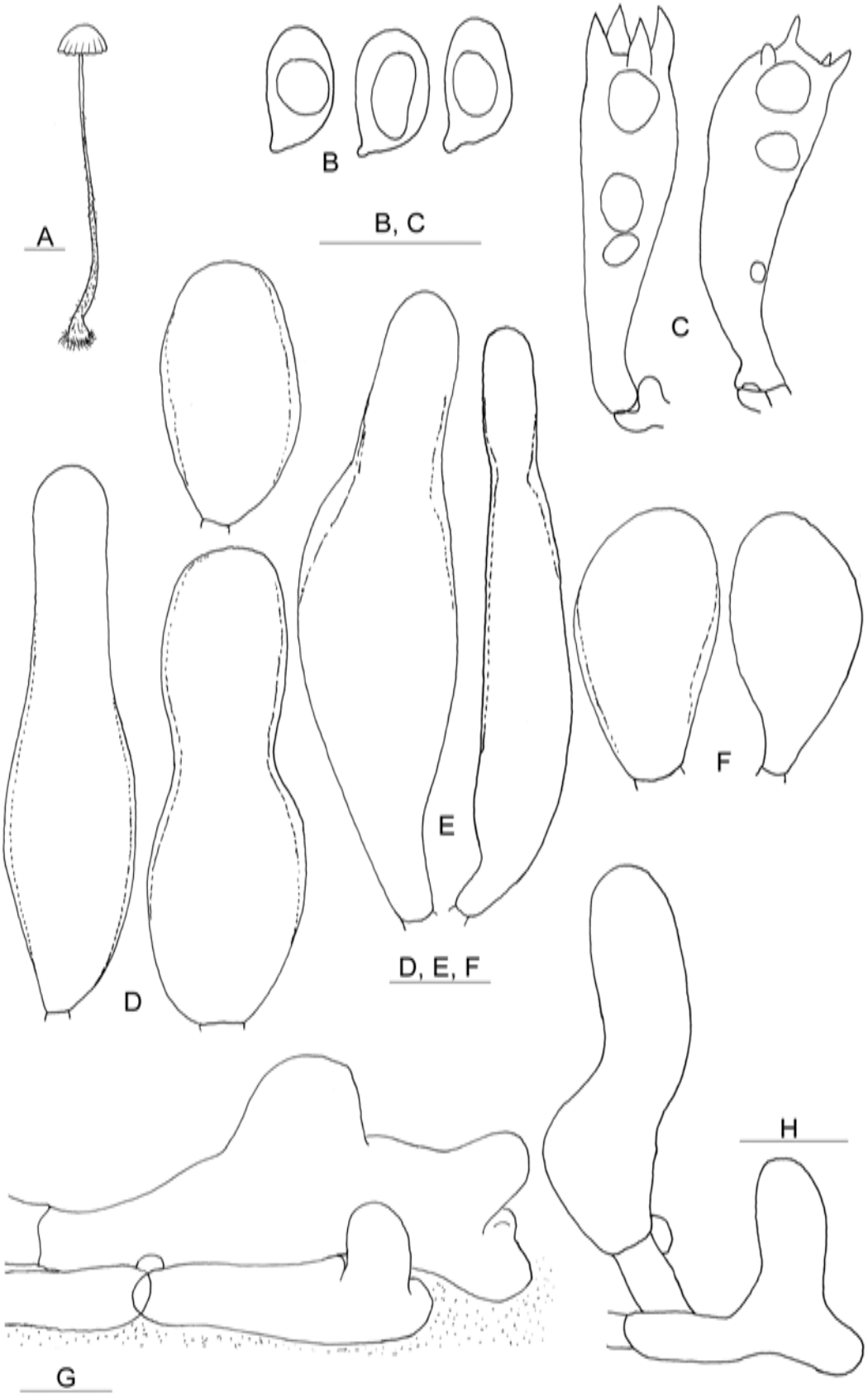


Figure 22. *Mycena sravaka*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pleurocystidia; F, pileus marginal cells; G, terminal elements of the pileipellis; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

Basidioma small. Pileus 6 mm diam., 2.5 mm high, convex; surface dark brown (6E8) at the centre and on the striations, brown (6C4) towards margin and light brown (6D5) elsewhere, translucent-striate, finely pubescent; margin straight and entire, finely pubescent under a lens. Lamellae up to 15 reaching the stipe, ascending, adnate with a decurrent tooth, whitish, 1 mm thick, subclose, with lamellulae of 1–3 lengths; edge and sides finely hairy under a lens, edge concolourous with the sides. Stipe 35 × 1–1.5 mm, central, terete, slightly tapering towards the apex, hollow; surface translucent, whitish, finely pubescent; base slightly swollen, with off-white basal mycelium. Context not conspicuous. Odour and taste not distinctive.

Basidiospores 7.5–9 × 4–6 (8.03 ± 0.5 × 4.3 ± 0.57) µm, Q = 1.5–2.29, Q_m = 1.89, ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia 20.5–24 × 6.5–7.5 µm, clavate, bearing 4 sterigmata up to 5 µm long. Cheilocystidia crowded, 21–52 × 8–16 µm, versiform: ellipsoid, clavate, fusoid or lageniform, exuding a gelatinous substance, slightly (0.5–0.75 µm) thick-walled on sides, hyaline. Pleurocystidia 32.5–71 × 5.5–19 µm, similar to cheilocystidia in shape. Lamellar trama subregular; hyphae 2–19 µm wide, thin-walled, hyaline, slightly gelatinised towards the edge, moderately vinoid in Melzer's reagent. Subhymenium ramose, gelatinised. Pileus trama subregular; hyphae 6.5–25.5 µm wide, thin-walled, with greyish brown contents, very faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 2–12 µm wide, gelatinised, thin-walled, hyaline; terminal elements 28–68 × 15–17 × 7.5–11 µm, nodulose diverticulate, thin-walled, hyaline. Pileus marginal cells 21–33 × 8.5–19 µm, clavate, ovate or obovate, thin- to slightly (0.25–0.5 µm) thick-walled. Stipitipellis a cutis of smooth hyphae with ascending caulocystidia; hyphae 1.5–6 µm wide, thin-walled, hyaline. Caulocystidia 21–55.5 × 7.5–13 µm, fusoid to cylindrical, thin- to slightly (0.25–0.5 µm) thick-walled, hyaline or with pale greyish contents. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Solitary, on decaying twigs. November.

Notes:—Presence of inamyloid basidiospores, a brownish pileus, ascending lamellae and smooth hyphae of the pileipellis indicate that *M. sravaka* belongs in subsect. *Hiemales* of sect. *Hiemales*. In this subsection, only four species have, so far, been described that have pileipellis composed of smooth hyphae. *Mycena atropapillata*, known from France, has a grey brown pileus, smooth hyphae of the pileipellis, and smooth cheilocystidia like the present species. But that species differs in having a rooting stipe, a prominent, pointed umbo over the pileus and larger basidiospores and in lacking pleuro- and caulocystidia. *Mycena olida* is somewhat similar to *M. sravaka* in having somewhat similar-sized basidiomata, a finely puberulous stipe, similar-sized basidiospores and basidia, and morphologically similar cheilo- and pleurocystidia. However, that species has numerous lamellae (up to 22); a glabrous, pale cream or pale yellowish pileus surface; clampless cheilo- and pleurocystidia; inflated terminal cells of the pileipellis hyphae; and lobed caulocystidia. *Mycena globata*, reported from Brazil, is also comparable with *M. sravaka* as it has large cheilocystidia and smooth hyphae of the pileipellis. But the small, whitish basidiomata, the larger basidiospores, the inamyloid lamellar trama, and the cylindrical, curved caulocystidia make the Brazilian species distinct. *Mycena stictopus*, a La Réunion species (Maas Geesteranus & Hausknecht 1999), also possesses a brown pileus, clamp connections and smooth pileipellis hyphae like the present species. But the former differs in having smaller basidiomata, a grey-

brown dotted stipe surface, smaller basidiospores and an inamyloid lamellar trama and in lacking pleurocystidia.

23. ***Mycena vamana*** Aravind. & Manim. *sp. nov*. Pl. 2 L; Fig. 23 A–G

MycoBank MB811086

Diagnosis:—Characterised by very small corticolous basidiomata; two types of hymenial cystidia; a gelatinised subhymenium; slightly gelatinised and nodulose-diverticulate hyphae of the pileipellis; slightly gelatinised and smooth hyphae of the stipitipellis; and caulocystidia with brownish pigments. Differing from *M. stictopus* in having pleurocystidia, larger basidiospores and vinoid lamellar trama.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 25 September 2006, *D.M. Aravindakshan DM104*, K(M) 191760 (K!).

Etymology:—*vamana* (Sanskrit), short.

Basidiomata small. Pileus 3.5–4 mm diam., initially broadly parabolic with a slightly umbonate centre, becoming convex with a rather flat centre with age; surface brown (6E5) with darker centre and striations, whitish towards margin, translucent-striate, pubescent; margin straight, entire or undulating. Lamellae adnate with a decurrent tooth, ascending, white, thin, up to 1 mm wide, subdistant, with lamellulae of 3–4 lengths; edge finely hairy under a lens, concolourous with the sides. Stipe 5–9 × 0.5–1 mm, central, terete, almost equal, hollow; surface translucent, white, densely pruinose; base slightly swollen, with scanty basal mycelium. Context thin, less than 0.5 mm thick, concolourous with the pileus surface. Odour not distinctive. Taste not recorded.

Basidiospores 6.5–8.5 × 4.5–5.5 (7.45 ± 0.84 × 4.85 ± 0.54) µm, Q = 1.4–1.78, Q_m = 1.54, ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia 17–26 × 6.5–9.5 µm, clavate, bearing 2–4 sterigmata up to 2.5 µm long. Lamella-edge heterogeneous. Cheilocystidia two types: one type smaller, 27–41.5 × 10.5–13 µm, clavate, thin-walled, hyaline; second type larger, 38–75 (81.5) × 16–19 µm, utriform to fusoid, often with a long protruding apical half, thin- to slightly (0.25 µm) thick-walled, rarely with a coating of an amorphous substance around the protruding apical part, hyaline. Pleurocystidia similar to cheilocystidia in all aspects, including the dimorphic nature. Lamellar trama subregular; hyphae 1–18 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium gelatinised, ramose. Pileus trama interwoven; hyphae 2–33 µm wide, thin- to slightly (0.25 µm) thick-walled, with brownish contents, faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 2–8.5 µm wide, slightly gelatinised, thin- to slightly (0.5 µm) thick-walled, hyaline, nodulose-diverticulate. Pileus marginal cells 18–53 × 9–17 µm, versiform: oblong, ellipsoid or obovoid or broadly clavate, often with long, narrow stalk, thin- to slightly (0.5 µm) thick-walled, hyaline. Stipitipellis a cutis with scattered or clustered caulocystidia; hyphae 1.5–4.5 µm wide, slightly gelatinised, thin-walled, hyaline. Caulocystidia 23–44 × 5.5–13 µm, clavate or narrowly utriform, thin- to slightly (0.5 µm) thick-walled, with brownish contents. Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—In small groups, on the bark of a living tree (*Ficus religiosa*). September.

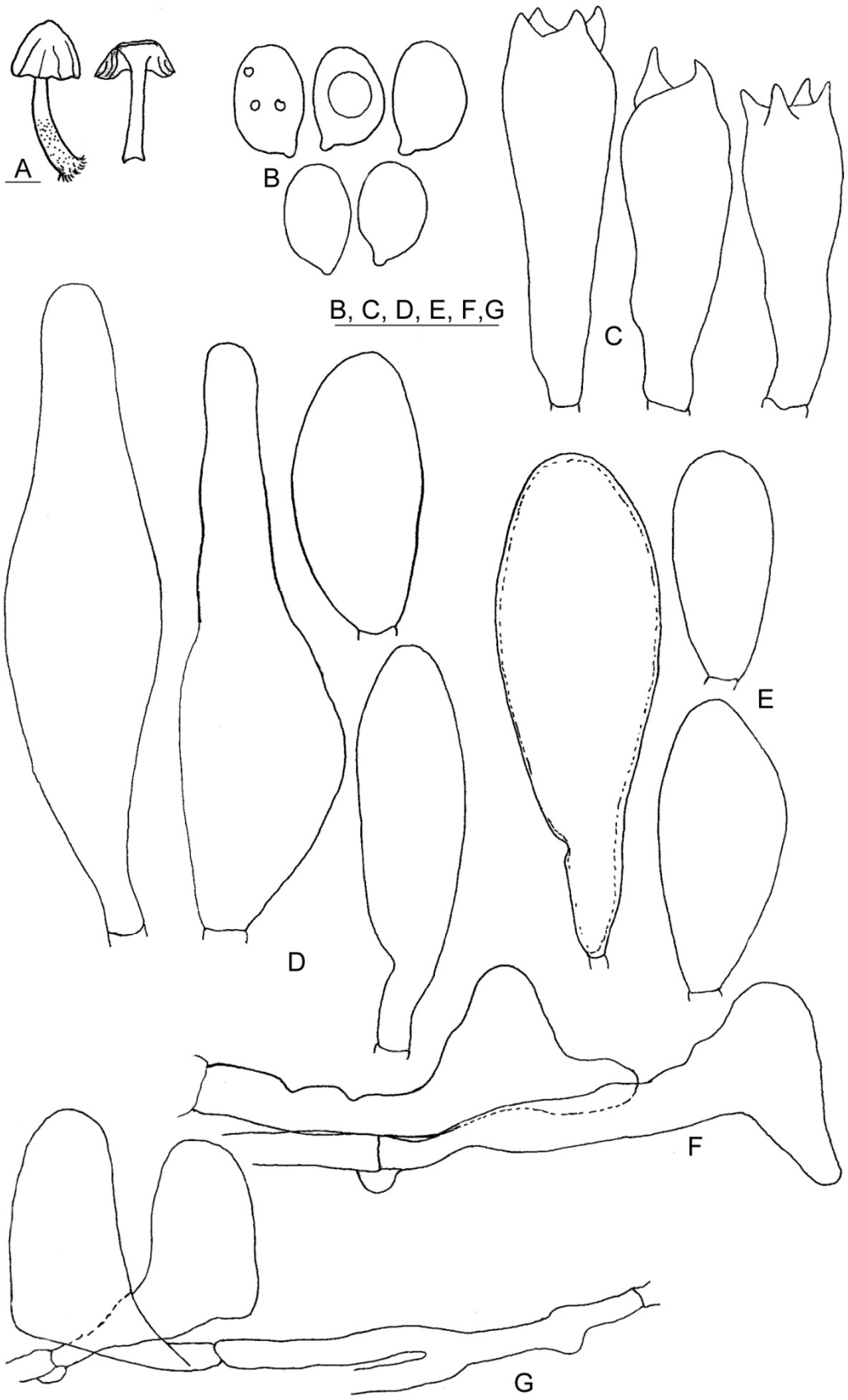


Figure 23. *Mycena vamana*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, hyphae of the stipitipellis. Scale bars: A = 1 mm; B-G = 10 µm.

Notes:—The inamyloid basidiospores, the ascending lamellae and the darker pileus together place *M. vamana* in subsect. *Hiemales* of sect. *Hiemales*. *Mycena vamana* has no features comparable with those of any northern hemisphere species (Maas Geesteranus 1992b). However, *M. stictopus* reported from La Réunion is somewhat similar to *M. vamana* in having a brown pileus, a brown-dotted stipe surface (due to pigmented caulocystidia), and hyphae with clamp connections. But that species differs in having smaller basidiospores and inamyloid lamellar trama and in lacking pleurocystidia. *Mycena acutifera* Métrod reported from Madagascar is phenetically similar in having brownish basidiomata, an umbonate pileus, similar-sized basidiospores, 2-spored basidia, and non-diverticulate hyphae of the pileipellis. But that species differs in having somewhat larger basidiomata, much larger (up to 120 µm long) pleurocystidia and hyaline caulocystidia.

24. ***Mycena sandra*** Aravind. & Manim. *sp. nov*. Pl. 2 M; Fig. 24 A–H

MycoBank 811103

Diagnosis:—Characterised by inamyloid, subamygdaliform basidiospores; versiform cheilo-, pleuro- and caulocystidia; and gelatinised hyphae of both the pileipellis and stipitipellis. Differing from *M. illita* in having smaller basidiomata, caulocystidia, and hyphae of the pileipellis with cystidioid terminal cells.

Holotype:—INDIA. Kerala State: Thiruvananthapuram District, Palode, TBGRI Campus, 18 July 2007, *D.M. Aravindakshan DM168*, K(M) 191762 (K!).

Etymology:—*sandra* (Sanskrit), viscid.

Basidiomata small. Pileus 4.5–9 mm diam., 2–3.5 mm high, conic when young, becoming broadly convex with age; surface dark brown (6F6) at the centre and on the striations, brown (6E5, 6E4) or light brown (6D4) elsewhere, translucent-striate, slightly viscid; margin straight and entire when young, becoming finely crenulate under a lens with age. Lamellae up to 13 reaching the stipe, sinuate or adnate with decurrent tooth, whitish, up to 1.5 mm wide, subclose, with lamellulae of 1–3 lengths; edge finely hairy under a lens, concolourous with the sides. Stipe 18–24 × 0.75–1 mm, central, terete, almost equal, hollow; surface translucent, whitish, finely pruinose or pubescent; base slightly swollen, with a basal mycelial felt. Context not conspicuous, 0.5 mm wide, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 8–10 × 5–7 (8.68 ± 0.63 × 5.85 ± 0.52) µm, Q =1.23–1.82, Q_m = 1.49, subamygdaliform, thin-walled, hyaline, smooth, inamyloid. Basidia 24 × 9 µm, clavate, easily collapsing. Lamella-edge sterile. Cheilocystidia crowded, 26.5–79 × 10–17 µm, versiform: fusion, narrowly utriform, flexuous or inflated clavate, thin- to slightly (0.25 µm) thick-walled on sides, hyaline. Pleurocystidia 45–77 × 10–15 µm, similar to cheilocystidia in all aspects. Lamellar trama subregular; hyphae 3–20 µm, thin-walled, hyaline, slightly gelatinised, inamyloid in Melzer's reagent. Subhymenium ramose. Pileus trama interwoven; hyphae 5–25 µm wide, thin- to slightly (0.5 µm) thick-walled, with a greyish contents, inamyloid in Melzer's reagent. Pileipellis a cutis; hyphae 2–7 µm wide, slightly gelatinised, thin-walled, hyaline, with intercalary diverticulations and cystidioid terminal cells; terminal cells cystidioid 32–66 × 8–19 × 8–9 µm, thin-walled, hyaline or

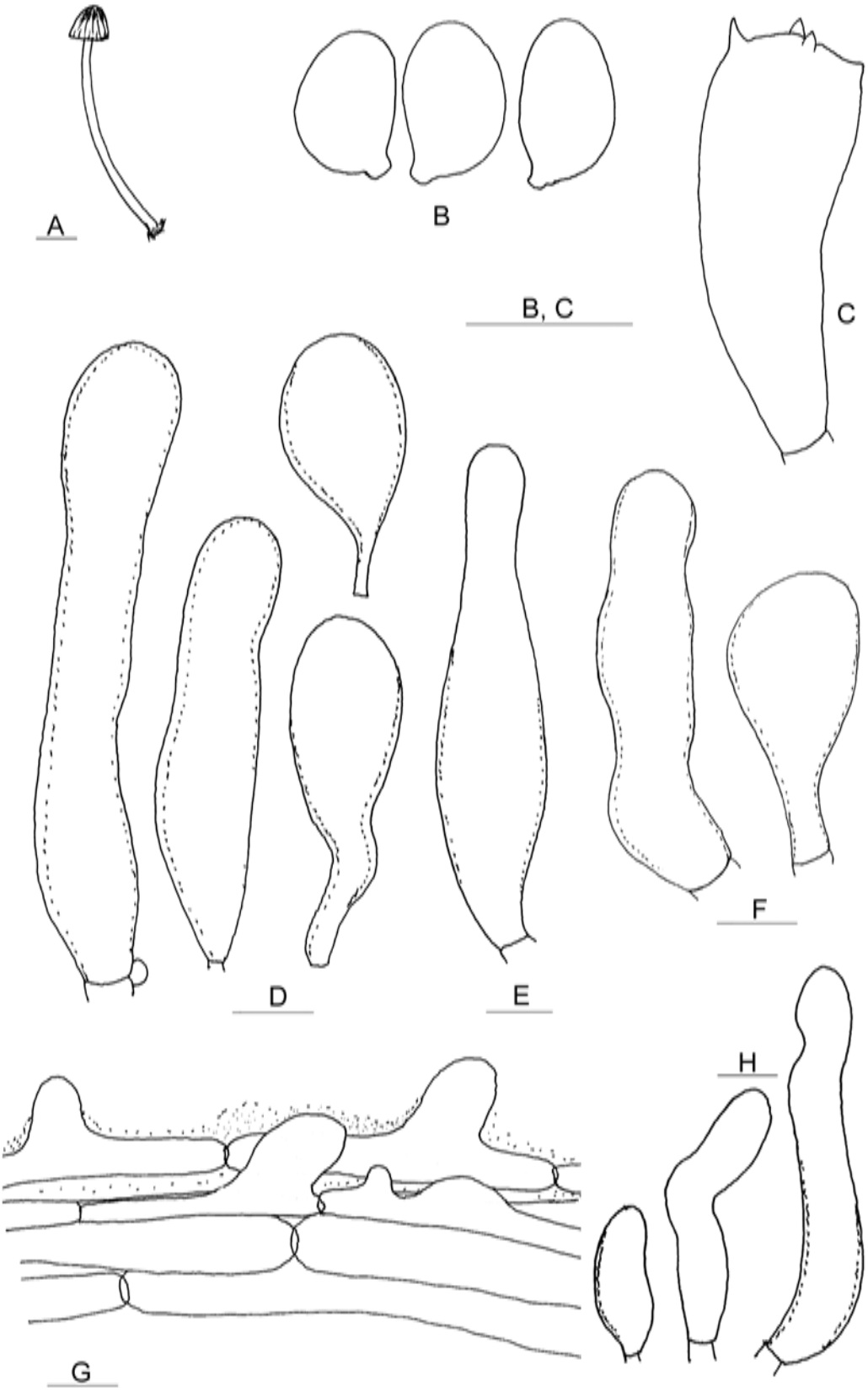


Figure 24. *Mycena sandra*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pleurocystidium; F, pileus marginal cells; G, cystidioid cells of the pileipellis; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

with pale greyish contents. Pileus marginal cells 31–70 × 12.5–20.5 µm, similar to cheilocystidia in all aspects. Stipitipellis a cutis of smooth hyphae with clusters of caulocystidia; hyphae 1–4 µm wide, slightly gelatinised, thick-walled (0.5 µm). Caulocystidia 19–84.5 × 7–9 µm, versiform; cylindrical or clavate or flexuous, slightly (0.5–1.5 µm) thick-walled, hyaline. Stipe trama inamyloid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on the bark of a standing tree. July.

Notes:—Characters such as the ellipsoid and inamyloid basidiospores, the pileipellis devoid of a separable pellicle, the ascending lamellae, and the dark brown pileus lead *M. sandra* species to sect. *Hiemales* subsect. *Hiemales*. But the key to the species of subsect. *Hiemales* (Maas Geesteranus 1992b) does not lead it to any species. *Mycena illita* Corner, a Malaysian species, shows remarkable similarity to *M. sandra* in having a sepia-brown, viscid pileus, similar-sized basidiospores, somewhat similar-shaped cheilo- and pleurocystidia, and gelatinised hyphae of both the pileipellis and stipitipellis. But that species differs in having somewhat larger basidiomata, ellipsoid to subglobose basidiospores and larger cheilo- and pleurocystidia and in lacking both pileocystidia (cystidioid terminal cells) and caulocystidia.

Mycena globata is also somewhat similar to the present species in having a sterile lamella-edge and almost similar type of cheilo-, pleuro- and caulocystidia. But the former is a white species with non-gelatinised hyphae of both pileipellis and stipitipellis and somewhat larger and narrower (9.2–11.2 × 4.9–5.8 µm, Q_m = 2.1) basidiospores. *Mycena mulika*, described elsewhere in this account and placed in sect. *Hiemales*, is also different from the present species because of the former's apparent association with plant roots, discoid stipe base, clavate cheilocystidia with excrescences, non-gelatinised hyphae of both the pileipellis and stipitipellis and much smaller and narrower basidiospores.

Mycena sect**.** ***Hiemales*** subsect. ***Omphaliariae*** Kühner ex Maas Geest., Persoonia 11 (1): 115 (1980).

Basidiomata with features as in sect. *Hiemales*, but lamellae horizontal to arcuate and the edge straight to concave.

Lectotype:—*Mycena speirea* (Fr.) Gillet

25. ***Mycena niranjana*** Aravind. & Manim. *sp. nov*. Pl. 2 N; Fig. 25 A–F

MycoBank MB811089

Diagnosis:—Characterised by small, whitish, corticolous basidiomata; deeply decurrent lamellae; cheilocystidia with coarse, finger-like excrescences; and nodulose-diverticulate caulocystidia. Differing from *M. speirea* in having smaller basidiospores, cheilo- and caulocystidia, clamp connection, and non-lubricous pileus.

Holotype:—INDIA. Kerala State: Palakkad District, Silent Valley National Park, 17 June 2010, *D.M. Aravindakshan DM431*, K(M) 191763 (K!).

Etymology:—*niranjana* (Sanskrit), stainless.

Basidiomata small. Pileus 2.5–5 mm diam., up to 2 mm high, parabolic when young, becoming convex with age; surface pale greyish at the centre and on the striations, pure white elsewhere, translucent-striate, finely pruinose; margin straight, entire when young, becoming slightly undulate with age. Lamellae deeply decurrent to almost arcuate, white, less than 0.5 mm wide, subdistant, with lamellulae of 1 length; edge finely torn under a lens, concolourous with the sides. Stipe 5–15 × 1 mm, central, terete, almost equal, hollow; surface translucent, white, pruinose; base swollen but not discoid, with a basal mycelial felt. Context not conspicuous, less than 0.5 mm wide, concolourous with the pileus. Odour and taste not recorded.

Basidiospores 6–7.5 × 3–4 (6.7 ± 0.47 × 3.39 ± 0.37) µm, Q = 1.5–2.33, Q_m = 1.99, oblong-ellipsoid, thin-walled, hyaline, smooth, inamyloid. Basidia 10.5–19 × 6–7.5 µm, clavate, bearing 4 sterigmata up to 5 µm long. Lamella-edge sterile. Cheilocystidia crowded, 9.5–16 × 4–7 µm, cylindrical to clavate, thin-walled, hyaline, with a few finger-like outgrowths at the apex (1–6.5 × 1–2.5 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 4–15 µm wide, thin-walled, hyaline, very faintly dextrinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 7–30 µm wide, thin-walled, hyaline, very faintly dextrinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 1.5–6 µm wide, slightly gelatinised, thin-walled, hyaline, nodulose-diverticulate. Stipitipellis a cutis with scattered or clustered caulocystidia; hyphae 1–4 µm wide, thin-walled, hyaline, smooth. Caulocystidia 10.5–21 × 3–7 µm, nodulose-diverticulate. Stipe trama inamyloid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on the bark of unidentified standing trees. June.

Notes:—*Mycena niranjana* easily fits in sect. *Hiemales* subsect. *Omphaliariae* owing to its whitish basidiomata, ellipsoid and inamyloid basidiospores, arcuate lamellae, and a whitish lamella-edge. Characters such as the ellipsoid basidiospores and the simple excrescences of the gelatinised hyphae of the pileipellis lead it to the *M. speirea* complex. Within the *M. speirea* complex, *M. niranjana* can be compared only with a white form of *M. speirea* (Maas Geesteranus 1992b: 467), known only from the Netherlands, in having whitish basidiomata, a sterile lamella-edge, and diverticulate hyphae of the pileipellis. But that taxon differs in the presence of somewhat lubricous pileus, larger basidiospores, and larger cheilo- and caulocystidia and in the absence of clamp connections in any tissues.

Mycena alba (Bres.) Kühner, a European species, is similar to *M. niranjana* in several characters such as the small basidiomata, the greyish or white pileus, the arcuate lamellae, the puberulous stipe, the non-vinescent lamellar trama, the smooth hyphae of the stipitipellis, the clavate to irregularly shaped caulocystidia, and the occurrence on trunks of trees. However, the globose basidiospores, the larger cheilocystidia with broader apices and the morphology of the hyphae of the pileipellis of *M. alba* make it distinct from *M. niranjana*. *Mycena phaeophylla* Kühner, another species of the subsect. *Omphaliariae*, also has similar ellipsoid basidiospores. That species, however, differs from *M. niranjana* in having larger basidiomata, a dark brown pileus, slightly broader basidiospores, and a pileus trama with brownish contents and in lacking caulocystidia. The Brazilian species, *M. lepida* Maas Geest. & de Meijer, of subsect. *Omphaliariae*, also seems to be somewhat close to *M. niranjana* owing to similar-sized basidiomata,

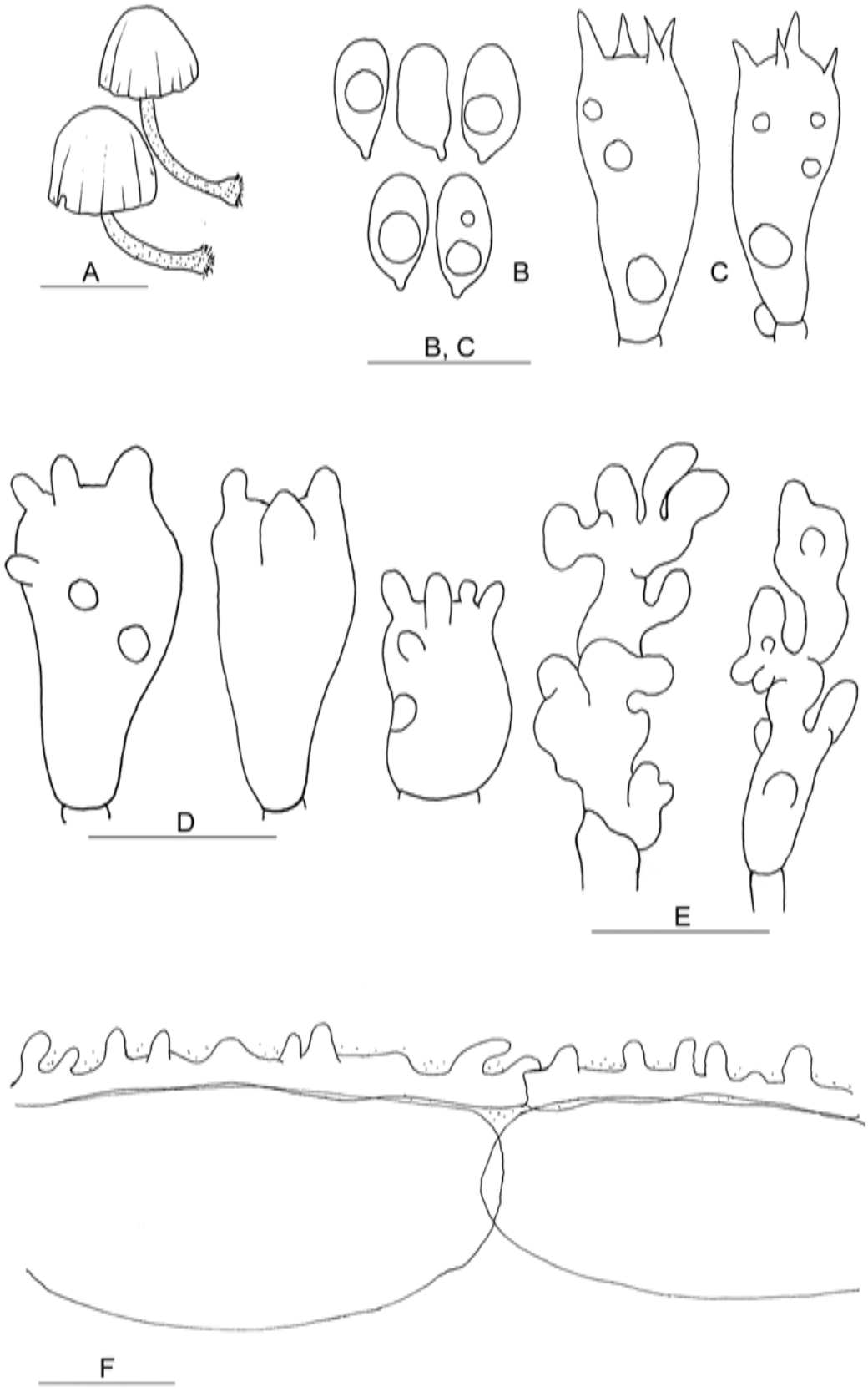


Figure 25. *Mycena niranjana*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis. Scale bars: A = 5 mm; B-F = 10 µm.

basidiospores, basidia, cheilocystidia and caulocystidia. However, characters such as a very pale yellowish pileus, a much longer (up to 4 cm) stipe, and occurrence on decaying leaves make *M. lepida* different.

26. ***Mycena nimna*** Aravind. & Manim. *sp. nov*. Pl. 2 O; Fig. 26 A–F

MycoBank MB811090

Diagnosis:—Characterised by corticolous basidiomata, an olive brown to dark brown pileus with a central depression, versiform cheilocystidia, a duplex pileus trama, nodulose-diverticulate and slightly gelatinised hyphae of the pileipellis, and caulocystidia with brownish contents. Differing from *M. phaeophylla* in having pleurocystidia and caulocystidia.

Holotype:—INDIA. Kerala State: Kozhikode District, Cheruvannur, 9 July 2007, *D.M. Aravindakshan DM157*, K(M) 191764 (K!).

Etymology:—*nimna* (Sanskrit), with a depressed surface.

Basidiomata small. Pileus 4–17 mm diam., up to 6 mm high, convex with a central depression, rarely umbonate or umbilicate; surface initially uniformly olive brown (4E3, 4D3) or brownish grey (4E2) with a whitish margin, becoming dark brown (5F6) at the centre, orange grey (5B2) at the margin, and greyish brown (5D3) elsewhere with age, translucent-striate, finely pruinose or pubescent; margin straight and entire when young, flaring out and becoming wavy with age. Lamellae 16–17 reaching the stipe, adnate with a decurrent tooth or subdecurrent or arcuate, yellowish grey (4B2) or white, up to 3 mm wide, subdistant, with lamellulae of 1–4 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 4–23 × 0.5–1.5 mm, excentric or central, terete, almost equal, hollow; surface translucent, yellowish grey (4B2) to yellowish white (4A2), pruinose or pubescent; base slightly swollen with a white, cottony basal mycelial felt. Context thin, up to 1.5 mm thick, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6–8 × 4–6.5 (7.13 ± 0.5 × 4.99 ± 0.44) µm, Q = 1.18–1.63, Q_m = 1.44, broadly ellipsoid to subamygdaliform, thin-walled, hyaline, smooth, inamyloid. Basidia 24–32 × 7–8.5 µm, clavate to subcylindrical, hyaline, bearing 4 (rarely 1) sterigmata up to 4 µm long. Lamella-edge heterogeneous. Cheilocystidia 16.5–38 × (6) 8–17 µm, versiform: cylindrical, clavate, utriform or irregular in outline, thin-walled, hyaline. Pleurocystidia very rare, 24 × 8 µm, fusoid. Lamellar trama subregular; hyphae 1–24.5 µm wide, thin-walled, hyaline, inamyloid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama duplex, subregular; upper hyphae 12.5–32.5 µm wide, thin- to slightly (0.5 µm) thick-walled, with pale brownish contents, faintly vinoid in Melzer's reagent; lower hyphae 2.5–15 µm, thin-walled, hyaline. Pileipellis a cutis; hyphae 2–7.5 µm wide, slightly gelatinised, thin-walled, hyaline, nodulose-diverticulate or with short lateral branches (10–13 × 8.5–12 µm) or rarely with short, cylindrical excrescences (3 × 1.5 µm). Stipitipellis a cutis; hyphae 3–8 µm wide, thin- to slightly (0.5 µm) thick-walled, hyaline; caulocystidia 16–44.5 × 7.5–13 µm, versiform: clavate or subcylindrical, thin- to slightly (0.5 µm) thick-walled, with brown contents. Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen in all tissues.

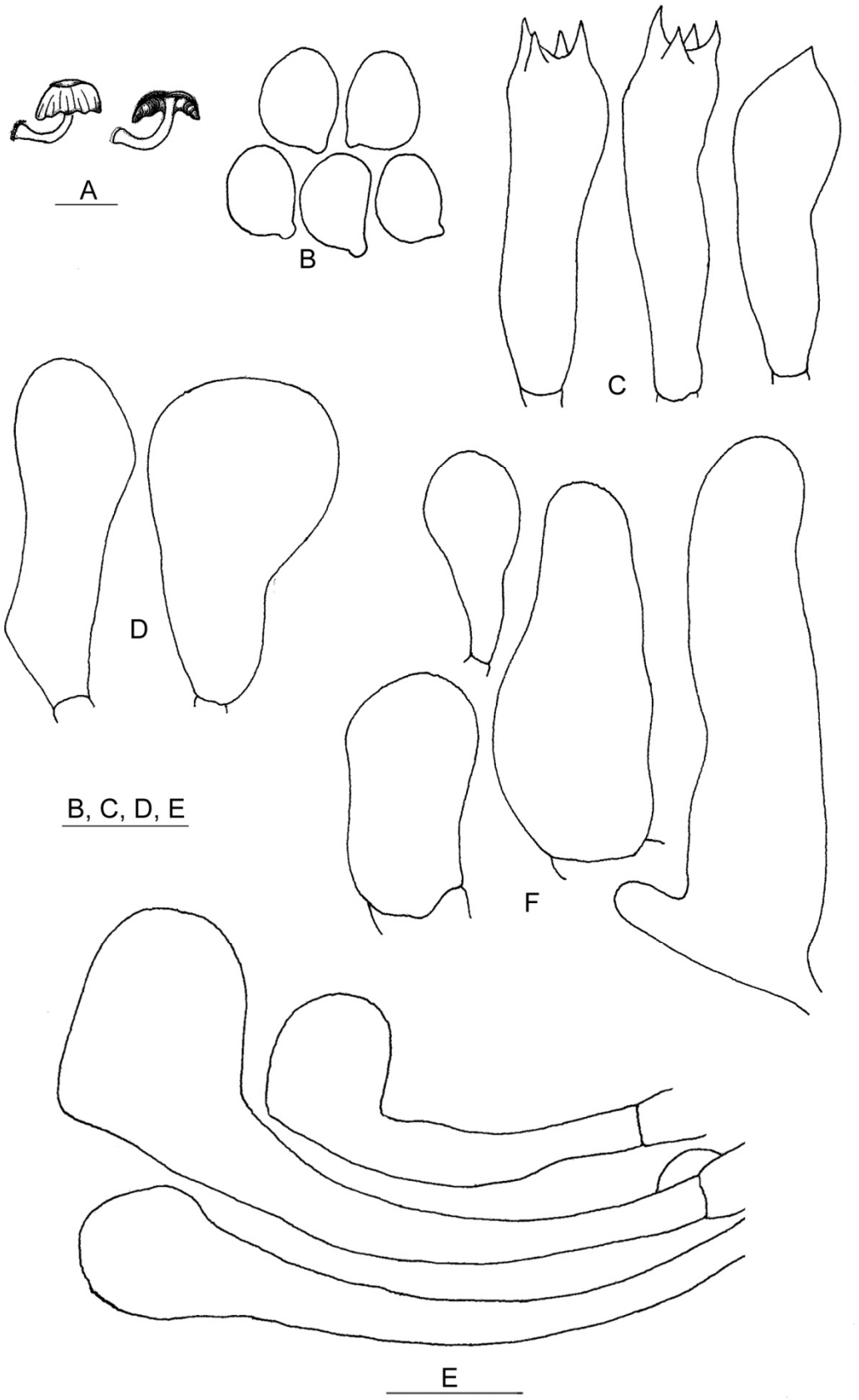


Figure 26. *Mycena nimna*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, hyphae of the pileipellis; F, caulocystidia. Scale bars: A = 1 cm; B-F = 10 µm.

Habit, habitat and phenology:—In small groups, on the bark of living trees (*Averrhoa carambola* and *Artocarpus heterophyllus*). July-September.

Additional collection examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, Botanical Garden, 20 September 2006, *D.M. Aravindakshan DM91*.

Notes:—In the infrageneric classification of the genus outlined by Maas Geesteranus (1992b), subsect. *Omphaliariae* of sect. *Hiemales* is the best place to accommodate this species owing to its inamyloid basidiospores, arcuate lamellae, whitish lamella-edge, and inamyloid lamellar trama. So far, seven species of *Mycena* belonging to this subsection have been reported. Owing to the presence of ellipsoid or amygdaliform basidiospores and simple excrescences on the hyphae of the pileipellis, *M. nimna* is closer to *M. phaeophylla* known from France. In addition, the latter species has a dark brown pileus, similar number of lamellae, a pruinose stipe surface, similar-sized basidiospores and hyphae of the hypoderm with brownish contents. But *M. phaeophylla* differs in having narrowly lageniform cheilocystidia, non-gelatinised hyphae of the pileipellis, and densely diverticulate hyphae of both pileipellis and stipitipellis and in lacking pleurocystidia and caulocystidia. Moreover, that species grows on moss-covered pieces of bark on the ground or on moss-covered stumps.

Mycena alba, a European species, is similar to the present species in having characters such as clavate to subcylindrical cheilocystidia, inflated, simple excrescences over the hyphae of the pileipellis, similar-sized basidiomata, similar-sized cheilocystidia, inamyloid lamellar trama, smooth hyphae of the stipitipellis and habitat on the trunks of trees. But that species differs in having globose basidiospores, irregularly shaped or lobed and hyaline caulocystidia, and whitish to cream-coloured basidiomata. *Mycena straminella* Maas Geest. & de Meijer, a Brazilian species, has ellipsoid to subamygdaliform basidiospores and smooth hyphae of the stipitipellis similar to the present species. But in all other characters, it differs from *M. nimna*.

VIII**. *Mycena*** section ***Hygrocyboideae*** (Fr.) Singer, Beihefte zur Sydowia 7: 49 (1973).

Basidiomata medium-sized. Pileus viscid. Covered with a separable, tough, gelatinous pellicle, variously coloured but never orange. Taste indistinctive, farinaceous or rancid. Lamellae ascending, decurrent with a tooth, the edge separable as an elastic-tough thread. Stipe viscid, sometimes reddening with age. Basidiospores ellipsoid, amyloid. Basidia clavate, 2- or 4-spored, without or with clamps. Cheilocystidia forming a sterile band, embedded in a gelatinous matter, generally clavate, excrescences at the apex. Pleurocystidia absent. Hyphae of the pileipellis embedded in a gelatinous matter, diverticulate. Hyphae of the stipitipellis embedded in a gelatinous matter, smooth; terminal cells diverticulate.

Type species:—*Mycena epipterygia* (Scop.) Gray

During the present study, only one species belonging to sect. *Hygrocyboideae* was observed.

27. ***Mycena vimala*** Aravind. & Manim. sp. nov. Pl. 3 A; Fig. 27 A–F

MycoBank MB811091

Diagnosis:—Characterised by clavate cheilocystidia with excrescences that are embedded in a gelatinous matter, absence of pleurocystidia, gelatinised hyphae of the pileipellis and stipitipellis, and distinct pileo- and caulocystidia. Differing from *M. epipterygia* in having pileocystidia, caulocystidia, smaller basidiomata, less number of lamellae, and smaller basidiospores.

Holotype:—INDIA. Kerala State: Palakkad District, Silent Valley National Park, 16 June 2010, *D.M. Aravindakshan DM407*, K(M)190595 (K!).

Etymology:—*vimala* (Sanskrit), pristine.

Basidiomata small. Pileus 2–5 mm diam., 2–3.5 mm high, conic or broadly parabolic when young, becoming broadly convex with age; surface greyish yellow (4C3) at the centre and on the striations, yellowish grey (4B2) elsewhere when young, becoming brownish grey (5D2) at the centre and on the striations, yellowish grey (4B2) elsewhere with age, translucent-striate, becoming faintly sulcate, slightly sticky, with a separable pellicle; margin slightly incurved and entire when young, becoming straight and slightly undulate with age. Lamellae 8–10 reaching the stipe, decurrent, white, thin, 1.5 mm wide, subdistant, with lamellulae of one length; edge entire, concolourous with the sides. Stipe 8–25 × 0.75–1.5 mm, central, terete, almost equal, hollow; surface translucent, white, faintly brownish towards base when young, becoming yellowish white (4A2) or yellowish grey (4B2) towards base with age, glabrous, slightly lubricous; base slightly swollen, almost insititious or with scanty basal mycelium. Context not conspicuous. Odour and taste not distinctive.

Basidiospores 6–7 × 3–4 (6.51 ± 0.45 × 3.41 ± 0.27) µm, Q = 1.63–2.33, Q_m = 1.92, ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia 13.5–18 × 5.5–7 µm, clavate, bearing 4 sterigmata up to 4 µm long. Cheilocystidia 11–21 × 4–13 µm, clavate or narrowly clavate, thin-walled, hyaline, with excrescences (2–18 × 1.5–3.5 µm). Pleurocystidia none. Lamellar trama subregular; hyphae 2.5–22 µm wide, thin-walled, hyaline, moderately vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 11–32 µm wide, thin-walled, hyaline or with pale brownish contents, moderately vinoid in Melzer's reagent. Pileipellis a cutis with terminal or intercalary pileocystidia; hyphae 1.5–9 µm, gelatinous, thin-walled, hyaline, with excrescences (1–13 × 1.5–3 µm); pileocystidia 13–28 × 5–13.5 µm, clavate or irregularly shaped, thin-walled, with simple or branched excrescences (3.5–12.5 × 1.5–3 µm). Pileus marginal cells similar to pileocystidia. Stipitipellis a cutis with terminal or intercalary caulocystidia; hyphae 1.5–6 µm wide, embedded in thick gelatinous matter, thin-walled, hyaline, with excrescences (3.5–15 × 1.5–2.5 µm). Caulocystidia 20–46 × 3–8 µm, clavate to irregularly shaped, thin-walled, hyaline, with simple or furcate excrescences or protrusions (2.5–24 (39) × 2–4.5 µm). Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. June.

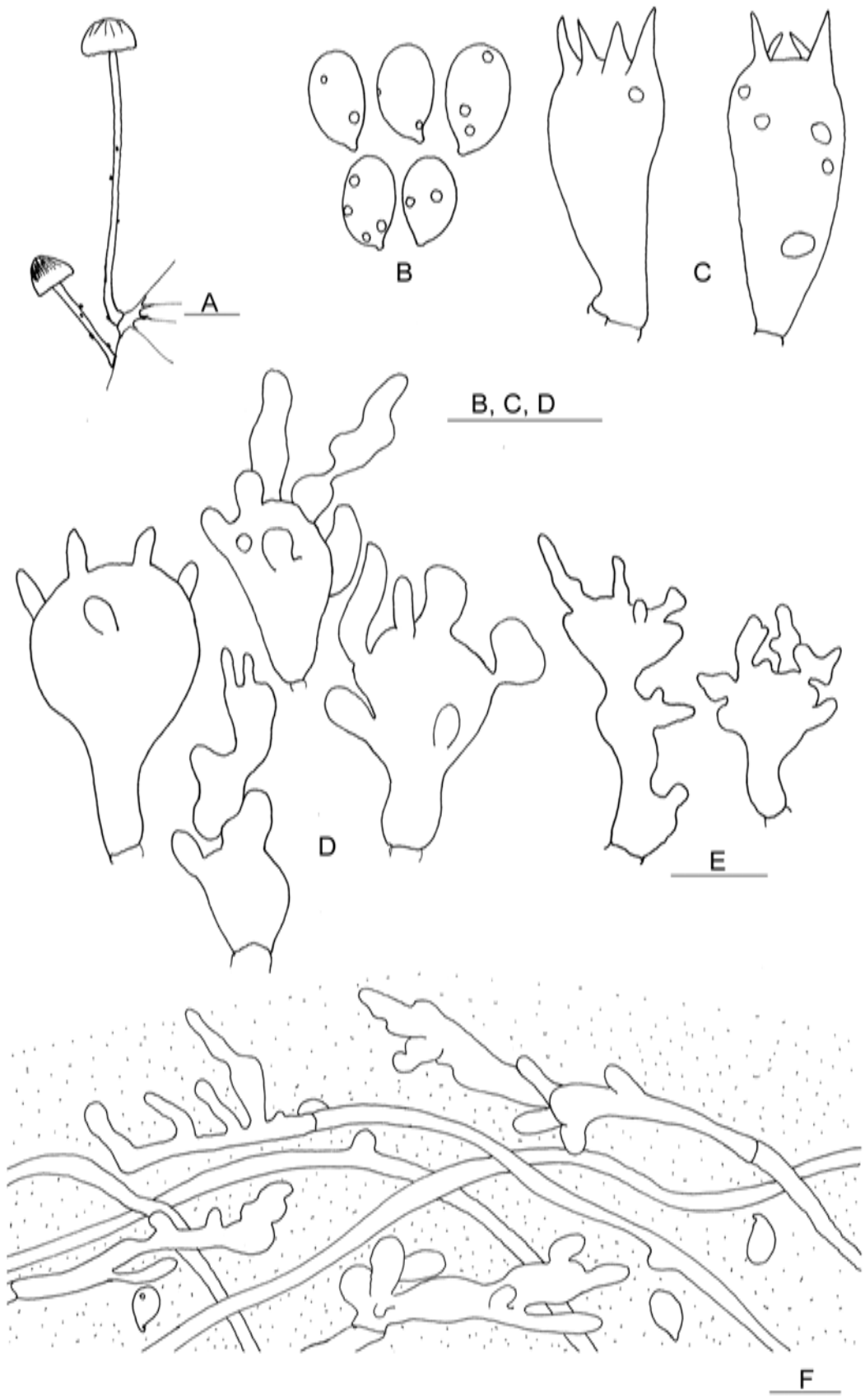


Figure 27. *Mycena vimala*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileocystidia; F, hyphae of the stipitipellis with caulocystidia. Scale bars: A = 5 mm; B-F = 10 µm.

Notes:—Characters such as the viscid pileus and stipe surfaces, the decurrent lamellae, the fragile stipe, the ellipsoid and amyloid basidiospores, the absence of pleurocystidia and the diverticulate hyphae of the pileipellis and stipitipellis are hallmarks of sect. *Hygrocyboideae*. Members of sect. *Fuliginellae* also show several of these characters, but they have tenacious stipe and are associated with conifer needles.

Section *Hygrocyboideae* comprises about eleven species. They include four American species (*M. epipterygia* with fifteen varieties, *M. griseoviridis* A.H. Sm., *M. viscosa* and *M. epipterygioides* A. Pearson), one Euro-Asiatic species (*M. lamprospora*) and six Australian species (*M. nyula* Grgur., *M. murna* Grgur., *M. tuuwuulensis* Grgur., *M. tasmaniensis* Grgur. and two as yet unnamed species (see Grgurinovic 2003, p196–197)).

Mycena epipterygia differs from *M. vimala* in having larger basidiomata with numerous lamellae and larger basidiospores and in lacking distinct pileocystidia and caulocystidia. *Mycena griseoviridis* differs in having large, olive-yellow basidiomata; broader (4.6–7.5 µm) basidiospores; larger cheilocystidia with much longer (–28 µm) digitate appendages; narrower (up to 14 µm) lamellar trama; and strongly gelatinised pileipellis; and in lacking distinct pileocystidia and caulocystidia. Although *M. viscosa* has yellowish grey basidiomata, it differs in having larger basidiomata with a rancid taste; larger, lacrymoid to subovoid basidiospores and larger cheilocystidia; and in lacking distinct pileo- and caulocystidia. Characters such as the larger and deep olive-coloured basidiomata and the larger basidiospores differentiate *M. epipterygioides* from *M. vimala*. *Mycena lamprospora* is a different species with a white pileus with greyish spots towards margin, broader (3 mm) lamellae, longer and narrower basidiospores, and larger cheilo- and pileocystidia.

Of the six Australian species of the sect. *Hygrocyboideae*, only one unnamed species (designated as *M.* sp. indet. A by Grgurinovic 2003) shows some similarity with *M. vimala* in having similar-sized basidiomata and adnate or decurrent lamellae. But that species differs from *M. vimala* in having a white-coloured pileus, a greyish yellow stipe base, and larger, cylindrical and doubtfully inamyloid basidiospores. All other Australian species have somewhat darker and larger basidiomata and larger (9.5–12.1 µm long) basidiospores.

IX. ***Mycena*** section ***Longisetae*** A. H. Sm. & Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 86 (3): 418 (1983).

Basidiomata small. Pileus less than 10 mm diam., convex to plano-convex, pilose owing to erect setae, white to orangish white or grey. Lamellae ascending, narrowly adnate to free, rarely forming pseudocollarium. Stipe filiform, variously pruinose, hispid or puberulous, typically arising from a circular hispid basal disc or sometimes merely subbulbous. Basidiospores ellipsoid, amyloid or rarely inamyloid. Basidia clavate, 4-spored. Cheilocystidia present or absent, sometimes exudative. Pleurocystidia absent. Pileipellis ranging from a hymeniform layer of acanthocysts to a cutis of spinulose hyphae with acanthocyst terminal cells, gelatinous or non-gelatinous, through which arise numerous thick-walled, hyaline or pigmented pileosetae. Pileus marginal cells may or may

not have a smooth apical prolongation. Caulocystidia aculeate to acicular, thin- to thick-walled. Clamp connections present or absent.

Type species:—*Mycena longiseta* Höhn.

During the present work, five species belong to this section were observed.

Key to the species

1. Basidiomata with brownish pileosetae; basidiospores 7–9.5 × 4–6.5 µm. .... (Stirps *Brunneisetosa*)28. ***Mycena lomavritha***
- Basidiomata with hyaline pileosetae..... (Stirps *Longiseta*) 2
2. Caulocystidia thick-walled; basidiospores 7–9 × 3.5–4.5 µm .....29. ***Mycena lomamaya***
- Caulocystidia thin-walled. 3
3. Cheilocystidia fusoid; pileosetae with excrescences or with protrusions at the base; basidiospores 6–7.5 × 3–4 µm .....30. ***Mycena jatila***
- Not with this combination of characters.....4
4. Cheilocystidia absent; caulocystidia non-aculeate; basidiospores 7.5–9.5 × 3.75–5.5 µm..... .....31. ***Mycena saloma***
- Cheilocystidia cylindrical, smooth; caulocystidia aculeate; basidiospores 7.5–8.5 × 3–4.5 µm .....32. ***Mycena pelava***

Mycena sect ***Longisetae*** stirps ***Brunneisetosa*** Desjardin, Boonprat. & Hywel-Jones, Fungal Diversity 11: 73 (2002).

Pileipellis of primordia and immature basidiomata a hymeniform layer of acanthocysts through which arise numerous pileosetae; at maturity the pileipellis develops (through expansion) into a subhymeniform layer or a cutis of densely spinulose hyphae with scattered, erect acanthocysts.

28. ***Mycena lomavritha*** Manim., Mycotaxon 117: 244 (2011). Pl. 3 B; Fig. 28 A–G

≡ *Mycena indica* Manim. & Leelav., Mycologia 80 (6): 861 (1988), nom. illeg., non Sarwal & Rawla (1983: 564).

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 6 July 1987, *P. Manimohan M383*, TRTC 50991 (TRTC!) .

Basidiomata small. Pileus 3–10 mm diam., initially convex, becoming conico-convex or broadly convex or hemispherical with age; surface initially white, becoming brownish grey at the centre with age, finely sulcato-striate from the disc to the margin, dry, pruinose, with scattered, erect pale brown hairs that are more towards margin; margin initially incurved, crenulate, becoming straight to plane, fimbriate with age. Lamellae narrowly adnate to adnexed to free, ascending, white, thin, up to 1 mm wide, close to subdistant, with lamellulae in three lengths; edge finely pruinose or torn, concolourous with the sides when fresh, becoming reddish brown when dry. Stipe 3–9 × 0.5–1 mm, central, terete, equal, hollow; surface translucent, white when fresh,

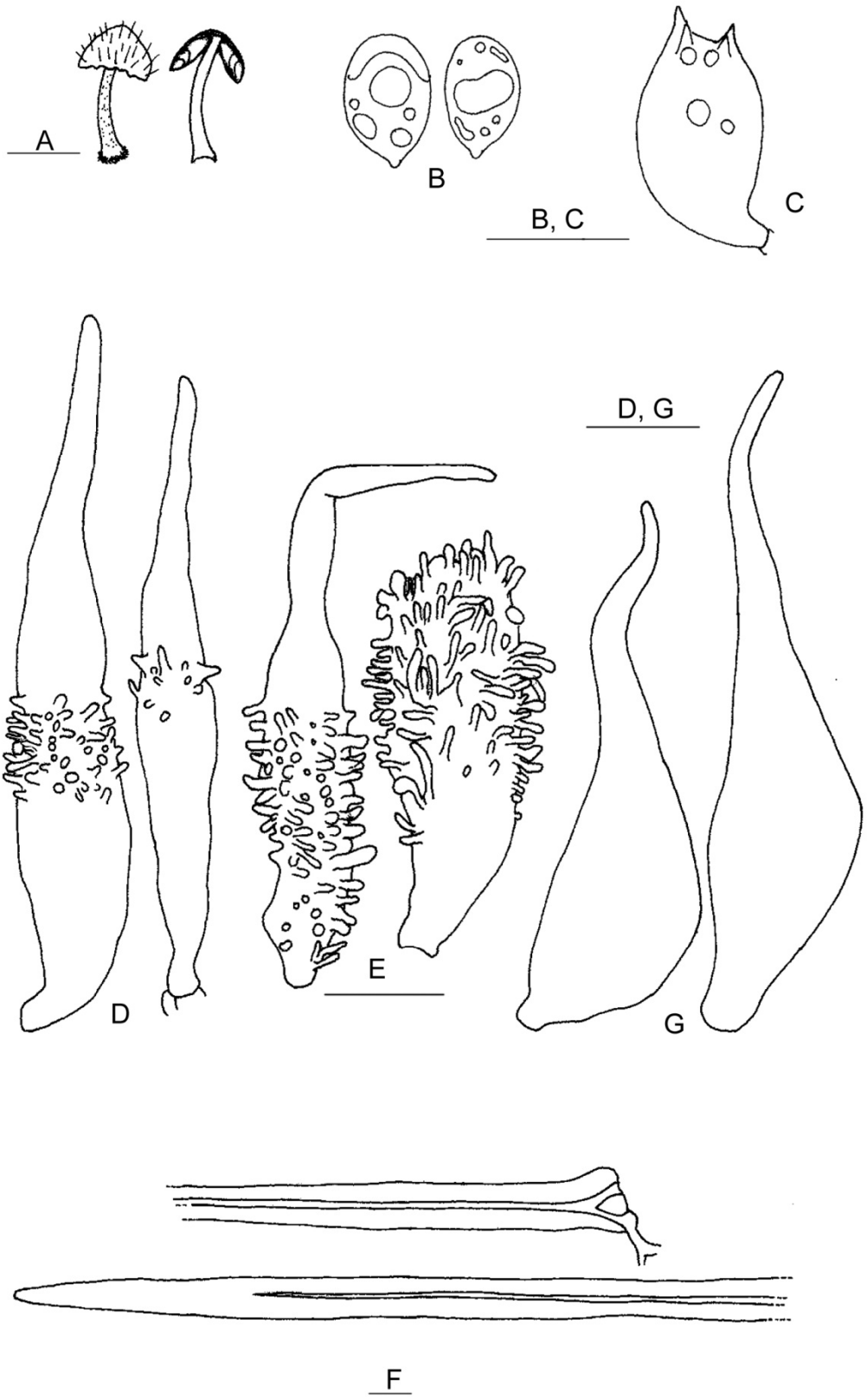


Figure 28. *Mycena lomavritha*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, pileoseta; G, caulocystidia. Scale bars: A = 1 cm; B-G = 10 µm.

becoming reddish brown when dry, densely pruinose or pubescent; base discoid, with white, finely hairy basal mycelium. Context thin, up to 0.5 mm thick, pale grey. Odour not distinctive. Taste not recorded.

Basidiospores 7–9.5 (12) × 4–6.5 (8.2 ± 1.24 × 5.58 ± 0.3) µm, Q = 1.17–1.9, Q_m = 1.47, ellipsoid to ovo-ellipsoid, thin-walled, hyaline, smooth, often with small guttules, strongly amyloid. Basidia 13–23 × 6–12 µm, clavate, bearing 4 sterigmata up to 8 µm long. Lamella-edge sterile. Cheilocystidia 45–130 × 5.5–13 µm, ventricose-fusoid with pointed apex, thin-walled, hyaline, with simple, cylindrical excrescences (0.5–3.5 × 0.5–1.25 µm) restricted at middle or towards lower portion. Pleurocystidia none. Lamellar trama more or less regular; hyphae 2–10 µm wide, often inflated (up to 35 µm diam.), thin-walled, hyaline when fresh, maroon or reddish brown pigment ooze out through the edge as droplets when mounted after drying, faintly vinoid in Melzer's reagent; subhymenium pseudoparenchymatous. Pileus trama interwoven, hyphae 2–10 µm wide, faintly vinoid in Melzer's reagent. Pileipellis a pulverulent epithelium of acanthocyst cells; acanthocyst cells 15–78 × 8–25 µm, versiform: subglobose, ovoid, clavate or fusoid, pyriform, thin-walled, hyaline to pale brownish, with simple, cylindrical excrescences (1–5 × 0.5–1 µm) that may be confined to the base or apex or distributed all over. Pileosetae 88.5–500 × 8–25 µm, with a brown, thick (1–7 µm), refractive wall. Pileus marginal cells similar to cheilocystidia. Stipitipellis a cutis with scattered or clustered terminal caulocystidia; hyphae 1–20 µm wide, thin-walled, hyaline; caulocystidia 25.5–67 × 8–16 µm, lageniform, or obclavate with swollen base and tapering apex, thin-walled, hyaline, smooth. Stipe trama hyaline when fresh, maroon or reddish brown pigment ooze out when mounted after drying, faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on the bark of standing trees such as *Artocarpus heterophyllus* and *Phyllanthus emblica*. June-July.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 7 June 2006, *D.M. Aravindakshan DM13*; Palakkad District, Silent Valley National Park, 16 June 2010, *D.M. Aravindakshan DM423*.

Notes:—The taxonomy of this species was discussed by Aravindakshan & Manimohan (2011), who reassigned it to the redefined sect. *Longisetae,* where it seems close to *M. brunneisetosa* Corner from Singapore. This is the only species from Kerala that can be placed in the stirps *Brunneisetosa* of sect. *Longisetae*.

Mycena sect. ***Longisetae*** stirps ***Longiseta*** A.H. Sm., North American Species of *Mycena*: 39 (1947).

Pileipellis of both primordia and mature basidiomata a cutis of repent, densely spinulose hyphae with repent acanthocyst terminal cells through which arise numerous pileosetae.

29. ***Mycena lomamaya*** Aravind. & Manim., Mycosphere 5 (2): 291 (2014). Pl. 3 C; Fig. 29 A–H

Holotype:—INDIA. Kerala State: Idukki District, Anamudi Shola National Park, 17 August 2010, *D.M. Aravindakshan DM498*, K(M) 178340 (K!).

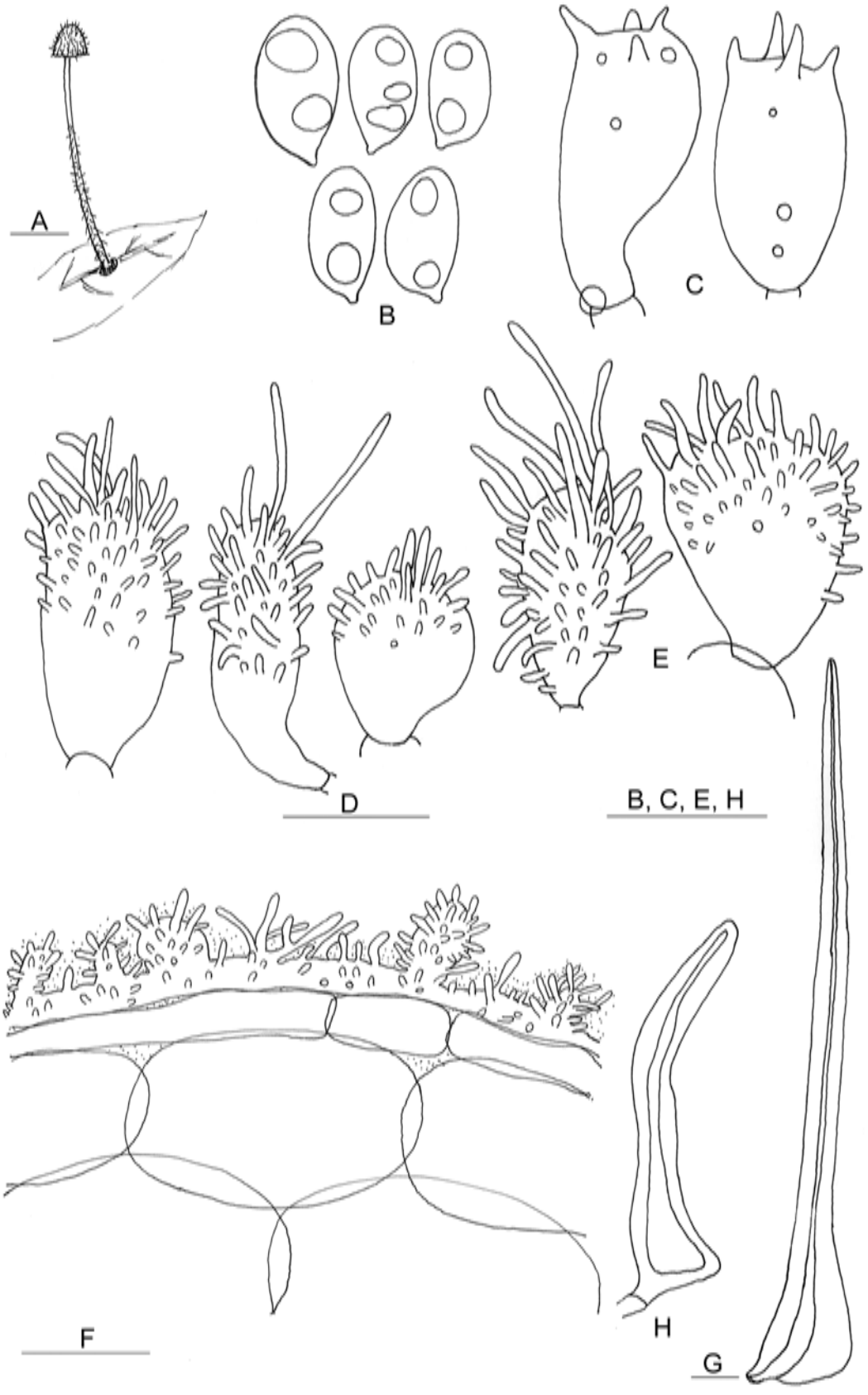


Figure 29. *Mycena lomamaya*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, pileoseta; H, caulocystidium. Scale bars: A = 5 mm; B-H = 10 µm.

Basidiomata very small, delicate. Pileus 1–4.5 mm diam., 0.5–1 mm high, convex when young, becoming hemispherical with age; surface brownish grey (6D2) at the centre and on the striations, whitish towards margin, and brownish grey (6C2) elsewhere, finely hairy, translucent-striate, finely pruinose; margin straight, entire when young, becoming undulate with age. Lamellae pseudocollariate, whitish, up to 0.5 mm wide, subdistant, with lamellulae of 1–2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 5–22.5 × 0.25–0.5 mm, central, terete, almost equal, hollow; surface translucent, white, finely pubescent, more so towards the base, almost glabrous at the apex; base discoid, thin, with finely radiating basal mycelium. Context narrow, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores (5) 7–9 (10) × (3) 3.5–4.5 (5) (8.03 ± 0.62 × 3.98 ± 0.42) µm, Q =1.56–2.5, Q_m =2.03, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, with a few refractive guttules, weakly amyloid. Basidia 11–19 × 7.5–10 µm, clavate, pedicellate, hyaline, bearing 4 sterigmata up to 5 µm long. Lamella–edge sterile. Cheilocystidia crowded, 13.5–30 × 7–11 µm, clavate, thin-walled, hyaline, with cylindrical excrescences (1–20 × 1–1.5 µm). Lamellar trama regular to subregular; hyphae 3–23 µm, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular or interwoven; hyphae 10.5–26.5 (30) µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–3 µm wide, slightly gelatinised, thin-walled, hyaline, with intercalary subglobose protrusions, entirely covered with cylindrical excrescences (1–3 × 0.5–1 µm). Hypodermium distinct, composed of 3.5–10 µm wide, thin-walled, hyaline, smooth hyphae. Pileosetae 43–207.5 × 5–25 µm, aculeate, thick-walled (2–5.5 µm), hyaline, smooth. Pileus marginal cells 11–31.5 × 6–11 µm, clavate, obovoid or cylindrical, thin-walled, hyaline, with cylindrical excrescences (1–17 × 1–2 µm). Stipitipellis a cutis; hyphae 2–5.5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 65–203 × 5–14 µm, aculeate, thick-walled (1–5 µm), hyaline, rarely branching. Stipe trama moderately vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. August.

Notes:—Aravindakshan & Manimohan (2014) provided a detailed account of this species. It seems to be close to *M. aciculata* (A.H. Sm.) Desjardin & Horak, a common temperate Northern Hemisphere species, because of the similar-sized basidiospores, cheilocystidia, and pileosetae (up to 200 µm long), thick-walled, setoid caulocystidia, and gelatinised pileipellis hyphae. But *M. aciculata* differs in having inamyloid basidiospores and cheilocystidia of a different morphology and in lacking pileus marginal cells.

30. ***Mycena jatila*** Aravind. & Manim., Mycosphere 5 (2): 293 (2014). Pl. 3 D; Fig. 30 A–H

Holotype:—INDIA. Kerala State: Kollam District, Sasthamkotta, 29 September 2010, *D.M. Aravindakshan DM531*, K(M) 178341 (K!).

Basidiomata very small, delicate. Pileus 0.5–1 mm diam., initially hemispherical, becoming applanate with age; surface pale brownish at the centre and on the striations, whitish elsewhere, translucent- to sulcate-striate, with very fine hairs; margin straight and entire when young, becoming plane and finely torn. Lamellae 7–9 reaching the stipe, free, white, less than 0.5 mm wide, subdistant; lamellulae absent or rarely in one length; edge finely torn under a lens, concolourous with the sides. Stipe 3–8 × 0.25–0.5 mm, central, terete, tapering towards the apex,

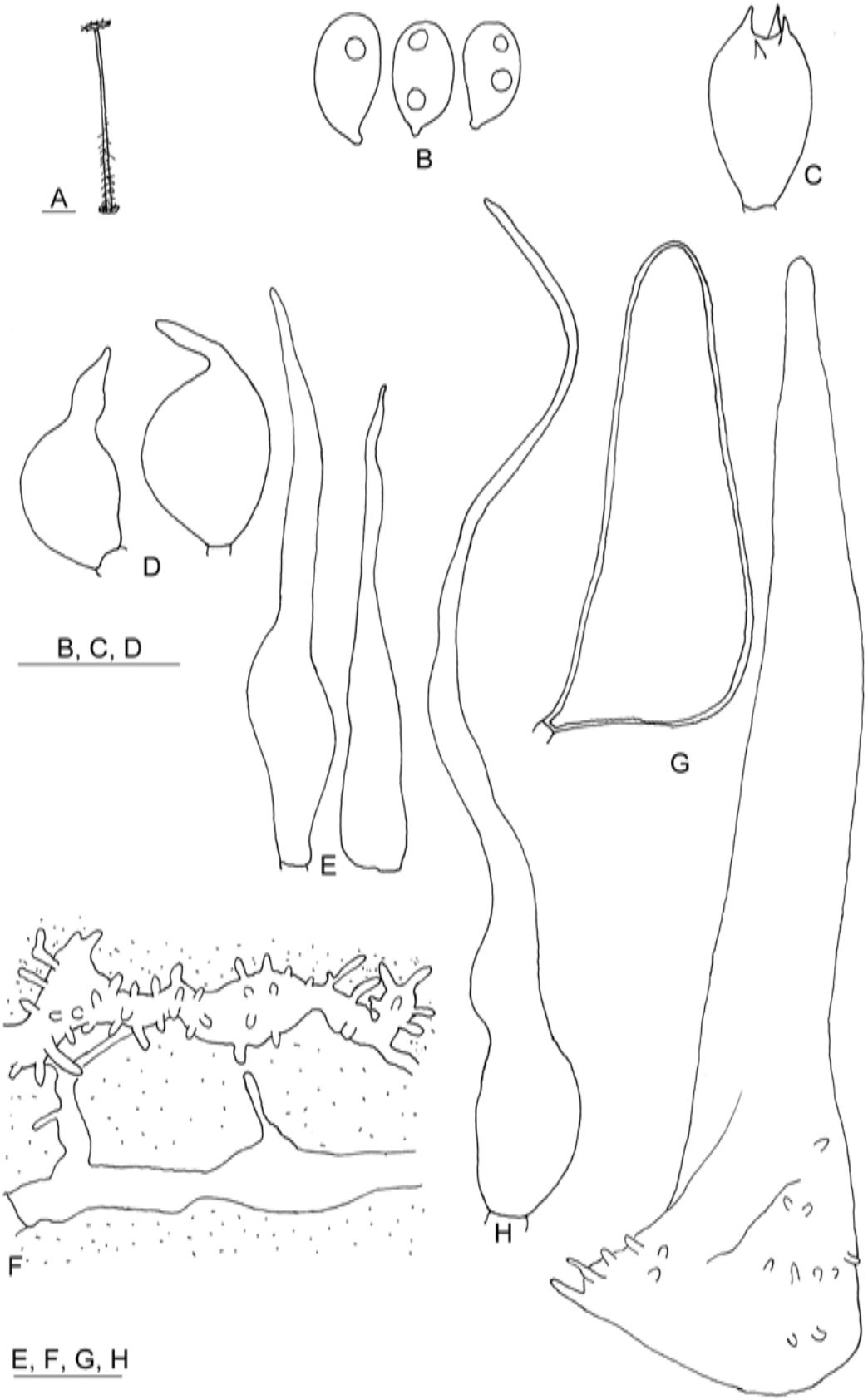


Figure 30. *Mycena jatila*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, pileosetae; H, caulocystidium. Scale bars: A = 1 mm; B-H = 10 µm.

hollow; surface translucent, white, with very fine, white pubescence, more so towards base, almost glabrous at the apex; base discoid. Context narrow, concolourous with the pileus surface. Odour and taste not recorded.

Basidiospores 6–7.5 × 3–4 (6.83 ± 0.57 × 3.55 ± 0.43) µm, Q = 1.71–2.33, Q_m = 1.94, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, inamyloid. Basidia 13–17 × 6.5–8.5 µm, clavate, hyaline, bearing 4 sterigmata up to 3 µm long. Lamella-edge fertile. Cheilocystidia scattered, 9–15.5 × 3.5–7 µm, ellipsoid or fusoid with an apical beak-like protrusion (5–13 µm long), smooth, thin-walled. Pleurocystidia none. Lamellar trama subregular; hyphae 5–19 µm, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium thin. Pileus trama subregular; hyphae 8–22 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Pileipellis a cutis of hyphae with terminal pileosetae; hyphae 2–11 µm wide, embedded in a gelatinous matter, thin-walled, hyaline, with short, conic or cylindrical excrescences (0.5–4 × 0.5–1.5 µm). Pileosetae 46–111 × 9–33 µm, obclavate with a tapering apex, slightly (0.5–1 µm) thick-walled, sometimes with small protrusions (5–9 × 4–7 µm) at the base, with sparse excrescences (1–3 × 0.5–1 µm). Pileus marginal cells 39–67 × 6–0 µm, fusoid or lageniform, thin-walled, hyaline, smooth. Stipitipellis a cutis; hyphae 1–3.5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 18.5–113 × 5–11.5 µm, with a swollen base and a long, flexuous, gradually tapering apex, thin-walled, hyaline, smooth. Stipe trama vinoid in Melzer's reagent. Clamp connections not seen at the base of cheilocystidia.

Habit, habitat and phenology:—Scattered, on decaying leaves. September.

Notes:—The taxonomy of this species was discussed by Aravindakshan & Manimohan (2014). *Mycena aciculata* seems to be the closest species, but it differs in having somewhat larger basidiomata, larger basidiospores (7.5–10.5 × 3.8–4.7 µm), longer pileosetae (up to 200 µm), larger cheilocystidia and thick-walled caulocystidia.

31. ***Mycena saloma*** Aravind. & Manim., Mycotaxon 117: 240 (2011). Pl. 3 E; Fig. 31 A–G

Holotype:—INDIA. Kerala State: Idukki District, Munnar, 14 August 2010, *D.M. Aravindakshan DM461*, DM461 (L!).

Basidiomata very small, delicate. Pileus 1.25–5 mm diam., up to 3 mm high, initially parabolic, becoming hemispherical to convex with age; surface initially pure white, becoming whitish with age, with prominent white hairs up to 0.5 mm long that are denser at the centre, translucent-striate, very faintly sulcate, dry, finely pruinose; margin straight, finely fringed. Lamellae adnexed, pure white, thin, 0.5-0.75 mm wide, subdistant, with lamellulae of 1–2 lengths; edge entire, concolourous with the sides. Stipe 3.5–22 × 0.25–0.5 mm, central, terete, tapering towards apex, hollow; surface translucent, white, pubescent, more so towards the base, almost glabrous at apex; base discoid, with finely radiating basal mycelium. Context very thin, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 7.5–9.5 (11) × 3.75–5.5 (8.57 ± 0.68 × 4.45 ± 0.44) µm, Q = 1.66–2.4, Q_m = 1.9, ellipsoid to ovo-ellipsoid, thin-walled, hyaline, smooth, with refractive guttules, strongly amyloid. Basidia 12–19 × 9.5–13 µm, subglobose, pedicellate, hyaline, bearing 4 sterigmata up to 5 µm long. Lamella-edge fertile. Cheilocystidia and pleurocystidia not seen. Lamellar trama regular

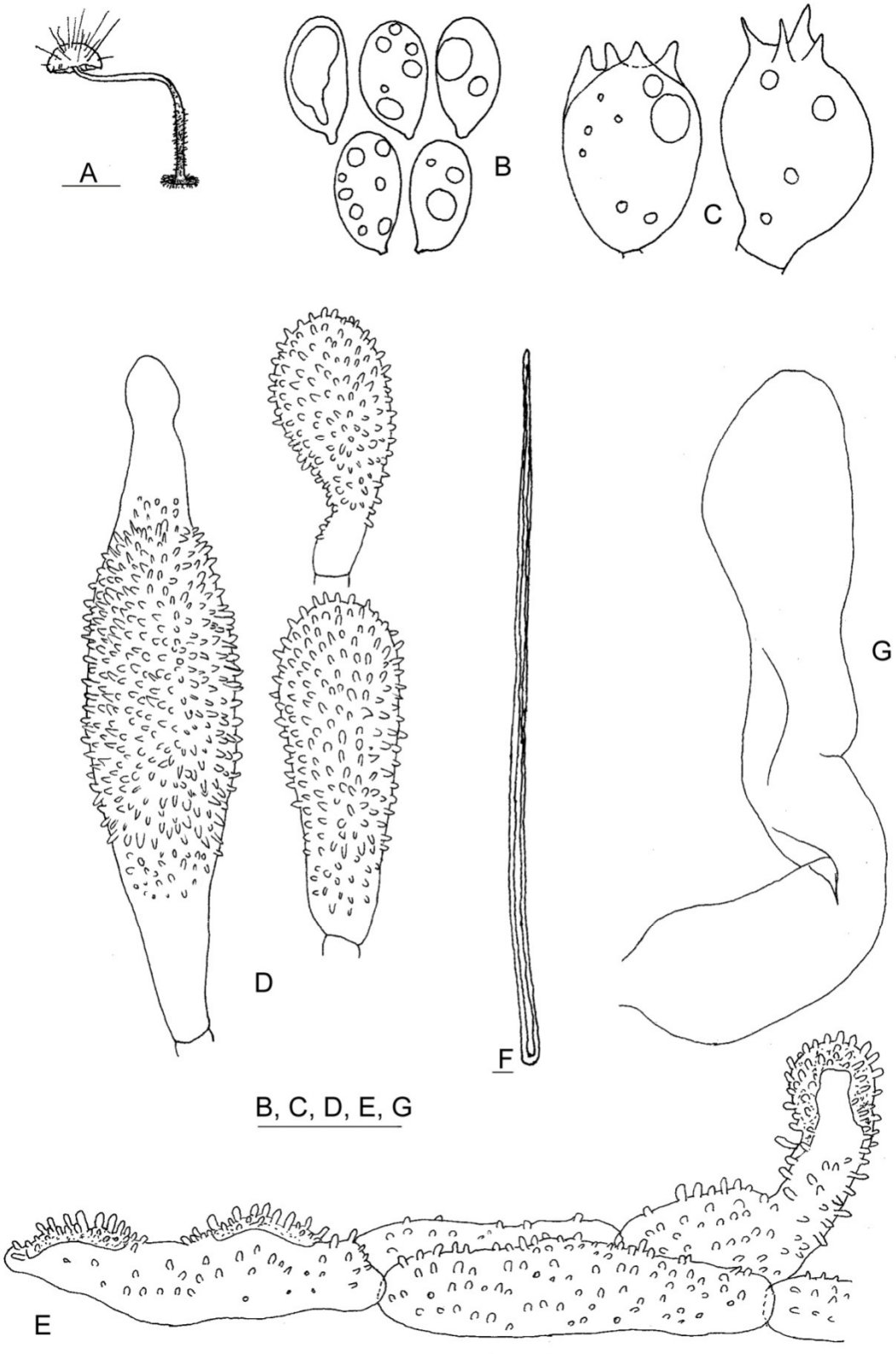


Figure 31. *Mycena saloma*: A, basidioma; B, basidiospores; C, basidia; D, pileus marginal cells; E, hyphae of the pileipellis with acanthophysoid terminal cells; F, pileoseta; G, caulocystidium. Scale bars: A = 5 mm; B-G = 10 µm.

to subregular; hyphae 2–15.5 (30) µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 3–26 (37.5) µm wide, thin-walled, hyaline, distinctly vinoid in Melzer's reagent. Pileipellis a cutis of repent hyphae supporting scattered pileosetae; hyphae 2–11.5 µm wide, thin- to slightly (0.25 µm) thick-walled, hyaline, verrucose, with acanthophysoid terminal elements, with simple, cylindrical excrescences (0.5–1.5 × 0.25–0.5 µm); acanthophysoid terminal elements 12–37 × 7–19 µm, repent or ascending, clavate to narrowly clavate or cylindrical, with refractive guttules and with simple, cylindrical excrescences (0.5–2 × 0.5–1 µm). Pileosetae 60–780 µm long, 15–30 µm broad at the base, 10–11 µm broad at the apex, gradually tapering towards the apex, with an obtuse apex and a subbulbous base, smooth, hyaline, with a thick (1.25–8.75 µm), refractive wall. Pileus marginal cells 17–82 × 6.5–20 µm, clavate or fusiform, entirely verrucose or often with a smooth apical prolongation, thin-walled, hyaline, with simple, cylindrical excrescences (0.75–4 × 0.75–1 µm). Stipitipellis a cutis; hyphae 2–8 µm wide, thin-walled, hyaline, smooth. Caulocystidia 92.5–125.5 × 15–33 µm, flexuoso-cylindric, fusoid or lageniform with an obtuse apex, thin-walled, hyaline, smooth. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on dicotyledonous leaves and twigs. August.

Additional collection examined:—INDIA. Kerala State: Idukki District, Eravikulam National Park, 16 August 2010, *D.M. Aravindakshan DM486*, DM486 (L).

Notes:—Aravindakshan & Manimohan (2011) compared *M. saloma* with *M. breviseta* Höhn., *M. longiseta* (both from Java) and *M. rhaphidocephala* Maas Geest & de Meijer (from Brazil). The Brazilian species is similar to *M. saloma* in most macro- and microscopic features, but differs mainly in having much longer (up to 3000 µm) pileus hairs.

32. ***Mycena pelava*** Aravind. & Manim., Mycosphere 5 (2): 294 (2014). Pl. 3 F; Fig. 32 A–G

Holotype:—INDIA, Kerala State, Thiruvananthapuram District, TBGRI Campus, 8 September 2009, *D.M. Aravindakshan DM310*, K(M) 178342 (K!).

Basidiomata very small, delicate. Pileus 0.5–1 mm diam., up to 0.5 mm high, convex to broadly convex with a central shallow depression; surface pale greyish at the centre and on the striations, whitish elsewhere, translucent- to sulcate-striate, with very fine hairs; margin straight, crenate when young, becoming undulate or fringed. Lamellae up to 9 reaching the stipe, free, pure white, less than 0.5 mm wide, subdistant, with lamellulae of one length; edge very finely torn under a lens, concolourous with the sides. Stipe 4.5–5 × 0.1–0.25 mm, central, terete, tapering towards the apex, hollow; surface translucent, white, with very fine, white pubescence, more so towards base, almost glabrous at the apex; base swollen, with fine, radiating basal mycelium. Context narrow, concolourous with the pileus surface. Odour and taste not recorded.

Basidiospores 7.5–8.5 (9) × 3–4.5 (8.18 ± 0.44 × 3.85 ± 0.37) µm, Q = 1.78–2.67, Q_m = 2.14, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, weakly amyloid. Basidia 10–15 × 8–10 µm, subglobose to ovoid, hyaline, bearing 4 sterigmata up to 2.5 µm long. Lamella-edge heterogeneous. Cheilocystidia scattered, 15.5–22 × 4.5–6 µm, cylindrical, thin-walled, smooth. Pleurocystidia none. Lamellar trama subregular; hyphae 4–17 µm, thin-walled, hyaline, faintly

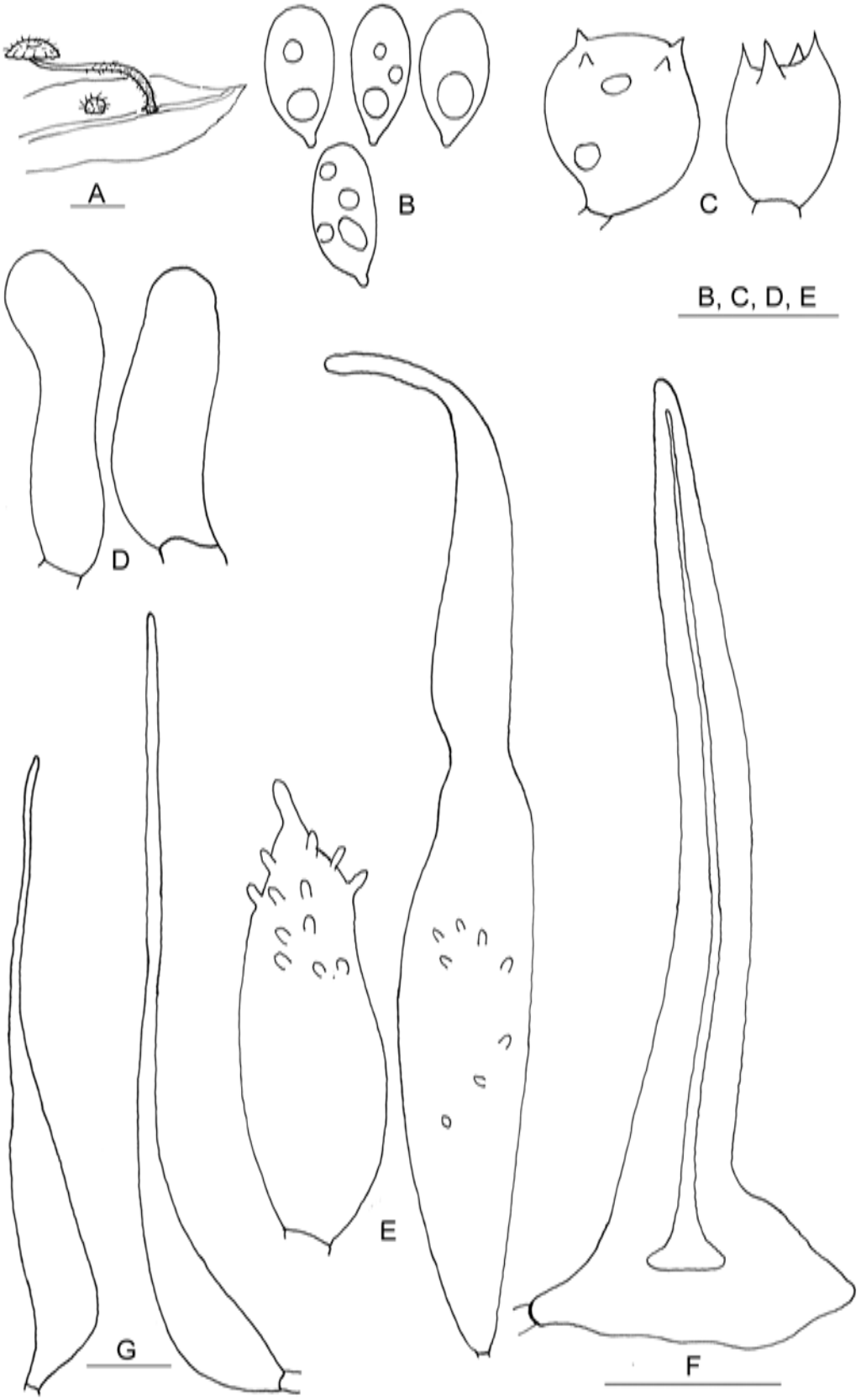


Figure 32. *Mycena pelava*: A, basidioma and primordium; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, pileoseta; G, caulocystidia. Scale bars: A = 1 mm; B-G = 10 µm.

vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 6–29 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent. Pileipellis a cutis of hyphae with terminal or intercalary pileosetae; hyphae 2–11 µm wide, slightly gelatinised in KOH, thin-walled, hyaline, with short, conic or cylindrical excrescences (0.5–4 × 0.5–1 µm). Pileosetae 45–215 × 6–22 µm, aculeate, thick-walled (1.5–6 µm), with subglobose or geniculate base, slightly gelatinised in KOH. Pileus marginal cells 27–91 × 6–13.5 µm, clavate or fusiform, thin-walled, hyaline, with sparse, short, cylindrical excrescences (0.5–4 × 0.5–1 µm) mostly at the middle part or close to the apex. Stipitipellis a cutis with intercalary or terminal caulocystidia; hyphae 1.5–3 µm wide, thin-walled, hyaline, smooth. Caulocystidia 55–125.5 × 15–33 µm, with a fusoid base and a long, tapering apical part. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. September.

Notes:—The taxonomy of this species was discussed by Aravindakshan & Manimohan (2014). This species seems to be somewhat close to *M. longiseta*, a species restricted to Southeast Asia (see Desjardin & Horak 2002). But the latter species has slightly larger basidiomata and non-gelatinised, longer (up to 1000 µm) pileosetae and it lacks cheilocystidia.

X. ***Mycena*** section ***Polyadelphia*** Singer ex Maas Geest., Persoonia 11 (1): 103 (1980).

Basidiomata small to minute. Pileus dry, pruinose to somewhat granular, glabrescent, generally not becoming lubricous when wet, white, pale yellowish brown or pale greyish brown or pink to somewhat purplish or violaceous. Lamellae arcuate or ascending, generally decurrent with a tooth, edge white. Stipe pruinose, glabrescent, rarely black, insititious or attached to the substratum by a whorl of radiating mycelial hyphae. Basidiospores ellipsoid, almost cylindrical or subglobose, amyloid. Basidia 2- or 4-spored, without or with clamp connections. Cheilocystidia clavate, more or less densely covered with simple excrescences. Pleurocystidia absent. Hyphae of both pileipellis and stipitipellis more or less densely diverticulate. Inflated and diverticulate caulocystidia present at the base of the stipe in several species.

Type species:—*Mycena polyadelpha* (Lasch) Kühner

Two species of *Mycena* belonging to the sect. *Polyadelphia* were observed during the present study.

Key to the species

1. Basidiomata minute, pure white; lamellae narrowly adnate; pileocystidia present; basidiospores 6–8 × 4–5 µm ..... 33. ***Mycena amala***

- Basidiomata small, brown; lamellae subdecurrent to arcuate; pileocystidia absent; basidiospores 6–9.5 × 3–4.5 µm ..... 34. ***Mycena saparna***

33. ***Mycena amala*** Aravind. & Manim. *sp. nov*. Pl. 3 G; Fig. 33 A–G

MycoBank MB811092

Diagnosis:—Characterised by minute, pure white basidiomata; lamellae that secede to form a pseudocollarium; ellipsoid to subglobose and amyloid basidiospores; morphologically similar cheilo-, pileo- and marginal cystidia; and clamp connections that are hard to find. Differs from *M. quercus-ilicis* in having smaller basidiomata, a non-gelatinised pileus trama, and narrower basidiospores.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 22 August 2006, *D.M. Aravindakshan DM64*, K(M) 190597 (K!).

Etymology:—*amala* (Sanskrit), unstained.

Basidiomata very small, delicate. Pileus 0.5–1 mm diam., hemispherical, umbonate when young, becoming hemispherical with slight depression with age; surface pure white, sulcate-striate, finely pruinose or pubescent; margin straight, entire when young, becoming undulate with age. Lamellae narrowly adnate, seceding and becoming pseudocollariate, pure white, thin, less than 0.5 mm wide, distant, without lamellulae; edge very finely torn under the lens, concolourous with the sides. Stipe 0.5–1 × 0.5 mm, central, terete, almost equal, hollow; surface pure white, pruinose or pubescent; base slightly swollen, with scanty basal mycelium. Context thin, up to 0.5 mm thick, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6–8 × 4–5 (7.0 ± 0.61 × 4.63 ± 0.43) µm, Q =1.33–1.78, Q_m = 1.52, ellipsoid to subglobose, thin-walled, hyaline, smooth, amyloid. Basidia 12–19 × 4–5 µm, clavate, bearing 4 sterigmata up to 6 µm long. Cheilocystidia 12–40 × 10.5–18 µm, clavate or sphaero-pedunculate, with simple or branched excrescences (1–5 × 1–1.5 µm), thin-walled, hyaline. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 3–12.5 µm wide, thin-walled, hyaline, distinctly vinoid in Melzer's reagent; subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 7–25 µm wide, thin-walled, hyaline, distinctly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–8 µm wide, thin-walled, hyaline, with excrescences (1–7 × 1–1.5 µm); pileocystidia 20–48 × 12–20 µm, similar to cheilocystidia, with excrescences (1–7 × 1–1.5 µm). Pileus marginal cells 19–29 × 10–13.5 µm, similar to cheilocystidia, with excrescences (1–7 × 0.75–1.5 µm). Stipitipellis a cutis; hyphae 1.5–5 µm wide, thin-walled, hyaline, with excrescences (1–7 × 0.75–1.5 µm). Stipe trama distinctly vinoid in Melzer's reagent. Clamp connections seen on all hyphae but very hard to find.

Habit, habitat and phenology:—Gregarious, on decaying coconut husk. August.

Notes:—Characters such as the minute basidiomata, the ellipsoid and amyloid basidiospores, the white pileus, the clavate cheilocystidia covered with cylindrical excrescences, the absence of pleurocystidia, and the densely diverticulated hyphae of the pileipellis are indicative of sect. *Polyadelphia*.

Key to the species of sect. *Polyadelphia* (Maas Geesteranus 1992b) lead *M. amala* to *M. quercus-ilicis* Kühner as the latter has ellipsoid to subglobose basidiospores and a pileipellis with

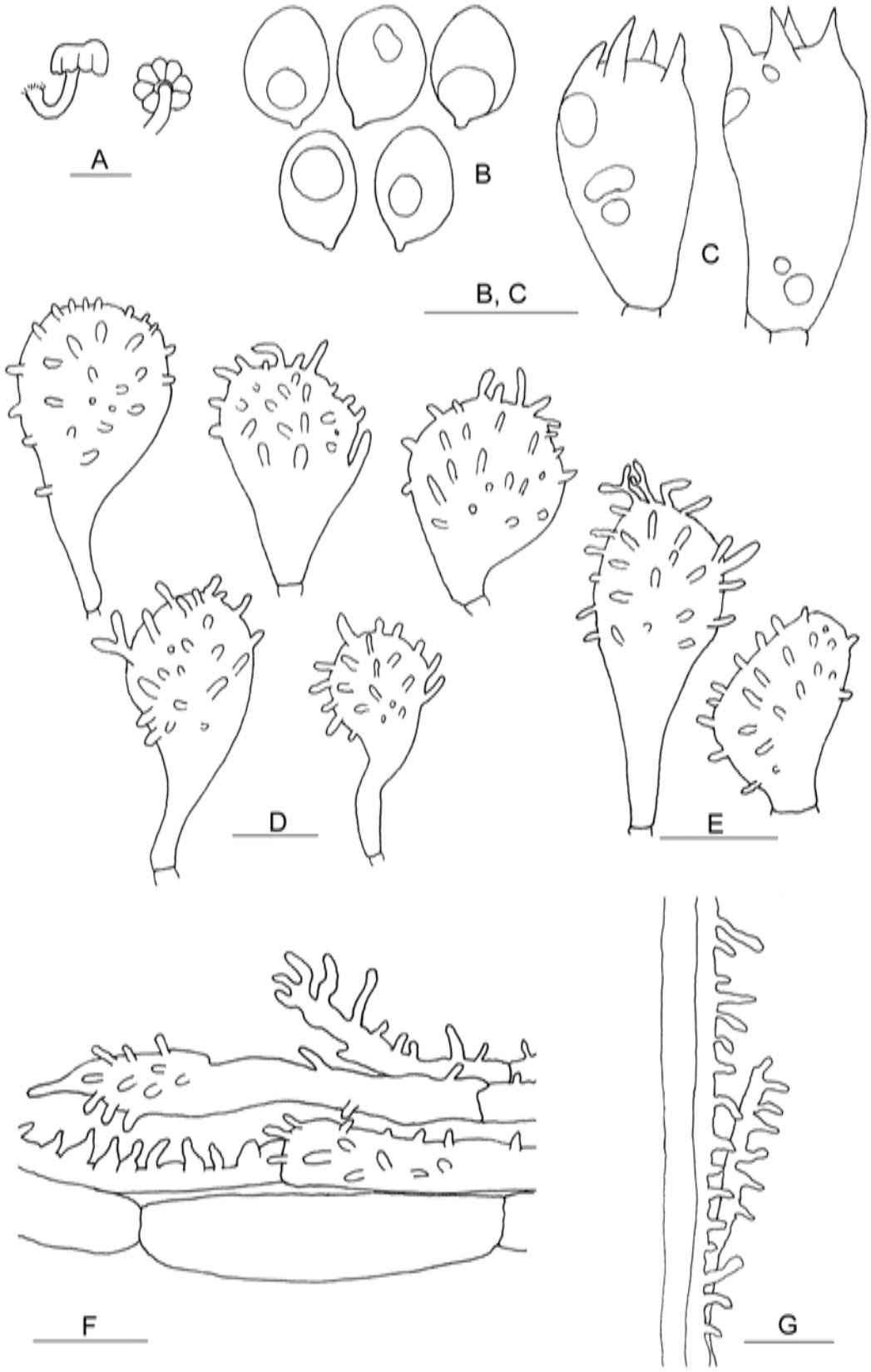


Figure 33. *Mycena amala*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis with pileocystidia; G, hyphae of the stipitipellis. Scale bars: A = 1 mm; B-G = 10 µm.

distinct terminal cells and pileus marginal cells. But that species differs from *M. amala* in having somewhat larger (lamellae 3 mm wide, stipe up to 10 mm long), greyish to whitish basidiomata, a gelatinised pileal trama, broader (5–7 µm) basidiospores, larger basidia, smaller cheilocystidia and terminal cells of pileipellis, pileus marginal cells with small excrescences, and distinct terminal cells (4.5–9 µm wide) in the stipitipellis hyphae. *Mycena flavovirens* Sacc., an Australian species, also possesses subglobose to broadly ellipsoid basidiospores. But that species differs from *M. amala* in having larger, yellowish-green basidiomata; smooth hyphae of the pileipellis; loop-like clamp connections; and acanthocysts on both pileipellis and stipitipellis; and in lacking both cheilo- and pileocystidia. All other species of sect. *Polyadelphia* have pip-shaped or cylindrical basidiospores.

34. ***Mycena saparna*** Aravind. & Manim., Mycosphere 3 (2): 241 (2012). Pl. 3 H; Fig. 34 A–F

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 5 July 2007, *D.M. Aravindakshan DM153*, K(M) 175513 (K!).

Basidiomata very small, delicate. Pileus 0.1–1.25 (2.5) mm diam., 0.5–2.75 mm high, broadly hemispherical with an acute or acuminate umbo when young, becoming conic or parabolic to cylindrico-campanulate with persisting umbo; surface off-white all over when very young, then yellowish brown (5D4) or greyish yellow (4C3) on umbo, whitish towards margin, and brownish orange (5C3) or yellowish grey (4B2) elsewhere, and finally becoming dark brown (6F7) or greyish brown (5E3) at the centre, whitish at margin, and brown (6E5) or orange grey (6B2) or brownish orange (5C3) elsewhere, sulcate-striate, dry, with fine ridges over mature pileus under a lens; margin slightly incurved and entire when young, becoming straight or nearly applanate and crenate or undulate with age. Lamellae 4–9, descending, subdecurrent to somewhat arcuate, off-white, up to 0.1 mm wide, distant, without lamellulae; edge finely torn under a lens, concolourous with the sides. Stipe 4–22 × 0.5–0.75 mm, central, terete, tapering towards apex in all stages of development, hollow; surface translucent, whitish or orange white (5A2), becoming brownish at extreme base, glabrous; base slightly broad, with a thin, inconspicuous basal mycelial felt. Context not conspicuous. Odour and taste not distinctive.

Basidiospores 6–9.5 × 3–4.5 (6.85 ± 0.27 × 3.078 ± 0.03) µm, Q = 2–2.66, Q_m = 2.33, oblong-ellipsoid, thin-walled, hyaline, smooth, with a few guttules, amyloid. Basidia 7.5–17 × 5–7 µm, clavate, bearing 4 sterigmata up to 5 µm long, hyaline, with a few guttules. Lamella-edge sterile. Cheilocystidia crowded, 6–20.5 × 2.75–6 µm, clavate, cylindrical or sphaero-pedunculate, thin-walled, hyaline, with short, conical or cylindrical excrescences (0.75–2 × 0.75-1 µm). Pleurocystidia none. Lamellar trama subregular; hyphae 2–11 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 3–32 µm wide, thin-walled, hyaline or with pale greyish brown contents, vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1–4.5 µm wide, slightly branched, slightly gelatinised, thin-walled, hyaline, with short, conical or cylindrical excrescences (0.5–2 × 0.5–0.75 µm). Stipitipellis a cutis; hyphae 1.5–6 µm wide, thin-walled, hyaline, with short, conical or cylindrical excrescences (0.5–2 × 0.5–1 µm). Caulocystidia none. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

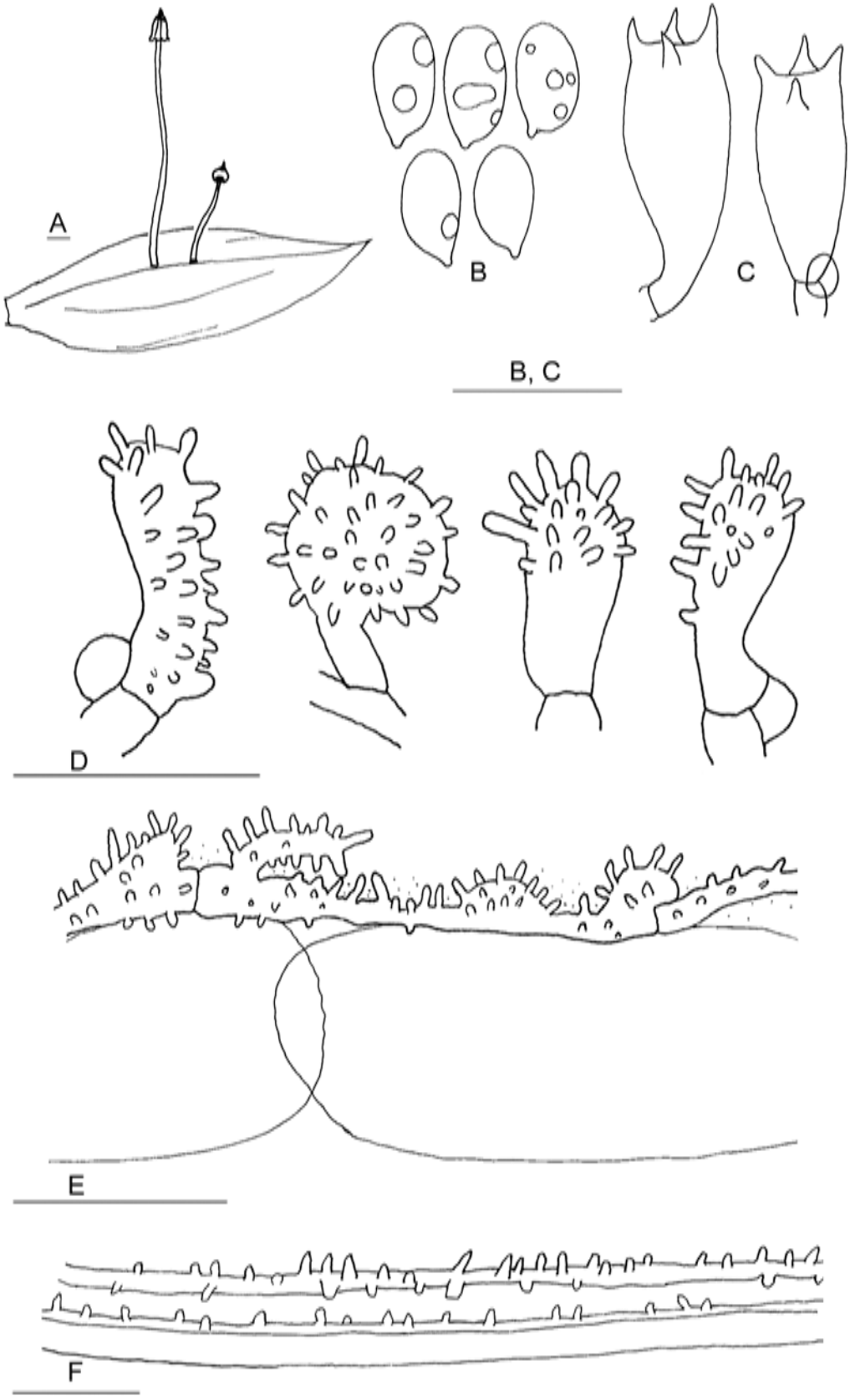


Figure 34. *Mycena saparna*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, hyphae of the pileipellis; F, hyphae of the stipitipellis. Scale bars: A = 1 mm; B-F = 10 µm.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. July–September.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 14 July 2007, *D.M. Aravindakshan DM153d*; 18 July 2007, *D.M. Aravindakshan DM170*, K(M) 175514; Kozhikode District, Koyilandy, Poyilkave, 26 September 2009, *D.M. Aravindakshan DM341*, K(M) 175515.

Notes:—*Mycena saparna* is strikingly similar to the Madagascan species *Mycena foliicola* Métrod in several features but differs from the latter in having subdecurrent to decurrent lamellae, tetrasporic basidia, clavate, cylindrical or sphaero-pedunculate cheilocystidia, and a different geographic distribution. A detailed account of this specimen is given in Aravindakshan & Manimohan (2012).

XI. ***Mycena*** section ***Radiatae*** Singer ex Maas Geest., Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 88: 414 (1985).

Basidiomata medium-sized, without blue pigments. Pileus dry, plicate, centrally squamulose. Lamellae ascending, free, ventricose, white with convex, concolourous edge. Stipe pruinose, white, somewhat enlarged at the base but without a basal disc, insititious. Basidiospores ellipsoid, amyloid. Basidia 4-spored, clavate to subglobose. Hyphae of the pileipellis and of the stipitipellis smooth. Stipitipellis with inflated terminal cells.

Type species:—*Mycena radiata* (Dennis) Singer ex Maas Geest.

During the present study, only one species belonging to this section was discovered.

35. ***Mycena samula*** Aravind. & Manim. *sp. nov*. Pl. 3 I; Fig. 35 A–E

MycoBank MB811093

Diagnosis:—Characterised by whitish, solitary basidiomata associated with herbaceous roots; numerous, free lamellae; subglobose and amyloid basidiospores; smooth hyphae of the pileipellis and stipitipellis; inflated-clavate and smooth caulocystidia and absence of both cheilo- and pleurocystidia. Differing from *M. radiata* in having small, whitish basidiomata; a non-squamulose pileus; and hyphae with clamp connections.

Holotype:—INDIA. Kerala State: Thrissur District, Peechi Forest Area, 5 July 2010, *D.M. Aravindakshan* DM446, K(M) 191765 (K!).

Etymology:—*samula* (Sanskrit), root-attached.

Basidioma small, delicate. Pileus 8 mm diam., nearly applanate with a shallow, central depression; surface pale greyish at the centre, snow white elsewhere, plicate-striate, glabrous, very thin; margin nearly plane, undulating. Lamellae up to 21 reaching the stipe, free, snow white, 0.5 mm wide, subdistant, without lamellulae; edge entire, concolourous with the sides. Stipe 35 × 1 mm, central, terete, almost equal, hollow; surface snow white, finely pruinose; base slightly swollen,

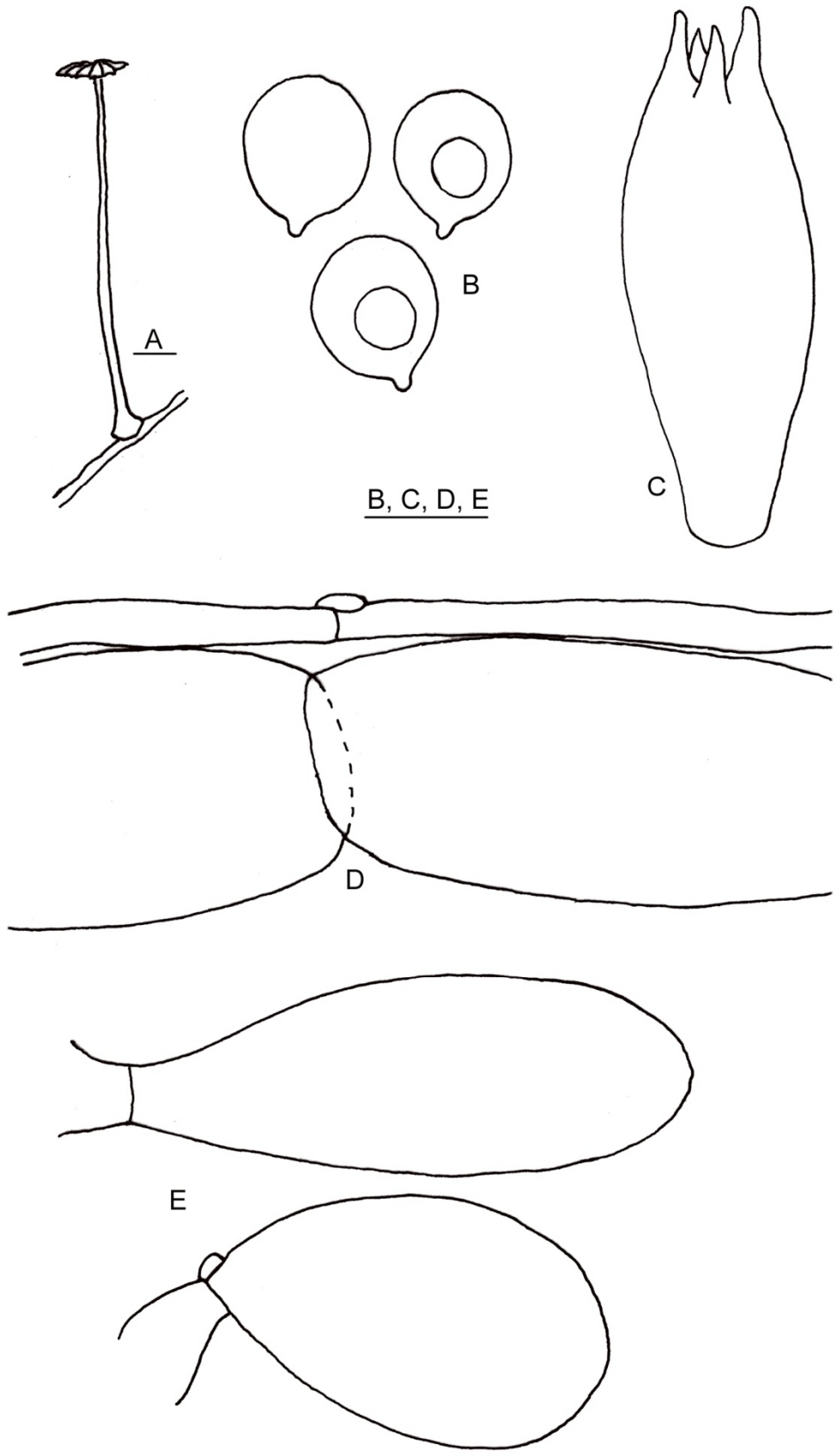


Figure 35. *Mycena samula*: A, basidioma; B, basidiospores; C, basidium; D, hyphae of the pileipellis; E, caulocystidia. Scale bars: A = 5 mm; B-E = 10 µm.

with scanty basal mycelium. Context not conspicuous, concolourous with the pileus surface. Odour and taste not recorded.

Basidiospores 6–8.5 × 4.5–6.5 (7.0 ± 0.61 × 4.63 ± 0.43) µm, Q =1.33–1.78, Q_m = 1.52, subglobose, thin-walled, hyaline, smooth, amyloid. Basidia 10–22.5 × 6.5–8.5 µm, clavate, bearing 4 sterigmata up to 3.5 µm long. Cheilocystidia and pleurocystidia absent. Lamellar trama regular to subregular; hyphae 15–22.5 µm wide, thin-walled, hyaline, faintly vinoid in Melzer's reagent; subhymenium pseudoparenchymatous. Pileus trama interwoven; hyphae 9–22 µm wide, thin- to slightly (0.25 – 0.5 µm) thick-walled, hyaline, inamyloid in Melzer's reagent. Pileipellis a cutis; hyphae 1.5–8 µm wide, thin-walled, hyaline, smooth. Stipitipellis a cutis; hyphae 1.5–7 µm wide, thin-walled, hyaline, smooth. Caulocystidia 31–43.5 × 14.5–17.5 µm, inflated-clavate to narrowly clavate, rarely mucronate, thin-walled, hyaline. Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Solitary, attached to root of some herb. July.

Notes:—The combination of characters such as the globose basidiospores and their amyloid reaction of *M. samula* makes it difficult to run through the key given in Maas Geesteranus (1992b). However, the combination of features such as the amyloid basidiospores, the non-gelatinised hyphae of the pileipellis, the concolourous lamella-edge, the lamellar trama not distinctly vinescent in Melzer's reagent, and the absence of cheilocystidia indicate that the present species belong to the section *Radiatae*. In addition, *M. radiata* (Maas Geesteranus 1992a), the type species of the section reported from Venezuela, shares the following characters with *M. samula*: a pileus becoming applanate with age; subdistant, free and ascending lamellae; strongly amyloid basidiospores; absence of both cheilo- and pleurocystidia; clavate basidia; smooth, non-gelatinised hyphae of both pileipellis and stipitipellis; and apically inflated, sometimes rostrate terminal cell of the stipitipellis. But *M. radiata* differs in having larger basidiomata with a brownish, finely squamulose pileus, oblong-ellipsoid to subcylindrical basidiospores, 2-spored basidia, decumbent hyphae of the pileipellis that form the squamules, and hyphae devoid of clamp connections.

Singer (1962b) who erected the sect. *Radiatae* placed three species, viz., *M. radiata*, *M. aosma* Singer and *M. chlorinosma* in this section. Later, *M. indica* Sarwal & Rawla and *M. auricoma* Har. Takah. were also placed under this section. However, Maas Geesteranus (1985) redefined the sect. *Radiatae* and made it a monotypic section. Later, Desjardin & Hemmes (2001) emended this section by extending the character states of some characters such as the shape of basidiospores. Besides that, they provisionally included *Corrugaria viridiflava* Métrod, *Trogia delicata* Corner and *Trogia crinipelliformis* Corner in the artificial key to the worldwide members of *Mycena* sect. *Radiatae*. *Mycena papyracea* Desjardin & Hemmes, a new species included in the emended section *Radiatae* (Desjardin & Hemmes 2001) differs from the present species in having elongate-subcylindrical basidiospores, pileocystidia and hyphae devoid of clamp connections.

XII. ***Mycena*** section ***Rubromarginatae*** Singer ex Maas Geest., Persoonia 11 (1): 106 (1980).

Basidiomata fairly small to medium-sized. Pileus pruinose or glabrescent, dry, more or less lubricous when wet, hygrophanous, variously coloured. Odour nitrous, raphanoid or indistinctive. Taste none, indistinctive or raphanoid. Lamellae ascending, adnate with a decurrent tooth, edge pink, red-brown, purplish brown or dark violet. Stipe fragile, slender, pruinose at least at the apex, glabrescent below, not lubricous when wet, variously coloured, base covered with coarse fibrils, sometimes rooting. Basidiospores ellipsoid, amyloid. Basidia 2- or 4-spored, clampless or clamped. Cheilocystidia usually forming a sterile band, versiform, with pink, reddish or violaceous contents, smooth or covered with a few, coarse excrescences. Pleurocystidia absent or rare. Hyphae of both the pileipellis and the stipitipellis smooth or diverticulate.

Type species:—*Mycena rubromarginata* (Fr.) P. Kumm.

Two species belonging to this section were found during this study.

Key to the species

1. Pileus with an acute umbo; pleurocystidia absent; basidiospores 8–12 × 4.5–5.5 µm .... 36. ***Mycena valkaja***

- Pileus not umbonate; pleurocystidia present; basidiospores 7.5–11 × 5–8.5 µm..... ..... 37. ***Mycena pingala***

36. ***Mycena valkaja*** Aravind. & Manim. *sp. nov*. Pl. 3 J; Fig. 36 A–F

MycoBank MB811094

Diagnosis:—Characterised by solitary basidiomata; a pinkish, heterogeneous lamella-edge; clavate cheilocystidia with pale brownish contents and with finger-like protuberances at the apex; a two-layered pileus trama with a gelatinised lower layer; and hyphae of both the pileipellis and the stipitipellis with brownish contents, gelatinised wall and nodulose diverticulate terminal cells. Differing from *M. elegantula* in having a reddish brown pileus, pleurocystidia, and larger cheilocystidia,

Holotype:—INDIA., Kerala State: Kozhikode District, Thusharagiri, 28 October 2009, *D.M. Aravindakshan DM343*, K(M) 190599 (K!).

Etymology:—*valkaja* (Sanskrit), born on bark.

Basidiomata medium-sized. Pileus 7.5–19 mm diam., 5.5–11 mm high, parabolic or convex with a small, acute umbo; surface initially pale pink at the centre and on the striations and whitish elsewhere, becoming reddish brown (8E5) at the apex, greyish brown (8D3) on the striations and on the margin, and reddish grey (7B2) elsewhere with time, translucent- to sulcate-striate, finely pruinose; margin straight and entire, becoming scalloped. Lamellae up to 16 reaching the stipe, ascending, slightly intervenose, adnate with a small decurrent tooth, off-white, up to 1.5 mm wide, subdistant, with lamellulae of one length; edge finely hairy under a lens, initially concolourous

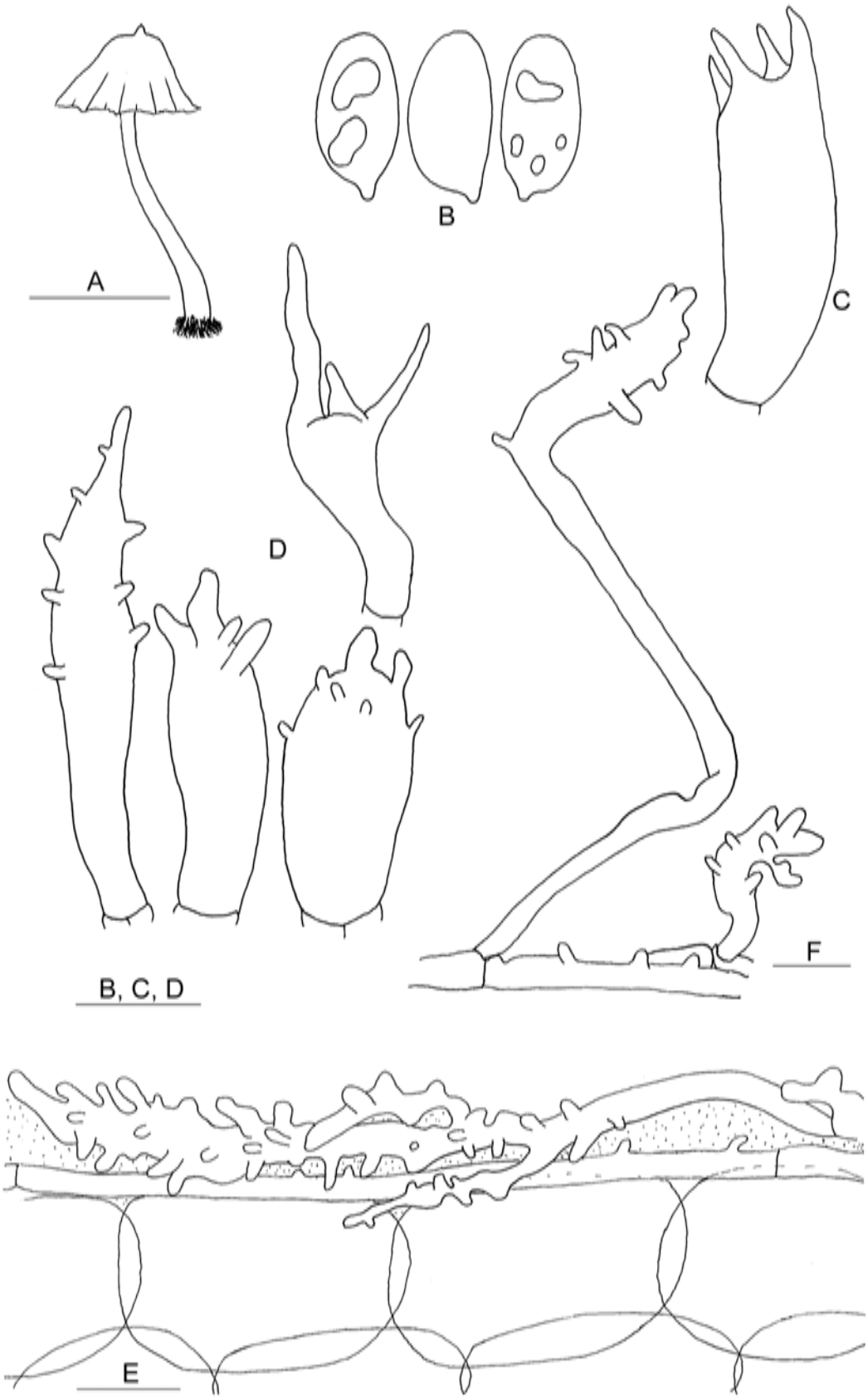


Figure 36. *Mycena valkaja*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, hyphae of the pileipellis with terminal cells; F, caulocystidia. Scale bars: A = 1 cm; B-F = 10 µm.

with the sides, becoming pinkish with time. Stipe 20–28 × 1–3 mm, central, terete or slightly flattened, almost equal, hollow; surface translucent, off-white or reddish grey (7B2) at the apex, pinkish or greyish brown (7D3) towards the base, glabrous; base slightly broader, with white, thick, cottony basal mycelium. Context not conspicuous, up to 1 mm wide, white. Odour not distinctive. Taste not recorded.

Basidiospores (7.5) 8–12 × 4.5–5.5 (9.6 ± 0.99 × 5.04 ± 0.33) µm, Q = 1.6–2.22, Q_m = 1.91, ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia 23–32 × 7.5–10 µm, clavate, bearing 4 sterigmata up to 6 µm long. Lamella-edge heterogeneous. Cheilocystidia (14) 23–51 (61) × (4) 6–12 µm, clavate, cylindrical or rarely fusoid, with a few finger-like or irregular protrusions (1.5–11 × 1–5.5 µm) at the apex, thin-walled, with pale brown contents. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2.5–20 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular, two-layered; upper hyphae 17–37 (46) µm wide, compactly arranged, thin-walled, hyaline; lower hyphae 2.5–14 µm wide, loosely arranged, slightly gelatinised, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis an epicutis; hyphae 2–8.5 µm wide, gelatinised, thin-walled, with brownish contents, with scattered, simple excrescences (1.5–6.5 × 1–2 µm); terminal cells 40–99 × 5–8 µm, narrowly clavate, nodulose-diverticulate. Stipitipellis a cutis; hyphae 2–5 µm wide, thin-walled, with brownish contents, with scattered, simple excrescences (1.5–7 × 1–1.5 µm). Caulocystidia 27–105 × 6–8 µm, similar to terminal cells of the pileipellis. Stipe trama dextrinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Solitary, on decaying barks of trees or on twigs. August-October.

Additional collection examined:—INDIA. Kerala State: Idukki District, Mattupetti, 15 August 2010, *D.M. Aravindakshan DM483*, K(M) 190600.

Notes:—Ellipsoid and amyloid basidiospores, a pileus devoid of a separable pellicle, and a pink lamella-edge are the characters of this species that lead it to *Mycena* sect. *Rubromarginatae*.

Characters such as the richly coloured pileus, the stipe without yellowish or olivaceous colours, the basidiospores with maximum width of 6 µm, and the cheilocystidia apically and laterally covered with a few, short excrescences lead *M. valkaja* very close to *M. elegantula* Peck, reported from the United States. In addition, the latter species has a similar-sized pileus, similar type of lamellae, a stipe base with whitish fibrils, almost similar-sized basidiospores, cheilocystidia with excrescences, and hyphae of both the pileipellis and stipitipellis with excrescences and it is devoid of pleurocystidia like *M. valkaja*. But *M. elegantula* differs from the present species in having a purplish brown pileus, a much longer (50 mm) stipe, smaller cheilocystidia (up to 28 µm long), non-gelatinised hyphae of the pileipellis, a gregarious to caespitose habit, and growth on decaying leaves and in lacking nodulose-diverticulate terminal cells of hyphae of both the pileipellis and stipitipellis. *Mycena schildiana*, described from Italy (Maas Geesteranus 1997), also shows a lamella-edge that darkens with time as is the case in *M. valkaja*. In addition, that species has terminal cells with dense diverticulations on the hyphae of the pileipellis and almost similar-sized basidiospores. But in all other macro- and microscopic characters, that species is different from *M. valkaja*. *Mycena oratiensis* Segedin from New Zealand also shows some similarity to the present species in several characters. That species, however, has a pileus with mammiform umbo,

a stipe that exudes a watery juice when cut, dendrophysoid cheilocystidia, a subpellis with red plasmatic pigment and non-gelatinised hyphae of the pileipellis.

37. ***Mycena pingala*** Aravind. & Manim. *sp. nov*. Pl. 3 K; Fig. 37 A–F

MycoBank MB811095

Diagnosis:—Characterised by a reddish brown pileus, stipe and lamella-edge; ellipsoid to subglobose, amyloid basidiospores; reddish brown contents in cheilocystidia, pleurocystidia, and hyphae of both the pileipellis and stipitipellis; typically smooth cheilo- and pleurocystidia; and gelatinised tramal tissues and pileipellis. Differing from *M. capillaripes* in having globose basidiospores and gelatinised hyphae of the pileipellis and in lacking a distinctive odour.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 2 June 2009, *D.M. Aravindakshan DM242*, K(M) 190601 (K!).

Etymology:—*pingala* (Sanskrit), reddish brown.

Basidiomata medium-sized. Pileus 8–42 mm diam., 8–15 mm high, parabolic when young, becoming broadly convex to campanulate with age; surface reddish brown (8F8, 8E4) or dark brown (7F6) or brown (7E5, 7E4) all over when young, retaining the colour at the centre, and on the striations and margin and greyish red (10C4) or greyish brown (8D3) or light brown (7D3) or brownish orange (7C3) elsewhere with age, hydrophanous and finally becoming reddish white (7A2) or brown (6D4) or greyish brown (6C3) or orange white (6A2), pruinose or finely squamulose, more so at the centre, initially translucent-striate, becoming sulcate-striate; margin straight and entire when young, becoming plane and crenate or crisped or undulating or eroded with age. Lamellae 13–16 reaching the stipe, adnate with a decurrent tooth or emarginate or sinuate, greyish red (9D5) or reddish brown (8E4) or dull red (8C3), up to 6.5 mm wide, subdistant, with lamellulae of 1–3 lengths; sides of the lamellae punctate with reddish brown dots; edge finely hairy, reddish brown (8F8) or dark brown (8F5). Stipe 19–50 × 1–5 mm, central, nearly terete or compressed, almost equal or slightly tapering towards apex, hollow; surface reddish brown (8F8) or leather brown (6E6) or light brown (6D4, 6D5) towards apex and reddish brown (8F6) or greyish brown (7D3) towards base when young, becoming light brown (7D4) all over with age, with dark brown (7F6) or reddish brown dots, pruinose to fibrillose towards apex, more or less glabrous towards base; base slightly swollen, with a reddish brown (8E6) to whitish basal mycelium. Context up to 1 mm thick, concolourous with the pileus surface. Odour not distinctive. Taste bitter.

Basidiospores 7.5–11 × 5–8.5 (8.65 ± 0.61 × 6.29 ± 0.59) µm, Q = 1.18–1.7, Q_m = 1.38, ellipsoid to subglobose, thin-walled, hyaline, smooth, amyloid. Basidia 17.5–30 × 7.5–11.5 µm, broadly clavate, bearing 4 sterigmata up to 7 µm long. Lamella-edge homogeneous. Cheilocystidia (18) 21–55 (85) × 9–13 µm, narrowly clavate to clavate, containing and exuding a reddish brown amorphous substance at the apex, thin-walled, smooth or apically somewhat broadened, often with 2–3 short protuberances (2–5.5 × 2.5–6 µm) at the apex, very rarely with

mucronate or pointed apex (7–13 µm long). Pleurocystidia 21–55 (85) × 9–13 µm, similar to cheilocystidia but smooth. Lamellar trama subregular; hyphae 1.5–30 µm wide, slightly gelatinous, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama interwoven, loosely arranged; hyphae 2.5–32 (46.5) µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a disrupted cutis; hyphae 1.5–8 µm wide, slightly gelatinous, thin-walled, hyaline or with brownish contents, with diverticulate terminal cells, 14–72 × 4–6 µm. Stipitipellis a cutis; hyphae 2.5–6 µm wide, thin-walled, hyaline to pale brownish or reddish brown; cystidioid elements 22.5–79 × 5–11 µm, often fasciculate, diverticulated. Stipe trama vinoid to moderately vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Caespitose or scattered, on the bark of standing trees (*Alstonia scholaris* and *Sapium*) and on decaying barks. June.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 7 June 2006, *D.M. Aravindakshan DM12*; 8 September 2007, *D.M. Aravindakshan DM213*; Kannur District, Neeliyar Kottam, 17 June 2009, *D.M. Aravindakshan DM264*; Palakkad District, Silent Valley National Park, 17 June 2010, *D.M. Aravindakshan DM430*.

Notes:—Characters such as the amyloid basidiospores, the differently coloured lamella-edge, the typically smooth cheilo- and pleurocystidia with coloured contents, and the diverticulate hyphae of both the pileipellis and stipitipellis lead *M. pingala* to sect. *Rubromarginatae*.

Of the many species of sect. *Rubromarginatae*, *M. capillaripes* Peck, an American species, seems to be the closest to *M. pingala* in having almost similar-sized basidiomata, a reddish or greyish brown, hygrophanous pileus, lamellae punctate with dark brown dots, a pronouncedly pruinose stipe apex, somewhat similar-sized basidia and cheilocystidia, and diverticulate hyphae of the pileipellis and stipitipellis. However, *M. capillaripes* differs in having a distinct nitrous or chlorinous odour, broadly adnate lamellae, somewhat cylindrical basidiospores, and non-gelatinised hyphae of the pileipellis with dense excrescences, and in lacking cystidioid terminal cells of hyphae of both pileipellis and stipitipellis. *Mycena porphyrea* Maas Geest. & E. Horak, a New Guinean species, is a somewhat similar species with dark red-brown dots on the sides of the lamellae, a red-brown lamella-edge, a hygrophanous pileus, red-brown dots on the stipe, fusiform to clavate cheilo- and pleurocystidia with red-brown contents, hyphae of the pileipellis with sparse or coarse excrescences and red-brown contents; mostly smooth hyphae of the stipitipellis and fasciculate caulocystidia. But the characters such as the purple brown basidiomata, the indistinctive taste, the somewhat smaller basidiospores and the non-gelatinised hyphae of the pileipellis make *M. porphyrea* distinct.

Mycena rubromarginata, *M. cheboyganensis* A.H. Sm., *M. hepatica* M. Villarreal, Heykoop & Maas Geest., *M. noctilucens* Corner, *M. singeri* Lodge and *M. pallidorubens* (Berk. & Broome) Sacc. are the other species of sect. *Rubromarginatae* with reddish brown basidiomata and lamella-edge. Both *M. rubromarginata*, a European species, and *M. cheboyganensis*, a North American species, have broader basidiospores (>5.5 µm) and pleurocystidia similar to those of present species. But those species are different with longer basidiospores, cheilocystidia with noticeable excrescences,

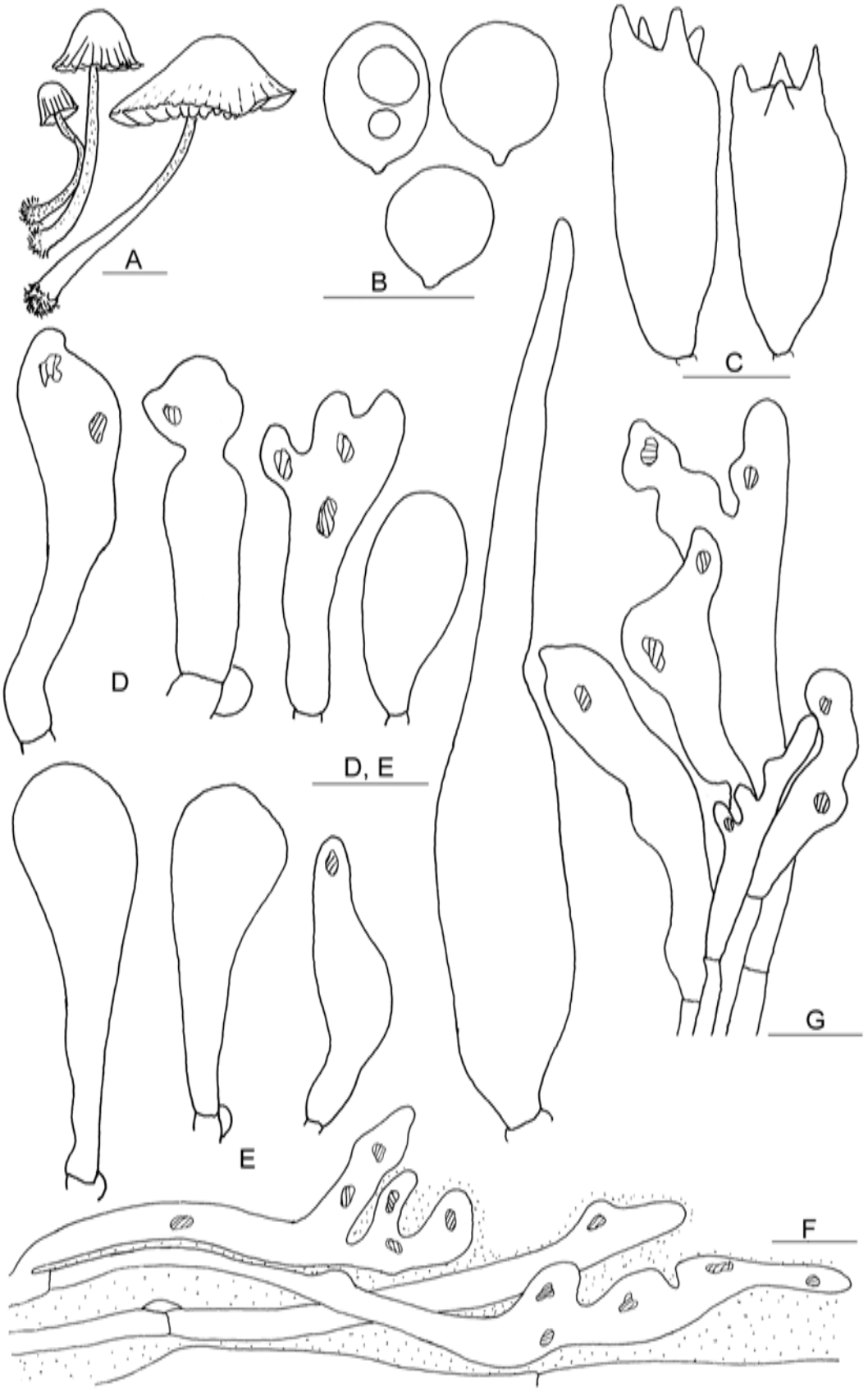


Figure 37. *Mycena pingala*. A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, hyphae of the pileipellis with terminal cells; F, caulocystidia. Scale bars: A = 1 cm; B-F = 10 µm.

non-gelatinous hyphae of the pileipellis with excrescences that form dense masses and hyphae of the stipitipellis with sparse or numerous excrescences. In addition to the colour of the basidiomata, *M. hepatica*, another European species, is similar to the present one in its indistinctive odour and distinct terminal cells of the stipitipellis hyphae. But characters such as the smaller basidiomata, the narrower basidiospores, the polymorphic cheilocystidia, the non-gelatinous hyphae of the pileipellis and the absence of pleurocystidia differentiate that species from *M. pingala*.

Mycena noctilucens, reported from Malaysia, has a comparable basidiospore size, non-lobed pleurocystidia with contents, and a disrupted cutis-type pileipellis with reddish brown contents similar to *M. pingala*. But that species has luminescent basidiomata; subcylindric, flexuous, protrusions of the cheilocystidia; much larger caulocystidia; and non-gelatinised hyphae of the pileipellis. *Mycena singeri*, another American species, formerly included in sect. *Mycena* subsect. *Ciliatae*, stirps *Rubromarginatae*, is phenetically very similar to *M. pingala* in having a reddish pileus, ascending lamellae with a decurrent tooth and reddish flecks distributed near the lamella-edge. But that species has globose to subglobose (Q = 1–1.2) basidiospores, frequently lobed cheilocystidia and a non-gelatinised epicutis. Although it has almost similar-sized and similar-coloured basidiomata, *M. pallidorubens* differs from *M. pingala* in having much smaller basidiospores and cheilocystidia, non-gelatinised hyphae of the pileipellis with many diverticulations, and hypodermium hyphae with reddish contents and in lacking pleurocystidia.

XIII. ***Mycena*** section ***Sacchariferae*** Kühner ex Singer, Sydowia 15: 65 (1962b).

Basidiomata small. Pileus obtusely conic or campanulate, expanding to broadly convex, seldom depressed, with a universal veil forming conic to pyramidal spines, flakes or granules; surface dull, dry or very slightly sticky, granulose, floccose or pulverulent, granules and flakes white, yellow, grey, fulvous or brown, surface under ornamentation white, pale yellow or pale grey. Lamellae typically present, ascending, adnate to free with white lamella-edge. Stipe puberulous, at least partly, or lightly powdered, white, with or without a basal disc. Basidiospores globose, ovoid, ellipsoid or cylindric, amyloid. Basidia 2- or 4-spored. Cheilocystidia typically present, variously shaped with the apex possessing dense or sparse spinulae, rarely non-spinulose. Pleurocystidia absent. Pileipellis ranging from a cutis with acanthocyst terminal cells to a subhymeniform layer of acanthocysts; hyphae smooth or spinulose, non gelatinous, non-incrusted. Acanthocysts globose, broadly clavate or irregular in outline, densely spinulose, hyaline or with dark brown contents. Universal veil formed of cherocytes or acanthocysts. Hyphae of the stipitipellis smooth, non-gelatinous. Caulocystidia smooth or densely spinulose.

Type species:—*Mycena adscendens* Maas Geest.

Key to the species

1. Cherocytes present, especially on surface of primordium and disc of pileus .....

.....(stirps ***Amparoina***) 2

- Cherocytes absent. 5

2. Cherocytes and acanthocysts with brownish contents; basidiospores 9–11 × 5–7.5 µm..... 38. ***Mycena albinea***

- Cherocytes and acanthocysts hyaline..... 3

3. Primordium surface covered with cone-shaped spines that are formed of chains of cherocytes; basidiospores 8–9.5 × 4.5–6 µm..... 39. ***Mycena spinosissima***

-. Primordium surface not covered with cone-shaped spines. 4

4. Cherocytes irregularly shaped; caulocystidia up to 125 µm long; basidiospores 6.5–9 × 4–5 µm..... 40. ***Mycena silvana***

- Cherocytes with a bulbous base and spine-like projections at the top; caulocystidia up to 80 µm long; basidiospores 6–8.5 × 3–4 µm..... 41. ***Mycena delicata***

5. Caulocystidia entirely or partly covered with spinules; basal disc typically absent.....

.....(stirps ***Alphitophora***) 6

- Caulocystidia entirely smooth; basal disc present.....(stirps ***Adscendens***) 9

6. Primordium pinkish; caulocystidia up to 125 µm long; basidiospores weakly amyloid, 8–9.5 × 3.5–5 µm..... 42. ***Mycena roseotincta***

- Primordium white; caulocystidia greater than 125 µm long; basidiospores distinctly amyloid 7

7. Detersile elements with broader excrescences; basidiospores globose to subglobose, 7–9 × 6–7.5 µm..... 43. ***Mycena globispora***

-. Detersile elements with narrower excrescences; basidiospores ellipsoid 8

8. Pileus densely pruinose; acanthocysts of universal veil occur in chains, with larger (up to (40 µm long) excrescences; basidiospores 7–9 × 3–4 µm ..... 44. ***Mycena distincta***

- Pileus not densely pruinose; acanthocyst of universal veil not in chains..... 45. ***Mycena alphitophora***

9. Pileus covered with bran-like flakes that are made of two types of detersile acanthocysts; basidiospores 7.5–8.5 × 3.75–4.75 µm..... 46. ***Mycena furfuracea***

- Pileus covered with sugar-like granules made of single type of acanthocysts; basidiospores 6–8 × 3.5–4 µm..... 47. ***Mycena apala***

Mycena sect**. *Sacchariferae*** stirps ***Amparoina*** Desjardin, Bibliotheca Mycologica 159: 14 (1995).

Primordia with universal veil formed from hyphae terminated by one or more cherocytes; cherocytes variously shaped, densely spinulose, thick-walled, with 1–12, thick-walled, spine-like projections. Caulocystidia densely spinulose overall. Base of stipe with or without a basal disc.

38. ***Mycena albinea*** Aravind. & Manim. *sp. nov*. Pl. 3 L; Fig. 38 A–H

MycoBank MB811096

Diagnosis:—Characterised by a pale brownish to off-white pileus that dries brownish, large (up to 11 µm long) basidiospores, and acanthocysts and cherocytes with greyish contents. Differing from *M. lasiopus* in having a whitish pileus, larger basidiospores and densely spinulose caulocystidia.

Holotype:—INDIA. Kerala State: Wayanad District, Periya, 23 July 2009, *D.M. Aravindakshan DM295*, K(M) 188293 (K!).

Etymology:—*albinea* (Latin), whitish.

Basidioma very small, delicate. Pileus 3 mm diam., 2 mm high, campanulate; surface brownish at the centre and on the striations and off-white towards margin, translucent-striate, finely pruinose; margin nearly plane, undulate. Lamellae narrowly adnate or adnexed, off-white, 0.5 mm thick, subclose, with lamellulae of 1–2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 22 × 0.5–1 mm, central, terete, almost equal to slightly tapering to apex, hollow; surface translucent off-white, thin, pubescent or pruinose; base discoid, radially lamellate. Context not conspicuous, concolourous with the pileus surface. Odour not distinctive. Taste not recorded.

Basidiospores (8) 9–11 (12) × 5–7.5 (9.94 ± 0.83 × 5.49 ± 0.53) µm, Q = 1.48–2.2, Q_m = 1.82, ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia 10–15 × 8–10 µm, clavate, bearing 4 sterigmata up to 3 µm long. Lamella-edge fertile. Cheilocystidia very difficult to observe, 13.5–25.5 × 6.5–12 µm, clavate, thin-walled, hyaline, with short, cylindrical excrescences (1–2 × 1 µm) over upper half. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2–12 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose, closely packed. Pileus trama subregular; hyphae 3–18 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis overlaid by elements of universal veil; hyphae 2–9 µm wide, thin-walled, hyaline, smooth; terminal cells modified as acanthocysts, 7.5–32.5 × 4.5–20 µm, clavate, ellipsoid or subglobose, thin-walled, with greyish contents, with short, cylindrical or conical excrescences (0.5–1 × 0.5 µm). Universal veil composed of detersile cherocytes, 18–31 × 9.5–24 µm, irregularly shaped, thick-walled (1–2 µm), with greyish contents, with short, cylindrical or conical excrescences (0.5–2.5 × 0.5–1 µm). Pileus marginal cells 10–11 × 5.5–9 µm, clavate, thin-walled, with short, cylindrical or conical excrescences (0.5–1.5 × 0.5–1 µm). Stipitipellis a cutis; hyphae 2–9 µm wide, thin-walled, hyaline, smooth. Caulocystidia 20.5–356 × 5–14 µm, cylindrical or clavate, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Stipe trama faintly vinoid in Melzer's reagent. Clamp connections seen only on the hyphae of the stipitipellis.

Habit, habitat and phenology:—Scattered, on decaying fruits of *Cullenia* sp. July.

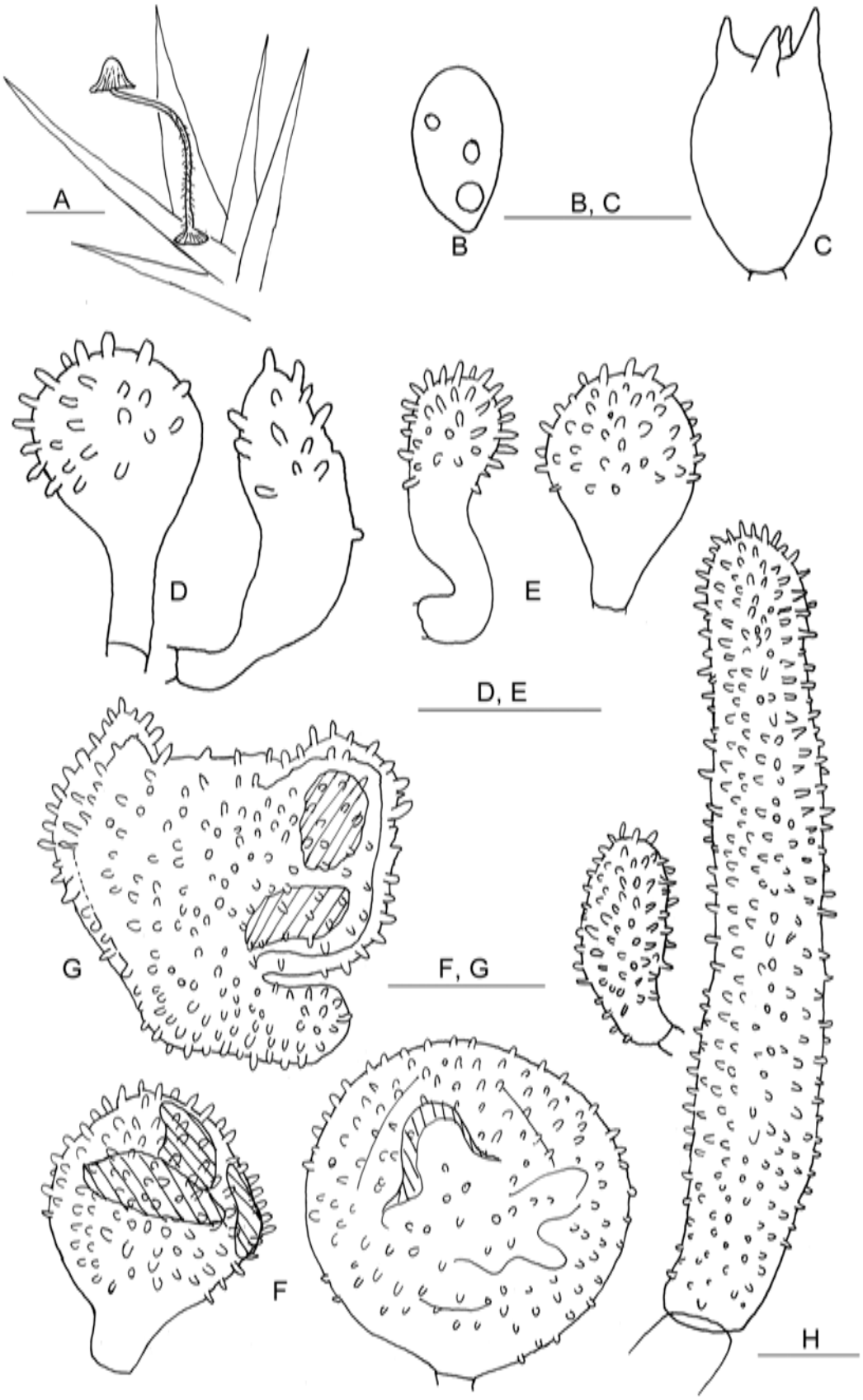


Figure 38. *Mycena albinea*. A, basidioma; B, basidiospore; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, pileal acanthocysts; G, cherocyte; H, caulocystidia. Scale bars: A = 5 mm; B-H =10 µm.

Notes:—Although the stirps *Amparoina* is characterised by the presence of thick-walled cherocytes with spine-like projections, a few borderline species have already been placed in that stirps. For example, Desjardin (1995) placed *M. sotae* Singer that has thin-walled, irregularly shaped acanthocysts and Maas Geesteranus & de Meijer (1998) placed *M. lasiopus* Maas Geest. & de Meijer that has thick-walled cherocytes without long, spine-like projections in that stirps. Maas Geesteranus & de Meijer argued that it was nearly impossible to define subgeneric taxa without allowing one or more taxa to deviate in one or two of its characters as sharp lines of demarcation are rare in nature. *Mycena albinea* is an example for this situation as it has somewhat thick-walled (up to 2.5 µm), non-spinulose (only projections) cherocytes and hence it is best placed in stirps *Amparoina*.

Mycena lasiopus, a Brazilian species, shares characters such as a stipe springing from a radially lamellate basal disc, a fertile lamella-edge, and acanthocysts and cherocytes with brownish contents with *M. albinea*. But that species differs in having a dark grey pileus, a smaller stipe (7 mm long), smaller basidiospores (8.1–9.8 × 5.4–6.5 µm), broadly clavate to subglobose basidia, and caulocystidia that are nearly smooth at the tip.

Mycena sotae, reported from Bolivia, the Hawaiian Islands and Puerto Rico, is also very similar to *M. albinea* in characters such as a brownish pileus drying dark brown, a stipe arising from a well-developed basal disc, acanthocysts with coloured contents, and densely spinulose, cylindrical caulocystidia. But that species differs in having much smaller basidiomata (stipe up to 12 mm long), a broadly convex to slightly depressed pileus, smaller basidiospores (7.5–9.3 × 4.5–6 µm), numerous broader cheilocystidia, thin-walled and irregularly shaped acanthocysts, and clamp connections. All the other species of stirps *Amparoina* are different from the present species in having distinct, thick-walled cherocytes with spines.

39. ***Mycena spinosissima*** (Singer) Desjardin, Bibliotheca Mycologica 159: 15 (1995). Pl. 3 M; Fig. 39 A–I

≡ *Marasmius spinosissimus* Singer, Schweizerische Zeitschrift für Pilzkunde 28: 193 (1950).

≡ *Amparoina spinosissima* (Singer) Singer, Mycologia 50: 110 (1958).

Basidiomata small, delicate. Pileus 2–5.5 mm wide, 2–4.5 mm high, initially conical, becoming broadly campanulate; surface white to whitish all over, entirely covered in the primordial stage with a universal veil made up of pale greenish or ivory-coloured, erect or curved, conic, detersile spines up to 0.75 mm long that disappear first from the middle, then from the margin and finally from the pileus disc with age, pruinose, dry, very thin, translucent-striate, becoming slightly plicate towards the margin; margin initially straight and appendiculate with spines, becoming plane and undulate or finely torn with age. Lamellae adnexed, fairly close, 15–20 reaching the stipe, with lamellulae in 1–3 tiers, ventricose, up to 0.5 mm broad, white; edge finely torn under a lens. Stipe 20–38 × 0.5–1.25 mm, central, terete or slightly compressed, almost equal or with a slightly dilated apex, hollow; surface translucent, white, dry, densely pruinose to hirsute towards the base, almost glabrous at apex; base often subbulbous, not discoid. Context very thin. Odour not distinctive. Taste not recorded.

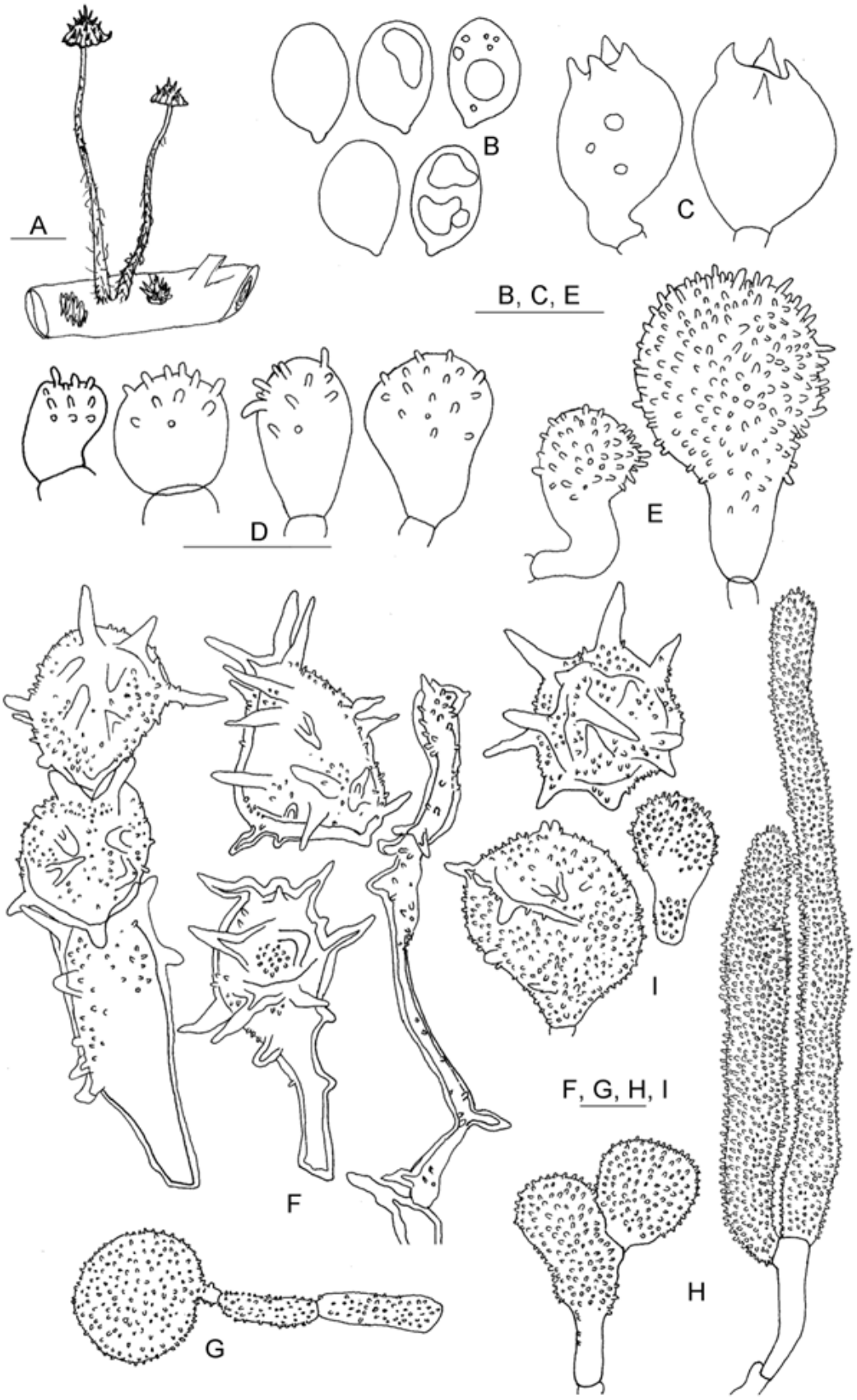


Figure 39. *Mycena spinosissima*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, universal veil cherocytes; G, hyphae of the pileipellis with terminal acanthocyst cell; H, caulocystidia; I, stipe basal cherocytes. Scale bars: A = 5 mm; B-I = 10 µm

Basidiospores (6–) 8–9.5 (–12) × 4.5–6 (–9.5) (8.86 ± 0.17 × 5.96 ± 0.15) µm, Q = 1.24–1.73, Q_m = 1.5, ellipsoid, ovoid or rarely subamygdaliform, thin-walled, smooth, with refractive guttules, inamyloid. Basidia 11–18 × 6–11.5 µm, broadly clavate to almost subglobose, thin-walled, hyaline, 4-spored, with sterigmata up to 4 µm long. Lamella-edge sterile. Cheilocystidia 7–23.5 × 5–12.5 µm, cylindrico-clavate, subglobose or vesiculose, covered entirely or at least at the apex with minute excrescences, occasionally smooth, thin- to slightly (0.5 µm) thick-walled, hyaline; excrescences (0.5–0.75 µm) long, cylindrical or subconical. Pleurocystidia absent. Lamellar trama subregular to almost regular; hyphae 2.5–32 µm wide, thin-walled, hyaline to pale yellowish, faintly dextrinoid. Pileal trama subregular; hyphae 2–20 µm wide, slightly inflated, thin-walled, hyaline to pale yellowish. Pileipellis basically a cutis composed of hyphae that are covered entirely with minute excrescences and terminating in acanthocysts which overlap in such a way as to give an apparent subhymeniform appearance; hyphae 2.5–5.5 µm wide, thin-walled, hyaline; acanthocysts 18–54 × 10–41 µm, versiform: globose, subglobose, clavate, ovoid or sphaero-pedunculate, thin-walled, hyaline, with excrescences (0.5–2 × 0.5–1.5 µm), cylindrical or subconical; hypoderm composed of distinctly more inflated hyphae lacking excrescences. Pileus marginal cells 10–26 × 4.5–15.5 µm, similar to cheilocystidia, thin-walled, hyaline. Spines of the universal veil made of cherocytes 25–90 × 2–31 µm, central and terminal ones mostly globose, clavate or fusiform, peripheral ones often cylindric, subcylindric or irregularly elongated, thick-walled (1–2 µm), with sparse excrescences, with 8–24 erect, pointed spine-like projections, 3–26 µm long. Stipitipellis a cutis with numerous caulocystidia; hyphae 2.5–13 µm wide, thin- to slightly (0.25 µm) thick-walled, hyaline; caulocystidia 34.5–331.5 × 6.5–15 (20) µm, long, scattered or in clusters, cylindrical, mostly with an obtuse apex, densely covered with excrescences all over. Both acanthocysts and cherocytes observed in the covering layers of the extreme base of the stipe; acanthocysts 11.5–71 × 7.5–30.5 µm, subglobose to clavate, obpyriform or lageniform or nearly sphaero-pedunculate, with evenly distributed excrescences (0.5–2 × 0.5–1.5 µm); cherocytes 23.5–33 × 12–27 µm, globose to subglobose or clavate, thick-walled (1–2 µm), with excrescences all over, and with 5–12 pointed spine-like projections, up to 8 µm long. Clamp connections observed in all hyphae except at the base of caulocystidia and on pileipellis hyphae. Cherocytes of both the pileal surface and stipe base showed a tendency to germinate when mounted in water.

Habit, habitat and phenology:—Scattered or caespitose, on decaying dicotyledonous twigs. July- August.

Additional collections examined:—INDIA. Kerala State: Calicut District, Koyilandy, Poyilkaavu, 31 July 2009, *D.M. Aravindakshan DM314*, K(M) 165810; Idukki District, Marayoor, Anamudi Shola National Park, 18 August 2010, *D.M. Aravindakshan DM503*, K(M) 188308.

Notes:—The convoluted taxonomic history of this species was discussed by Aravindakshan & Manimohan (2010). This species was earlier (Aravindakshan & Manimohan 2010) interpreted as *Amparoina spinosissima* owing to the consistently inamyloid basidiospores in the first observed collection (DM314). But surprisingly, a subsequent collection from Munnar revealed strongly amyloid basidiospores. Therefore, this species is presently treated as a *Mycena* because *Amparoina*, as recognised by Singer (1958), is characterised by inamyloid basidiospores. Horak (1968, 1980b, and his pers. comm. quoted by Desjardin 1995) also has made conflicting observations about amyloidity of basidiospores of this species. It seems basidiospores from

different populations of this species react differently with Melzer's reagent. Although only rarely collected, *M. spinosissima* is known thus far from Argentina, Colombia, Hawaii, Japan, New Caledonia, and Puerto Rico. The Kerala collection was the first record of *M. spinosissima* from continental Asia.

40. ***Mycena silvana*** Aravind. & Manim. *sp. nov*. Pl. 3 N; Fig. 40 A–H

MycoBank MB811174

Diagnosis:—Characterised by a pale greyish pileus coated with white granules; clavate or irregularly shaped cherocytes with hyaline contents and 4–6 spinulae covered with excrescences; and short caulocystidia. Differing from *M. biornata* in having slightly smaller basidiospores, cheilocystidia with excrescences, and hyaline acanthocysts and cherocytes and in lacking a well-developed stipe base.

Holotype:—INDIA. Kerala State: Palakkad District, Silent Valley National Park, 29 June 2010, *D.M. Aravindakshan DM429b*, K(M) 188294 (K!).

Etymology:—*silvana* (Latin), of the forest.

Basidiomata small, very delicate. Pileus 2.5–8 mm diam., up to 2 mm high, conic or parabolic when young, then broadly conic, convex or campanulate and finally applanate; surface grey (2E1, 2D1) at the centre and on the striations, whitish towards the margin, and pale grey (2B1) elsewhere, with fine, white pulverulence all over, translucent-striate; margin straight and entire when young, becoming plane or upturned and finally fissile with age. Lamellae 8–12 reaching the stipe, free, adnexed or narrowly adnate, pale greyish, less than 0.5 mm thick, subdistant, with lamellulae of 1–2 lengths; edge finely torn under a lens, paler than the sides. Stipe 5–43 × 0.25–0.5 mm, central, terete, almost equal or slightly tapering towards the apex, hollow; surface translucent, white, with short, white hairs; base slightly swollen but not discoid, pruinose. Context not conspicuous. Odour not distinctive. Taste not recorded.

Basidiospores 6.5–9 × 4–5 (8.18 ± 0.55 × 6.71 ± 0.48) µm, Q = 1.07–1.42, Q_m = 1.22, ellipsoid or subamygdaliform, thin-walled, hyaline, smooth, amyloid, with a few guttules. Basidia 13.5–17.5 × 6.5–9 µm, ovoid, obovoid or clavate, often with a short pedicel, bearing 4 sterigmata up to 3.5 µm long. Lamella-edge heterogeneous. Cheilocystidia 10–24 (31) × 5–7.5 µm, narrowly clavate or sphaero-pedunculate, thin-walled, hyaline, with a few, short, cylindrical excrescences (0.25–1 (2) × 0.25–0.5 µm) towards the apex. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 1.5–14 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium narrow, pseudoparenchymatous. Pileus trama subregular; hyphae 9–27 µm wide, thin-walled, hyaline or with pale greyish contents, vinoid in Melzer's reagent. Pileipellis a subhymeniform layer of acanthocyst terminal cells arising from a layer of inflated hyphae; hyphae 2–10 µm wide, thin-walled, hyaline, with short, cylindrical or conical excrescences (0.5–2.5 × 0.5–1 µm); acanthocyst terminal cells 14–42 × 7–31.5 µm, versiform: globose, subglobose, oblong, ovoid or sphaero-pedunculate, thin-walled, hyaline, with cylindrical excrescences (0.25–2.5 × 0.5–1 µm). Universal veil causing the pulverulence on the pileus surface formed from subparallel hyphae with each hypha terminating in a single detersile cherocytes; hyphae 2.5–7 (9.5) µm wide, thin-walled

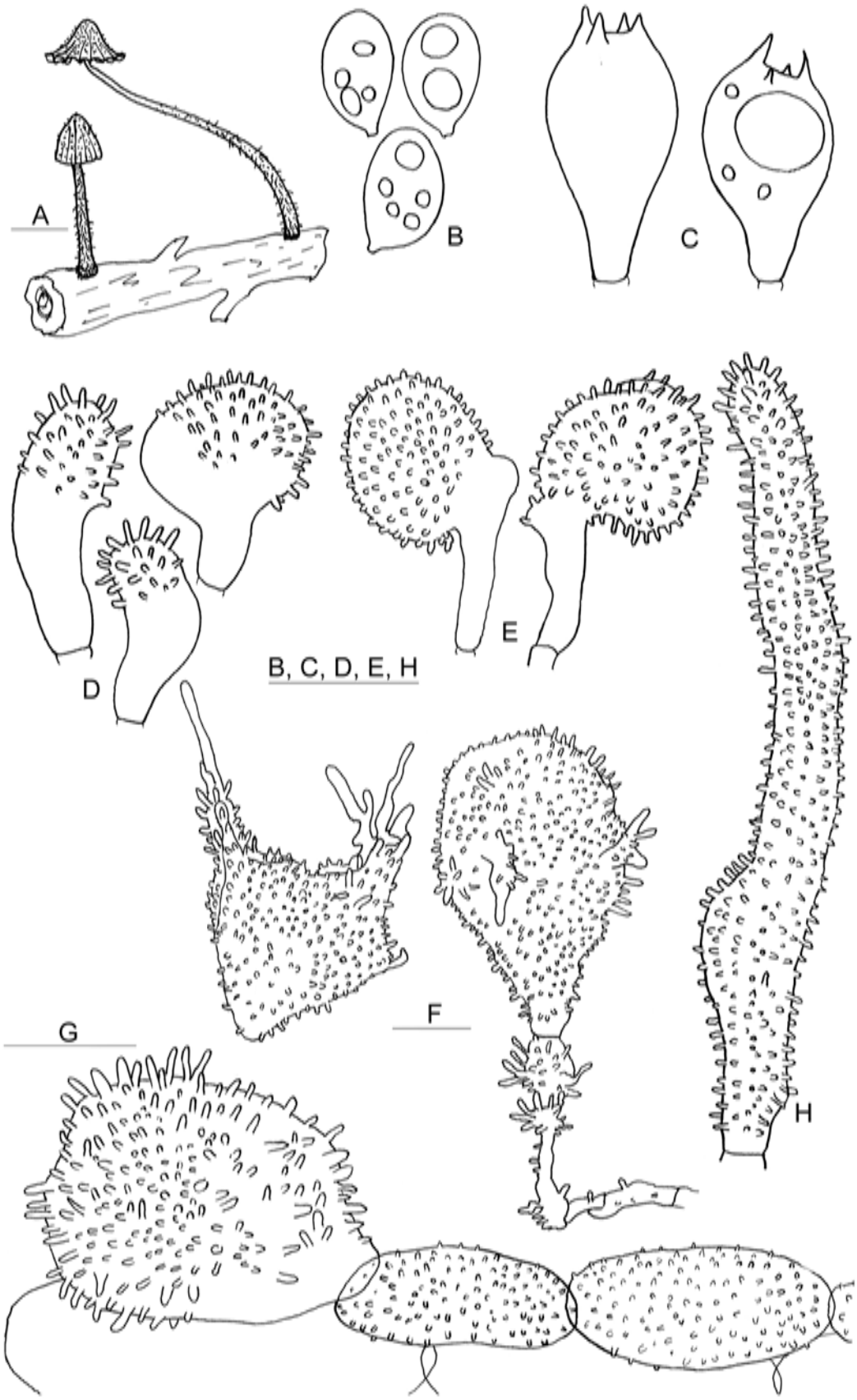


Figure 40. *Mycena silvana*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, cherocytes; G, hyphae of the pileipellis with terminal acanthocyst cell; H, caulocystidium. Scale bars: A = 5 mm; B-H = 10 µm.

(towards base, in side view), slightly (0.5–5 (8) µm) thick-walled (towards the apex, in top view), hyaline, with excrescences (0.25–5 × 0.25–2 µm); cherocytes 15–48 × 14–34 µm, clavate or irregularly-shaped, thin- to thick-walled (1–5 (8) µm), hyaline, with minute excrescences (1–3 × 0.5–1 µm) all over, and with 4–6 longer and broader protrusions (2–14 × 2.5–17 µm), with the longest excrescences (1–10.5 × 0.5–2 µm) at the apex. Pileus marginal cells 9–26.5 × 9–18.5 µm, versiform: clavate, ovoid, sphaero-pedunculate or globose, with short, cylindrical excrescences (0.5–1 × 0.5–1 µm). Stipitipellis a cutis of smooth hyphae with terminal or lateral caulocystidia; hyphae 1.5–7 µm wide, thin-walled, hyaline. Caulocystidia 9–125 × 5–16 µm, sinuoso-cylindric, thin-walled, with short, cylindrical excrescences (0.25–1 × 0.25–0.5 µm). Stipe basal cells 10–35 × 8–21 µm, clavate or broadly clavate, thin-walled, with short, cylindrical excrescences (0.5–2 × 0.5–1 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae but difficult to observe.

Habit, habitat and phenology:—Scattered, on decaying twigs. June-September.

Additional collections examined:—INDIA. Kerala State: Palakkad District, Silent Valley National Park, 17 June 2010, *D.M. Aravindakshan DM429a*; Kollam District, Kulathupuzha, 27 September 2010, *D.M. Aravindakshan DM516*, K(M) 188295.

Notes:—*Mycena biornata* Singer seems to be the closest species to the present one as it has similar-sized basidiomata growing on decaying leaves and long, cylindrical caulocystidia. But that species differs in having a pileus with fulvous granules, a well-developed stipe basal disc, cherocytes with much larger spines, and smooth cheilocystidia.

Mycena heteracantha (Singer) Desjardin, from Colombia, is similar to *M. silvana* in having somewhat similar cherocytes with angular or irregular outline and 4–8 erect, spine-like projections that in turn are ornamented basally with spinules and with hyaline contents, as well as similar cheilocystidia and acanthocysts. But that species is different in having conic spines of the universal veil on the pileus disc and on the stipe base, slightly broader (up to 6.7 µm wide) basidiospores and much longer (up to 440 µm long) caulocystidia and in lacking clamp connections. *Mycena excelsa* Maas Geest. & de Meijer, a Brazilian species, is somewhat similar to *M. silvana* in having hyaline cherocytes and acanthocysts. But that species has solitary or chains of globose, ellipsoid or subcylindrical cherocytes that form spines over the pileus, and somewhat longer, often more than 200 µm long caulocystidia.

41. ***Mycena delicata*** Aravind. & Manim. *sp. nov*. Pl. 4 A; Fig. 41 A-I

MycoBank MB811097

Diagnosis:—Characterised by a broadly hemispherical to infundibuliform pileus with fine hairs; cherocytes with a thin-walled, bulbous base and a thick-walled, spine-like apical projection with excrescences; and aculeate caulocystidia with smooth apical part. Differing from *M. trichocephala* in having a non-discoid stipe base; differently shaped cherocytes; and smooth apices for caulocystidia.

Holotype:—INDIA. Kerala State: Wayanad District, Periya, 23 July 2009, *D.M. Aravindakshan DM296*, K(M) 188296 (K!).

Etymology:—*delicata* (Latin), delicate.

Basidiomata very small, delicate. Pileus 1–1.25 mm diam., up to 0.5 mm high, parabolic or hemispherical when young, becoming applanate with a central depression with age; surface pure white all over, with fine, erect, white hairs, more so on the primordium and on the disc, very thin, translucent-striate, becoming sulcate with age, finely pruinose, not viscid; margin straight, finely crenate or fringed. Lamellae adnate, pure white, thin, less than 0.5 mm wide, distant, with lamellulae of 1 length; edge finely torn under the lens, concolourous with the sides. Stipe 1.5–4 × 0.5–1 mm, central, terete, almost equal when young, becoming slightly tapering towards the apex, hollow; surface translucent, white, pubescent, more so towards the base, almost glabrous at the apex; base swollen, thin, with finely radiating basal mycelium. Context thin, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6–8.5 × 3–4 (7.28 ± 0.64 × 3.38 ± 0.40) µm, Q = 1.75–2.67, Q_m = 2.17, ellipsoid to pip-shaped, thin-walled, hyaline, smooth, with refractive guttules, strongly amyloid. Basidia 13–6 × 6–6.5 µm, clavate, hyaline, bearing 4 sterigmata, up to 2 µm long. Lamella-edge fertile. Cheilocystidia 8–11 × 3–5 µm, clavate, thin-walled, hyaline. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2–10 µm, thin-walled, hyaline, vinoid in Melzer's reagent; subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 11–20 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a subhymeniform layer of terminal acanthocysts of somewhat broad hyphae; hyphae 1.5–9.5 µm wide, thin-walled, with short, cylindrical excrescences (0.5–1.25 × 0.5 µm); acanthocysts 19–23 × 8–14.5 µm, versiform: clavate, obovoid, ellipsoid, subglobose or globose, often pedicellate, thin-walled, with short, cylindrical excrescences (0.5–1.25 × 0.5 µm). Universal veil formed of cherocytes, 24–81 × 14–29 µm, with thin-walled bulbous base with short, cylindrical or conical excrescences (0.5–1.25 × 0.25–1 µm) and a thick-walled (1.25–3.25 µm), spine-like projection at the top with conical, solid excrescences (1–2.5 × 1–1.5 µm) towards the apex. Stipitipellis a cutis of smooth hyphae with intercalary or terminal caulocystidia; hyphae 2.5–5.5 µm wide, thin-walled, hyaline. Caulocystidia 33–79 × 4–6 µm, aculeate, with short, conical excrescences (0.5–2 × 0.75–1 µm) confined up to the middle, with long, smooth apical part. Stipe trama strongly vinoid in Melzer's reagent. Clamp connections present on all hyphae, but very difficult to observe.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. May-September.

Additional collections examined:—INDIA. Kerala State: Palakkad District, Silent Valley National Park, 21 May 2009, *D.M. Aravindakshan DM237*; Kozhikode District, Koyilandy, Poyilkave, 24 September 2009, *D.M. Aravindakshan DM339*, K(M) 188297.

Notes:—Neither the key to worldwide species of sect. *Sacchariferae* (Desjardin 1995) nor the key to species of *Sacchariferae* of Parana, Brazil (Maas Geesteranus & de Meijer 1998) lead *M. delicata* to any described species. However, the first key indicates that *M. delicata* is somewhat close to *M. trichocephala* Singer, a Brazilian species, in having a white, granulose and pilose pileus

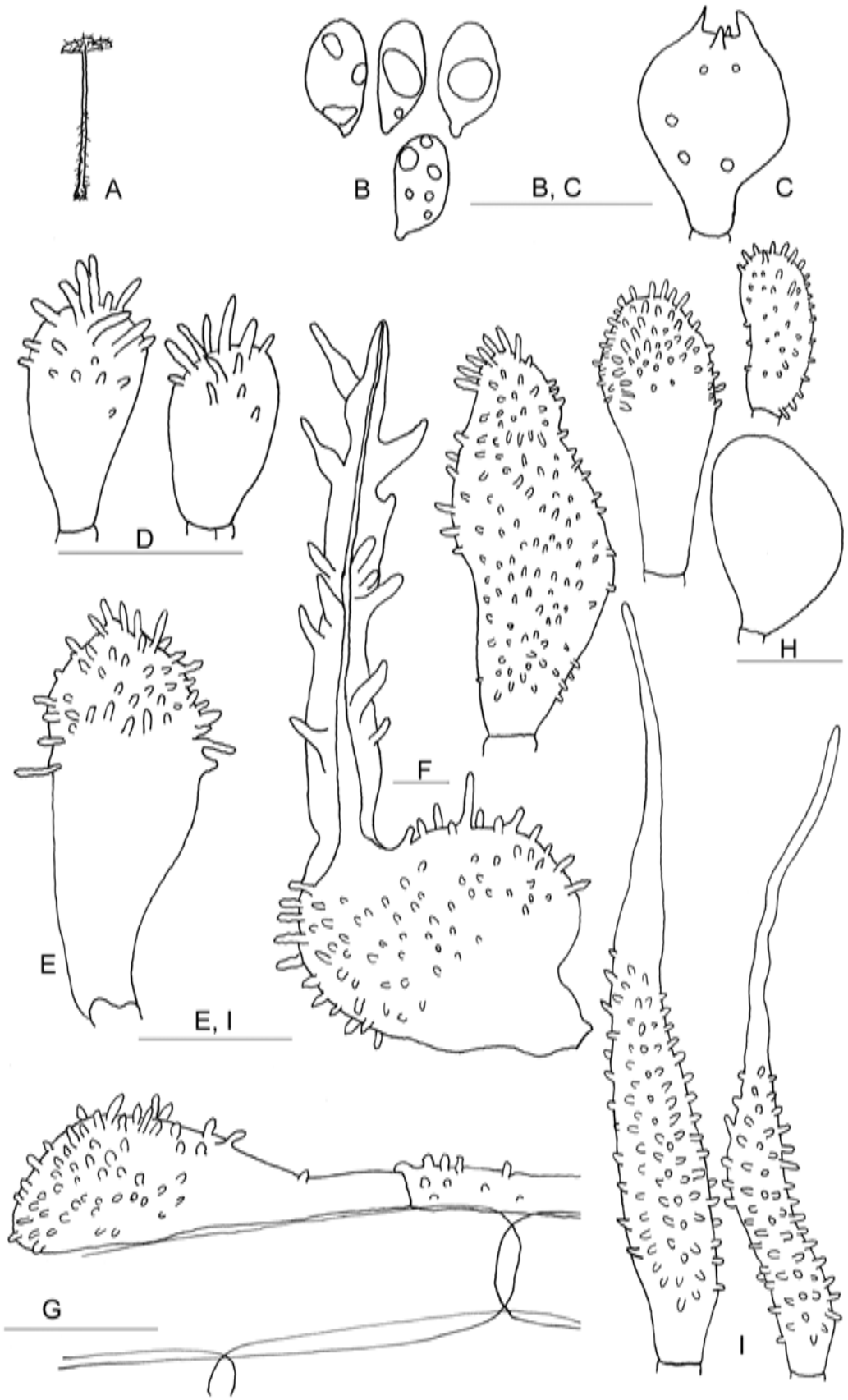


Figure 41. *Mycena delicata*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cell; F, cherocyte; G, hyphae of the pileipellis with acanthocyst; H, stipe basal cells; I, caulocystidia. Scale bars: A = 1 mm; B-I = 10 µm.

with sulcate margin and basidiomata growing on dicotyledonous leaves. But the Brazilian species differs in having a well-developed discoid stipe base, cherocytes with smooth spines, sparsely spinulose cheilocystidia and densely spinulose caulocystidia. Desjardin & Horak (2002) and Desjardin *et al*. (2002) transferred *M. trichocephala* to sect. *Longisetae* based on a re-evaluation of its protologue, morphology of the pileocystidia and micromorphological similarity to *M. tenuisetosa* Corner. The cherocyte morphology (i.e., thin-walled, bulbous base and thick-walled, spine-like projection with spinulae up to the apex) of *M. chloroxantha* var. *appalachienensis* Desjardin, a North American taxon, is similar to that of *M. delicata*. But in all other characters, that taxon is different.

Mycena sect. ***Sacchariferae*** stirps ***Alphitophora*** Desjardin, Bibliotheca Mycologica 159: 37 (1995).

Stipe arising from the substrate, not from a basal disc. Caulocystidia (or other terminal cells) densely spinulose overall. Cherocytes absent.

42. ***Mycena roseotincta*** Aravind. & Manim. *sp. nov*. Pl. 4 B; Fig. 42 A–H

MycoBank MB811098

Diagnosis:—Characterised by pale pinkish primordia; retention of the pink colour at the centre of the pileus in the mature basidiomata; subcylindrical, weakly amyloid basidiospores; a sterile lamella-edge; pink coloured detersile elements of the universal veil; and subglobose, clavate or cylindrical caulocystidia with excrescences. Differing from *M. incarnativelum* in having cheilocystidia and clamp connections on all hyphae.

Holotype:—INDIA. Kerala State, Malappuram District, Calicut University Campus: 20 October 2010, *D.M. Aravindakshan DM512*, K(M) 188298 (K!).

Etymology:—*roseotincta* (Latin), rose-tinted.

Basidiomata very small, delicate. Pileus 0.5–3 mm diam., up to 2 mm high, conic when young, becoming broadly conic or nearly campanulate to nearly applanate with age; surface entirely pale pinkish in primordium, becoming pale pinkish or brownish only on the disc with age, white elsewhere, translucent- to slightly sulcate-striate towards margin, pruinose; margin straight and crenate when young, becoming nearly plane and finely torn with age. Lamellae 8–10 reaching the stipe, free, pure white, 0.5 mm thick, subdistant, with lamellulae of 1–2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 8–28 × 0.25–0.5 mm, central, terete, almost equal when young, tapering towards apex with age, hollow; surface translucent, white, with short, stout hairs, more so towards base; base slightly broad, not discoid, pruinose. Context thin, not conspicuous. Odour and taste not distinctive.

Basidiospores 8–9.5 × 3.5–5 (8.78 ± 0.38 × 4.13 ± 0.36) µm, Q = 1.7–2.43, Q_m = 2.14, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, weakly amyloid. Basidia 12–13 × 7.5–9 µm, clavate or obovoid, often with a short pedicel, bearing 4 sterigmata up to 2.5 µm long. Lamella-edge sterile. Cheilocystidia 11–30 × 5.5–17 µm, clavate, cylindrical or sphaero-pedunculate, thin-walled, hyaline, with short, cylindrical or conical excrescences (0.5–2 × 0.5–1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 10–21 µm wide, thin-walled, hyaline, vinoid in

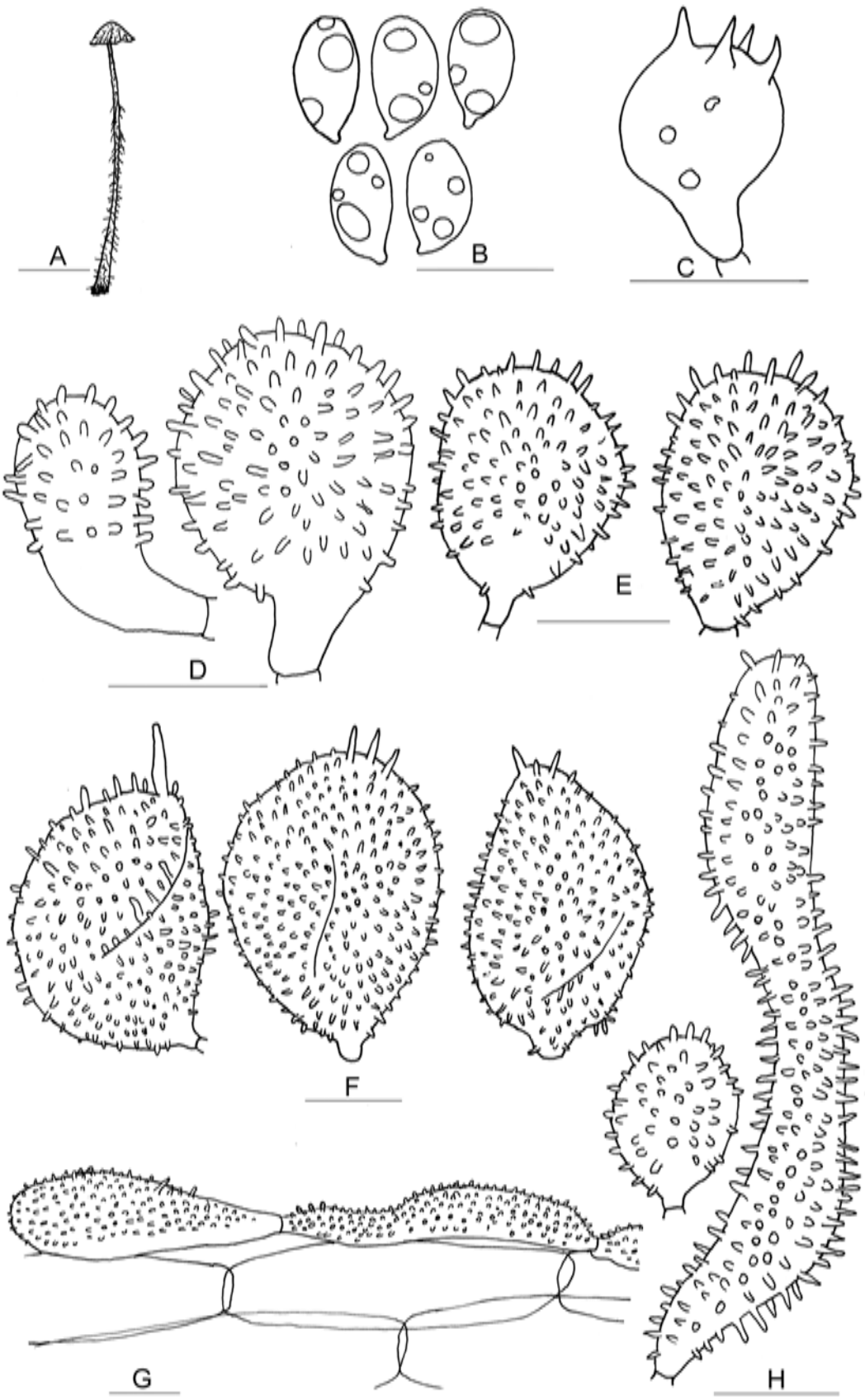


Figure 42. *Mycena roseotincta*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cell; F, universal veil acanthocysts; G, hyphae of the pileipellis with terminal acanthocyst; H, caulocystidia. Scale bars: A = 10 mm; B-H = 10 µm.

Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 7–23 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis overlaid by elements of universal veil; hyphae 1.5–8.5 µm wide, thin-walled, hyaline, with short, cylindrical excrescences (0.5–2 × 0.5–1 µm); terminal cells modified as acanthocysts, 9–38 × 7–20.5 µm, clavate, subglobose, obovoid or sphaero-pedunculate, often pedicellate, thin-walled, with short, cylindrical excrescences (0.5–1.5 × 0.5 µm). Universal veil composed of detersile acanthocysts, seen both on pileal surface and stipe base 19–36.5 (41) × 14–34 µm, ellipsoid to subglobose or obovoid or cylindrical (on stipe base), thin- to thick-walled (0.25–0.5 µm), with pinkish contents which is easily washed-off with water, with cylindrical or conical excrescences (0.5–10 × 0.5–2 µm), often attached to short, 1.5 µm wide, thin-walled, hyaline hyphae. Pileus marginal cells 19–30 × 11–14.5 µm, clavate or sphaero-pedunculate or obovoid, thin-walled, hyaline, with short, cylindrical excrescences (0.5–3.5 × 0.5–1 µm). Stipitipellis a cutis; hyphae 1.5–4 µm wide, thin-walled, hyaline, smooth. Caulocystidia 12.5–125 × 4.5–13 µm, cylindrical, clavate or rarely subglobose, thin-walled, hyaline, with short, cylindrical excrescences (0.5–2 (8.5) × 0.5–1 (1.5) µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying *Acacia* fruits and various leaves. October-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 11 November 2009, *D.M. Aravindakshan DM348*; 26 November 2010, *D.M. Aravindakshan DM512a*.

Notes:—The key to the stirpes of sect. *Sacchariferae* (Maas Geesteranus & de Meijer 1998) leads *M. roseotincta* to stirps *Alphitophora* due to the presence of densely spinulose caulocystidia, acanthocysts with pinkish contents and in the absence of cherocytes. The key to the species of sect. *Sacchariferae* (Desjardin 1995) leads it to *M. incarnativelum* Desjardin, since it is the only *Mycena* so far reported in sect. *Sacchariferae* with pink coloured primordia or pileus granules.

Mycena incarnativelum, a Hawaiian species, is strikingly similar to the present species in having similar-sized basidiomata, a pileus that retain the pink tints of the primordium only on the disc when mature, lamellae that do not form a pseudocollarium, a non-discoid stipe base, similar-sized basidiospores, pink contents of the acanthocysts that dissolves in water, similar-sized spinulae over the acanthocysts and similar caulocystidia. But that species has no cheilocystidia. Also, in that species, clamp connections are restricted to the base of basidia.

43. ***Mycena globispora*** (Manim. & Leelav.) Aravind. & Manim. *comb. et stat. nov*. Pl. 4 C; Fig. 43 A–H

MycoBank MB811200

Basionym:—*Mycena alphitophora* var. *globispora* Manim. & Leelav., Mycological Research 93 (1): 119 (1989).

Holotype:—INDIA. Kerala State: Palakkad District, Tarur, 27 June 1988, *P. Manimohan M429*, (K!).

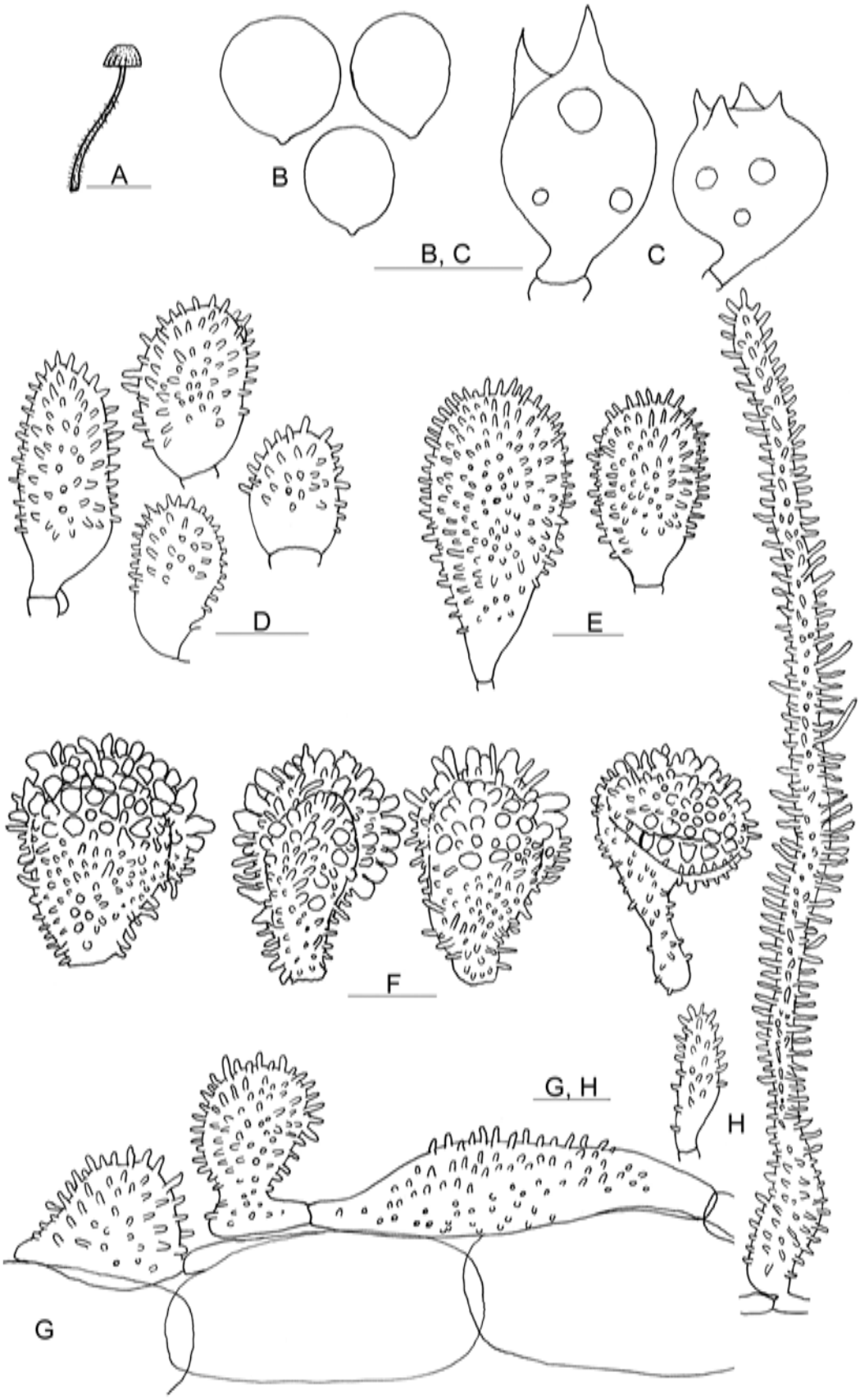


Figure 43. *Mycena globispora*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, detersile acanthocysts; G, hyphae of the pileipellis with terminal acanthocysts; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

Basidiomata very small, delicate. Pileus 1–3 mm diam., 1–2.5 mm high, conic or parabolic when young, becoming hemispheric or convex with age; surface pure white, finely pruinose to granular all over, translucent-striate, becoming nearly sulcate striate; margin straight and finely crenate when young, becoming slightly upturned and finely torn with age. Lamellae 13–15 (20) reaching the stipe, free, adnexed or narrowly adnate, pure white, up to 0.5 mm thick, subdistant, with lamellulae of one length; edge finely torn, concolourous with the sides. Stipe 1–17 × 0.25–0.5 mm, central, terete, almost equal or slightly tapering to apex, hollow; surface translucent, white, with short, white, erect hairs; base slightly broad, pruinose. Context not conspicuous. Odour not distinctive.

Basidiospores (6) 7–9 (9.5) × 6–7.5 (8.18 ± 0.65 × 6.71 ± 0.65) µm, Q = 1.07–1.42, Q_m = 1.22, globose to subglobose, thin-walled, hyaline, smooth, strongly amyloid, with a few guttules. Basidia 9–17.5 × 7–9 µm, obovoid to clavate, bearing 1–4 (mostly 2) sterigmata up to 5 µm long. Cheilocystidia 10.5–29.5 (36) × 7–19 µm, versiform: ellipsoid or obovoid or clavate or fusoid or broadly cylindrical, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 (3) × 0.5–1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2–21 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. Pileus trama subregular; hyphae 3–25 µm wide, thin-walled, hyaline vinoid in Melzer's reagent. Pileipellis a cutis overlaid by a universal veil composed of acanthocysts ; hyphae 2–17 µm wide, thin-walled, hyaline, with short, cylindrical excrescences (0.5–2.5 × 0.5–1 µm), with acanthocyst terminal elements 8.5–36 (47.5) × 8–25 µm, clavate or broadly clavate or subglobose or ovoid, thin-walled, hyaline, with short, cylindrical excrescences (0.5–2.5 (4.5) × 0.5–1 µm). Universal veil formed of detersile acanthocysts, seen both on pileal surface and stipe base, 15–40 × 8.5–30 µm, ellipsoid, broadly clavate or obovoid or nearly broadly utriform, thick-walled (up to 3 µm) towards the apex, hyaline, with short, coarse, cylindrical excrescences (0.5–4 × 0.5–3 µm). Pileus marginal cells 16.5–60 × 7–24 µm, clavate, ellipsoid or obovoid, with short, cylindrical excrescences (0.5–2 × 0.5–1 µm). Stipitipellis a cutis of smooth hyphae with terminal or lateral caulocystidia; hyphae 1–7.5 µm wide, thin-walled, hyaline. Caulocystidia 12–157 × 3.5–8 µm, clavate (mostly towards the stipe apex), cylindrical (mostly towards the stipe base) and with longest excrescences at the middle, thin- to slightly (0.5 µm) thick-walled, with cylindrical excrescences (0.5–5 × 0.5–1.25 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on the bark of *Anacardium occidentale* and on decaying twigs. June-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 12 June 2007, *D.M. Aravindakshan DM116*; 2 July 2009, *D.M. Aravindakshan DM284*, K(M) 188299; 17 November 2009, *D.M. Aravindakshan DM362*, *D.M. Aravindakshan* DM363; 27 November 2010, *D.M. Aravindakshan* DM521, K(M) 188300; Thrissur District, Peechi Forest, 7 July 2010, *D.M. Aravindakshan DM454*.

Notes:—This taxon was originally described as *M. alphitophora* var. *globispora* (Manimohan & Leelavathy 1989). A universal veil composed of acanthocysts that are thick-walled and with broader excrescences towards the apex, and present both over the pileus and at the stipe base; globose to subglobose and amyloid basidiospores; one to four-spored basidia; clavate and often

pedicellate cheilocystidia; and cylindrical caulocystidia with longest excrescences at the middle region are the unique features of *M. globispora*. Although Manimohan & Leelavathy (1989) treated it as a variety of *M. alphitophora*, a reassessment of its characters mentioned above supports elevation of the taxon to species level. Absence of both a discoid stipe base and cherocytes and presence of entirely spinulose caulocystidia indicate that it belongs to stirps *Alphitophora* of sect. *Sacchariferae*, where it is closely allied to *M. alphitophora*. *Mycena alphitophora,* however, has a greyish pileus, ellipsoid basidiospores, 4-spored basidia and caulocystidia with the longest excrescences at the tip.

Mycena yalensis Singer and *M. corynephora* Maas Geest. are the two species of sect. *Sacchariferae* stirps *Alphitophora* possessing globose to subglobose basidiospores. *Mycena yalensis* differs from *M. globispora* in having adnexed lamellae, larger, clavate and 4-spored basidia, clavate or sphaero-pedunculate cheilocystidia, and broadly clavate to vesiculose cells at the stipe base with sparse spinulae. Characters such as a campanulate pileus, broadly adnate to subdecurrent lamellae, larger, clavate, and 4-spored basidia, and much smaller caulocystidia make *M. corynephora* a different species.

44. ***Mycena distincta*** (Manim. & Leelav.) Aravind. & Manim. *comb. et. stat. nov*. Pl. 4 D; Fig. 44 A–H

MycoBank MB811199

Basionym:—*Mycena alphitophora* var. *distincta* Manim. & Leelav., Mycological Research 93 (1): 118 (1989).

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 26 July 1985, *P. Manimohan M189*, (K!).

Basidiomata very small, delicate. Pileus 2–6 mm diam., 2–3 mm high, conic or parabolic when young, becoming campanulate with age; surface pure white, initially densely pruinose or granulose all over, remaining so only at the disc with age, translucent-striate; margin straight and entire when young, becoming nearly plane or upturned and finely fissile with age. Lamellae 13–17 reaching the stipe, free, adnexed, or narrowly adnate, pure white, up to 0.5 mm thick, subdistant, with lamellulae of 1–2 lengths; edge densely pruinose under a lens, concolourous with the sides. Stipe 15–40 × 0.5–1 mm, central, terete, slightly compressed at the base, almost equal or tapering towards the apex, hollow; surface translucent, white, densely covered with fine, white, hairs; base slightly broader, not discoid, pruinose. Context not conspicuous. Odour not distinctive.

Basidiospores 7–9 × 3–4 (8.18 ± 0.63 × 3.5 ± 0.28) µm, Q = 1.07–1.42, Q_m = 1.22, ellipsoid to subcylindrical, thin-walled, hyaline, smooth, strongly amyloid, with a few guttules. Basidia 12–20 × 6–9 µm, clavate to obovoid, bearing 4 sterigmata up to 4 µm long. Cheilocystidia 10.5–29.5 × 7–16 µm, versiform: oblong or clavate, thin-walled, hyaline, with short, cylindrical excrescences (0.5–3 × 0.5–1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2–19 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 3–17.5 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis overlaid by elements of universal veil; hyphae 2–17 µm wide, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1 × 0.5–1 µm); acanthocyst terminal cells, 7–50 × 4–30 µm,

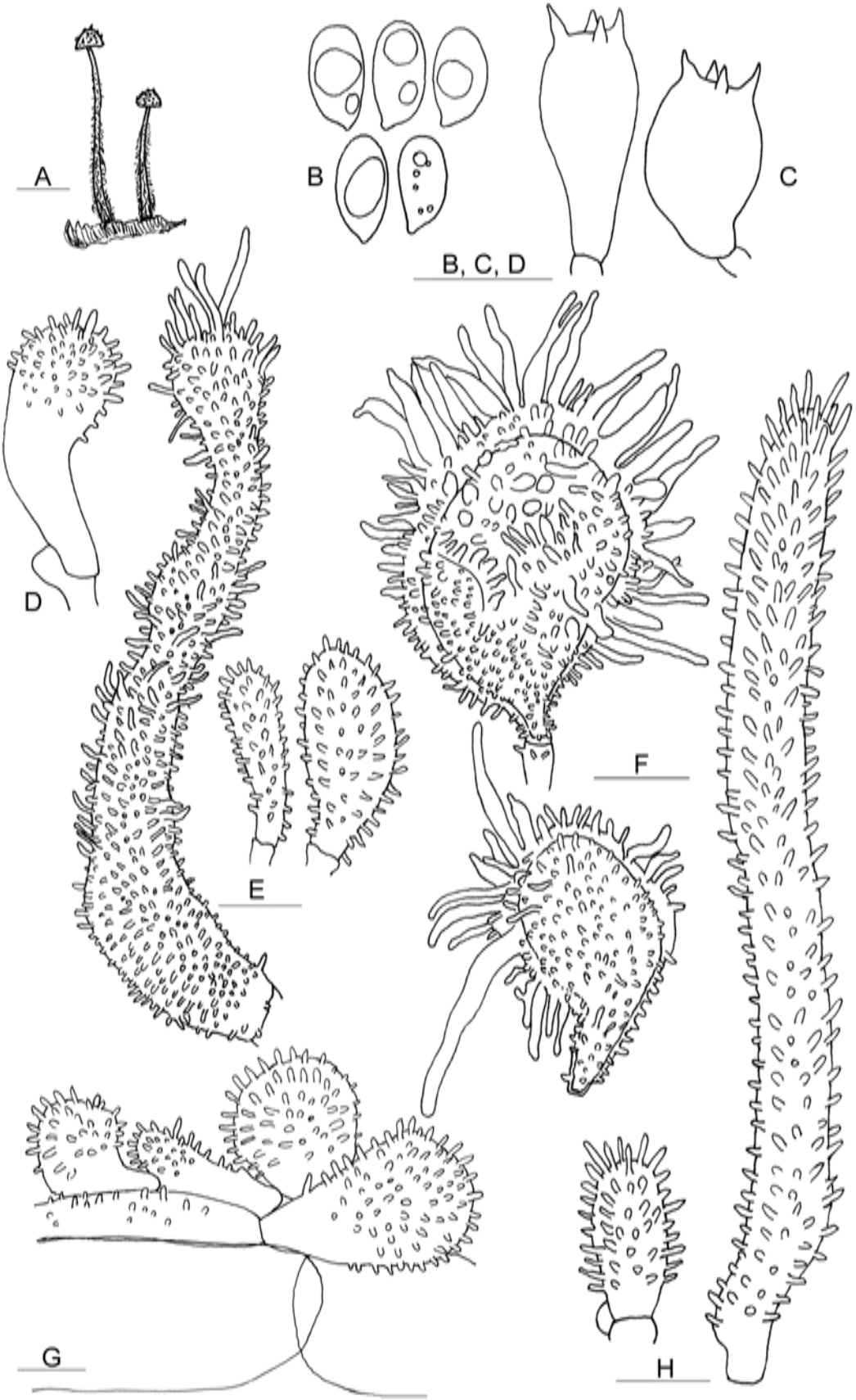


Figure 44. *Mycena distincta*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidium; E, pileus marginal cells; F, universal veil acanthocyst cells; G, hyphae of the pileipellis with acanthocyst terminal cells; H, caulocystidia. Scale bars: A = 1 cm; B-H = 10 µm.

clavate or subglobose or ovoid, with or without a pedicel, thin-walled, hyaline, with short, cylindrical excrescences (0.5–4 × 0.5–1 µm). Universal veil composed of acanthocysts, seen both on pileal surface and stipe base, 17.5–77.5 × 14–37.5 µm, versiform: globose or subglobose, clavate or ellipsoid, thick-walled (up to 2 µm) towards the apex, hyaline, with short, cylindrical excrescences (0.5–4 × 0.5–1 µm) or long and flexuous spinules (11–24 (34) × 1–2.5 µm), arising from narrow hyphae, 1.5–7 µm wide, thin- to slightly (0.5–2.5 µm) thick-walled, hyaline. Pileus marginal cells 11–40.5 × 5.5–16 µm, clavate or obovoid or sphaero-pedunculate or rarely cylindrical, with short, cylindrical excrescences (0.5–2 × 0.5–1 µm). Stipitipellis a cutis of smooth hyphae with terminal or lateral caulocystidia; hyphae 1–6 µm wide, thin-walled, hyaline. Caulocystidia 24–282.5 × 7.5–15.5 µm, clavate (mostly towards the apex) or cylindrical (mostly towards the base), thin- to slightly (0.5–1 µm) thick-walled, with short excrescences all over and long and flexuous spinules (0.5–8 × 0.5–1.25 µm) at the apex. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying twigs and leaves. May-August, October-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 25 June 2009, *D.M. Aravindakshan DM238*; 12 November 2009, *D.M. Aravindakshan DM351*; 20 October 2010, *D.M. Aravindakshan DM510*, K(M) 188302; 26 November 2010, *D.M. Aravindakshan DM513*, K(M) 188301; Kannur District, Neeliyar Kottam: 17 June 2009, *D.M. Aravindakshan DM269*.

Notes:—This taxon was originally described as *M. alphitophora* var. *distincta* (Manimohan & Leelavathy 1989). It is characterised by a combination of characters such as pure white basidiomata; a pileus with noticeable granulosity; a universal veil composed of clusters of slightly (up to 2.5 µm) thick-walled acanthocysts with numerous long and flexuous protrusions (up to 34 µm long), mostly at the apex in addition to the normal, short, cylindrical excrescences; and versiform pileus marginal cells. Here we elevate it to the species level as it is different from *M. alphitophora* in more than one feature, i.e., the granulose pileus surface formed of chains of slightly thick-walled acanthocysts with much elongated excrescences and versiform pileus marginal cells.

In the stirps *Alphitophora*, *M. distincta* can be placed close to *M. brunneospinosa* Desjardin, a Hawaiian species, since the latter has detersile, conic spines over the pileus that are made of clusters of acanthocysts with long (up to 12 µm), flexuous protrusions and caulocystidia like acanthocysts on the pileus margin. But *M. brunneospinosa* differs in having brown spines over the pileus, larger and broader basidiospores, somewhat larger and broader, cylindrical cheilocystidia, and somewhat shorter caulocystidia, and in lacking clamp connections in all tissues.

45. ***Mycena alphitophora*** (Berk.) Sacc., Sylloge Fungorum 5: 290 (1887). Pl. 4 E; Fig. 45 A–I

≡ *Agaricus alphitophorus* Berk., Journal of the Linnean Society of London, Botany 15 (82): 48 (1876).

≡ *Prunulus alphitophorus* (Berk.) Murrill., North American Flora. 9 (5): 339 (1916b).

= *Mycena microstena* Singer, Fieldiana Botany 21: 81 (1989).

= *Mycena osmundicola* J.E. Lange, Dansk Botanisk Arkiv Udgivet Af Dansk Botanisk Forening 1 (5): 35 (1914).

= *Mycena farinosa* Petch, Annals of the Royal Botanic Gardens Peradeniya 10 (1): 131 (1926).

Basidiomata very small, delicate. Pileus 4–7 mm diam., 3–4 mm high, conic when young, becoming nearly applanate with age; surface pure white all over, translucent-striate, pruinose; margin straight and entire when young, becoming nearly plane and finally fissile. Lamellae up to 15 reaching the stipe, free to narrowly adnate, pure white, 0.5 mm thick, subdistant, with lamellulae of 2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 13–22 × 0.5–1 mm, central, terete, tapering towards apex with age, hollow; surface translucent, white, finely pruinose at apex, pubescent towards base; base slightly swollen, pruinose, with scanty basal mycelium. Context not conspicuous. Odour and taste not distinctive.

Basidiospores 6–8 × 4–5 (7.43 ± 0.55 × 4.3 ± 0.34) µm, Q = 1.5–1.88, Q_m = 1.73, oblong, ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia 10–16 × 5–7.5 µm, obovoid or ellipsoid, bearing 4 sterigmata up to 4 µm long. Lamella-edge sterile. Cheilocystidia 14–23.5 × 4.5–13 µm, clavate, obovoid or sphaero-pedunculate, thin- to slightly (0.5 µm) thick-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 3–23 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 7–39 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis overlaid by elements of universal veil; hyphae 1.5–4 µm wide, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm); terminal elements modified as acanthocysts 7–32 × 4.5–31.5 µm, globose to subglobose or ellipsoid, thin-walled, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Universal veil composed of detersile acanthocysts 25–69.5 × 18–40 µm, clavate, subglobose or ellipsoid, thin- to thick-walled (0.5–1 µm) towards the apex, hyaline, with excrescences (0.5–9 (12) × 0.5–2 µm), often seen attached to short hyphae 2–3 µm wide, thin- to very slightly (0.25 µm) thick-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Pileus marginal cells 10–28.5 × 6–14.5 µm clavate or sphaero-pedunculate, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1.5 × 0.5–1 µm). Stipitipellis a cutis; hyphae 1.5–5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 21–338^{+} × 8.5–11.5 µm, clavate at stipe apex, cylindrical towards stipe base, thin- to slightly (0.5–1.5 µm) thick-walled, with short, conical excrescences (0.5–6 × 0.5–1.5 µm) of which those at the apex are slightly longer. Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. June.

Collection examined:—INDIA. Kerala State: Palakkad District, Silent Valley National park, 16 June 2010, *D.M. Aravindakshan DM409*, K(M) 191766.

Notes:—*Mycena alphitophora* is a widely distributed species recorded from North America, South America, Europe, Africa, Sri Lanka, Japan, the Caribbean Islands and the Hawaiian Islands. The Kerala collection is similar to the collections of *M. alphitophora* from Sri Lanka (Pegler 1986) in having almost similar-sized basidiospores (7–9 × 3.5–4.5 µm), basidia (13–15 × 6–8 µm) and

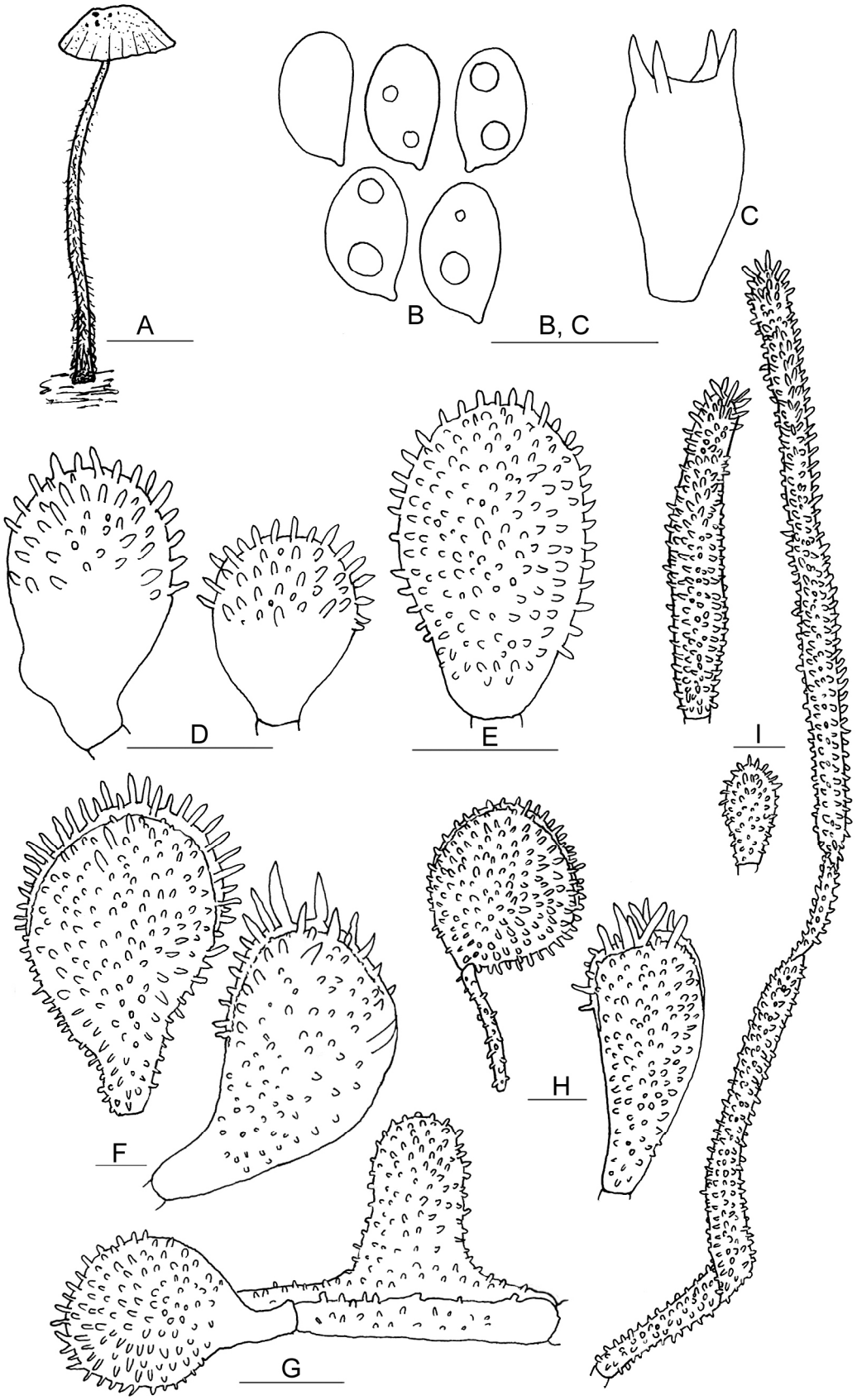


Figure 45. *Mycena alphitophora*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cell; F, universal veil acanthocyst cells; G, hyphae of the pileipellis with terminal acanthocyst; H, stipe basal cells; I, caulocystidia. Scale bars: A = 5 mm; B-I = 10 µm.

cheilocystidia (18–30 × 8–13 µm). The Kerala collection however, has somewhat smaller detersile elements (up to 35 µm long) of the pileal surface and caulocystidia (up to 150 µm long). Maas Geesteranus's (1992b) description of *M. alphitophora* is much similar to that of the present collection except for the comparatively longer basidiospores (8.1–9.7 × 4.5–5.5 µm), clavate to fusiform cheilocystidia (23–31 × 8–14 µm), and much larger basidia (22.5 × 7–10 µm) recorded by him.

Mycena sect**. *Sacchariferae*** stirps ***Adscendens*** Desjardin, Bibliotheca Mycologica 159: 53 (1995).

Stipe arising from a well-developed basal disc. Caulocystidia entirely smooth (non-spinulose) or only partially spinulose, never densely spinulose overall. Cherocytes absent.

46. ***Mycena furfuracea*** Aravind. & Manim. *sp. nov*. Pl. 4 F; Fig. 46 A–H

MycoBank MB811099

Diagnosis:—Characterised by a pale greyish to whitish pileus covered with white, bran-like particles; a discoid stipe base; a heterogeneous lamella-edge; a universal veil formed of detersile acanthocysts with excrescences; and smooth caulocystidia with a gradually tapering apex. Differing from *M. triplotricha* in having narrower basidiospores; shorter, subglobose basidia; and differently shaped stipe basal cells.

Holotype:—INDIA. Kerala State: Thrissur District, Peechi Forest Area, 6 October 2009, *D.M. Aravindakshan DM338*, K(M) 188303 (K!).

Etymology:—*furfuracea* (Latin), scurfy.

Basidiomata very small, delicate. Pileus 0.5–3.5 mm diam., 2 mm high, conico-convex, hemispheric or campanulate; surface whitish or pale greyish with scattered, white, bran-like flakes, that are more at the disc, translucent- to nearly sulcate-striate; margin straight, entire when young, becoming plane, finely torn with age. Lamellae up to 15 reaching the stipe, free or narrowly adnate, pure white, 0.5 mm thick, subdistant, with lamellulae of one length; edge finely torn under a lens, concolourous with the sides. Stipe 0.5–25 × 0.25–1 mm, central, terete, tapering towards apex, hollow; surface translucent, white, pubescent; base discoid, pruinose. Context not conspicuous. Odour and taste not noted.

Basidiospores 7.5–8.5 × 3.75–4.75 (7.94 ± 0.32 × 4.13 ± 0.30) µm, Q = 1.56–2.2, Q_m = 1.93, oblong-ellipsoid, thin-walled, hyaline, smooth, strongly amyloid. Basidia 9–11 × 6.5–9 µm, ovoid to subglobose, bearing 4 sterigmata up to 2 µm long. Lamella-edge fertile. Cheilocystidia crowded, 8–23 × 3.5–15 µm, clavate or cylindrical, thin-walled, hyaline, with short, conical excrescences (0.5–2 × 0.5–0.75 µm) restricted to the upper half. Pleurocystidia none. Lamellar trama regular to subregular; hyphae 4–31 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 7–23.5 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 2–11.5 µm wide, thin-walled, hyaline, with short, conical or cylindrical excrescences (0.5–1 × 0.25–0.5 µm) with acanthocyst terminal cells; acanthocyst terminal cells 20–40 × 12–29 µm, clavate or subglobose or sphaero-pedunculate, often pedicellate, thin-walled, with short, conical or cylindrical excrescences

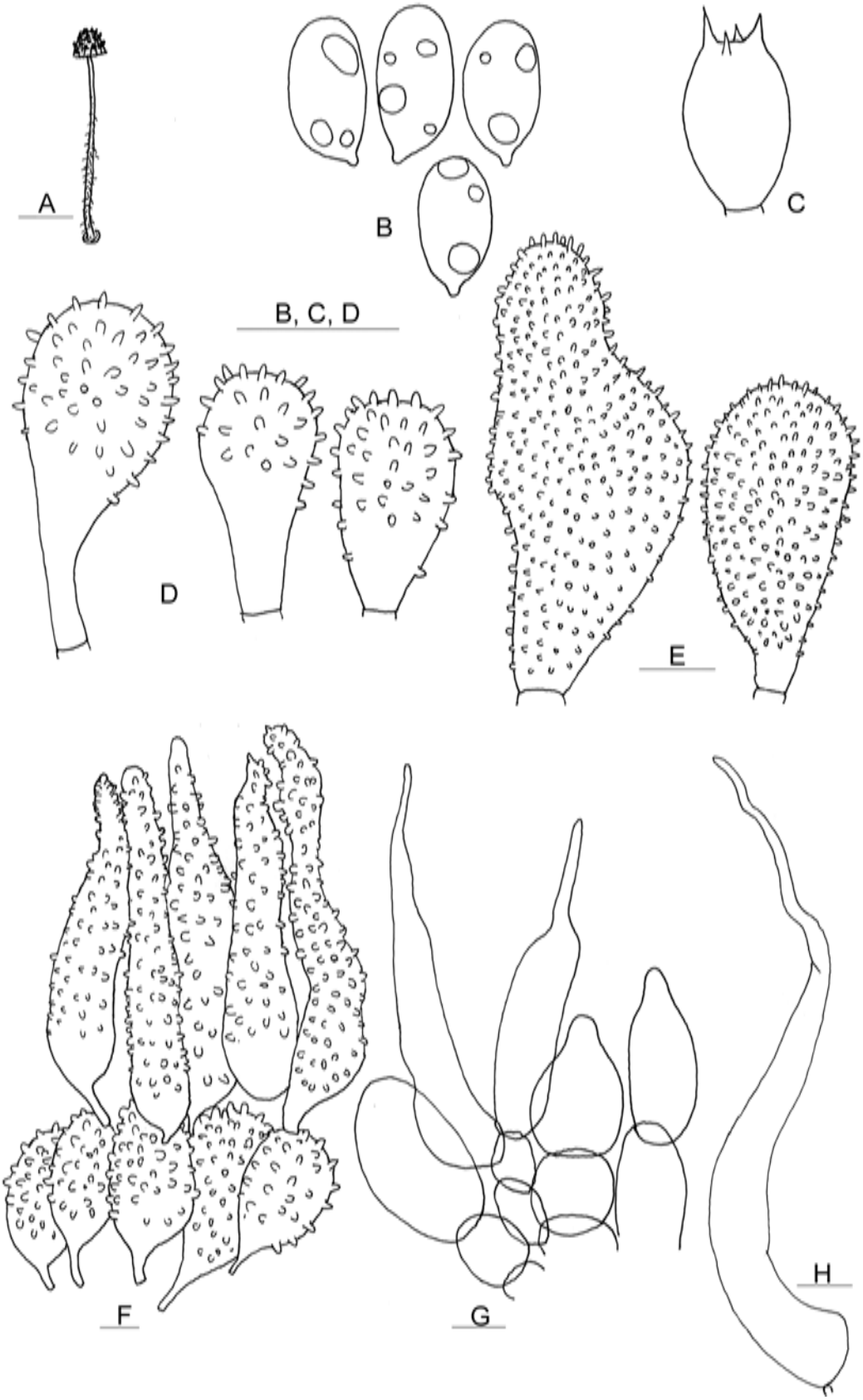


Figure 46. *Mycena furfuracea*: A, basidioma; B, basidiospores; C, basidium; D, cheilocystidia; E, pileus marginal cells; F, universal veil acanthocysts; G, stipe basal cells; H, caulocystidium. Scale bars: A = 5 mm; B-H = 10 µm.

(0.5–2.5 × 0.5–1 µm). Universal veil composed of detersile acanthocysts of two types: one type 14–23.5 × 9.5–20 µm, clavate to ovoid or obovoid, thin- to slightly (0.5 µm) thick-walled, hyaline, with short, conical or coarse excrescences (0.5–4 × 0.5–2 µm); other type 30–100 × 12–21 µm, utriform or fusoid, thin- to slightly thick-walled (0.5 µm), hyaline, with short, conical or coarse excrescences (0.5–4 × 0.5–2 µm). Pileus marginal cells 20.5–57 × 9.5–25 µm, clavate or subglobose or fusoid, thin-walled, with short, conical or cylindrical excrescences (0.5–1.5 × 0.5–0.75 µm). Stipitipellis a cutis; hyphae 2–5 µm wide, thin-walled, hyaline, smooth. Caulocystidia 30–208 × 13–19.5 µm, with a swollen base and a long and gradually tapering apical part, thin-walled, hyaline, smooth. Stipe basal cells 25–185 × 7.5–18.75 µm, utriform or broadly utriform, fusiform or cylindrical with an apical protrusion (up to 11.25 µm long) or similar to caulocystidia, thin-walled, hyaline, smooth. Stipe trama dextrinoid to very faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on decaying bark and leaves. August-October.

Additional collection examined:—INDIA. Kerala State: Idukki District, Anamudi Shola Forest, 14 August 2010, *D.M. Aravindakshan DM463*, K(M) 188304.

Notes:—Characters such as the furfuraceous pileus with detersile acanthocysts, the amyloid basidiospores, the presence of smooth caulocystidia and the absence of cherocytes place the present species in stirps *Adscendens* of sect. *Sacchariferae* (Maas Geesteranus & de Meijer 1998). The key to the worldwide members of sect. *Sacchariferae* (Desjardin 1995) leads *M. furfuracea* close to *M. triplotricha* Singer. But *M. triplotricha* has slightly broader basidiospores, much longer, clavate basidia, and lanceolate stipe basal cells that are sometimes beset with apical spinulae. *Mycena hawaiiensis* also has similar large-sized acanthocyst cells. But that species has much smaller basidiomata, a papillate pileus, much larger, 2-spored basidia, much smaller caulocystidia, lanceolate stipe basal cells often with apical spinulae, and a pileus surface devoid of detersile acanthocysts.

47. ***Mycena apala*** Aravind. & Manim. *sp. nov*. Pl. 4 G; Fig. 47 A–I

MycoBank MB811100

Diagnosis:—Characterised by a foliicolous habitat; a pale greyish pileus overlaid with easily removable white, sugar-like granules; pyriform or utriform acanthocysts; and versiform stipe basal cells with sparse, apical excrescences. Differing from *M. triplotricha* in having larger basidiomata, smaller acanthocysts, and dissimilar caulocystidia and stipe basal cells.

Holotype:—INDIA. Kerala State: Kozhikode District, Cheruvannur, 9 August 2010, *D.M. Aravindakshan DM458*, K(M)188305 (K!).

Etymology:—*apala* (Latin), tender.

Basidiomata very small and delicate. Pileus 0.5–3 mm diam., up to 2.5 mm high, conico-parabolic when young, becoming broadly conic to campanulate with age; surface pale greyish at the centre, white elsewhere, translucent-striate, coated with fine, white, sugar-like granules; margin straight

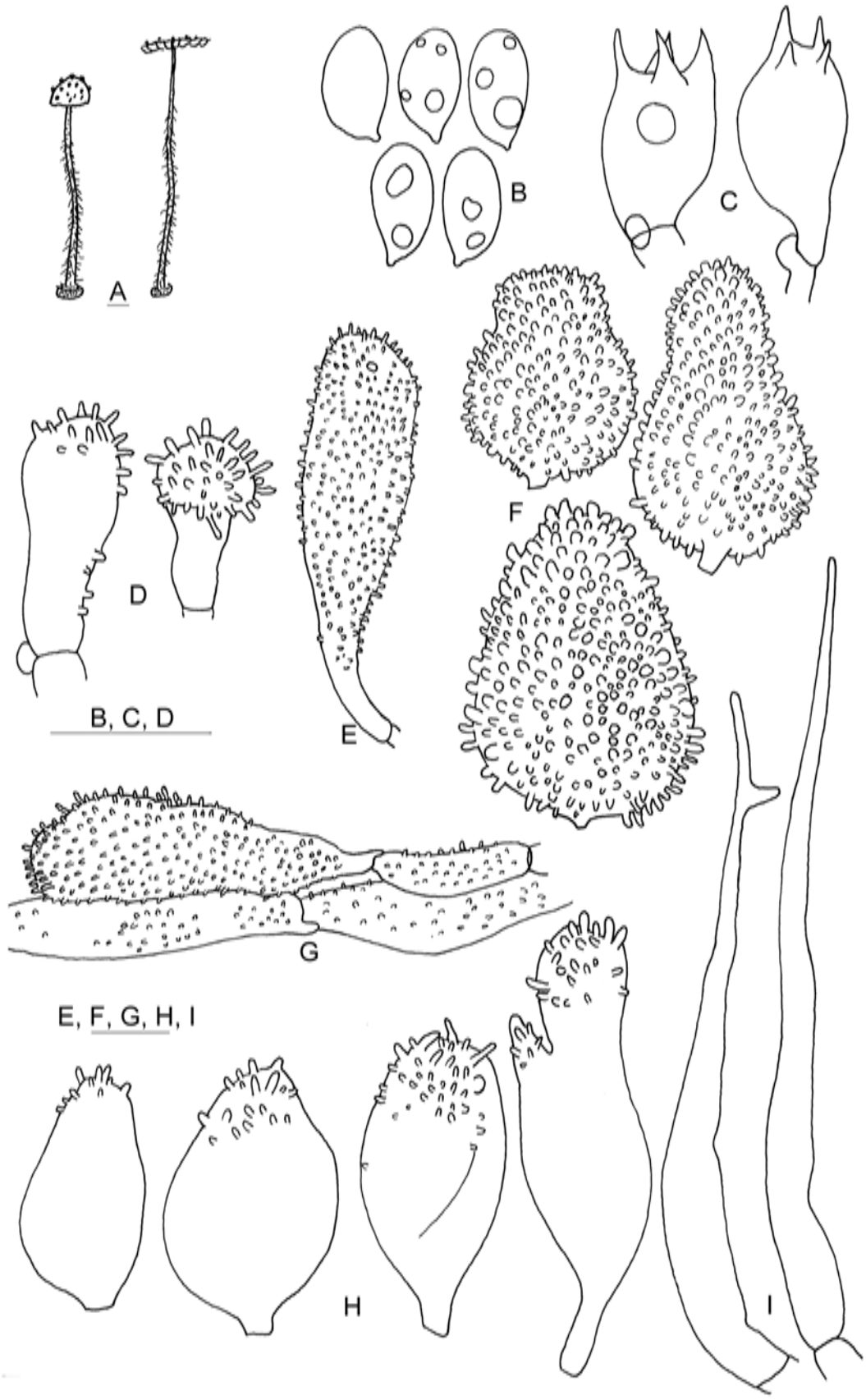


Figure 47. *Mycena apala*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, universal veil acanthocysts; G, hyphae of the pileipellis with terminal acanthocyst; H, stipe basal cells; I, caulocystidia. Scale bars: A = 1 mm; B-I = 10 µm.

and finely torn. Lamellae 10–13 reaching the stipe, free or adnexed, pure white, 0.5 mm thick, subdistant, with lamellulae of one length; edge finely torn under a lens, concolourous with the sides. Stipe 3–30 × 0.25–0.5 mm, central, terete, almost equal when young, tapering towards the apex with age, hollow; surface translucent, with fine, white hairs, more so towards the base; base discoid, pruinose. Context thin, not conspicuous. Odour and taste not distinctive.

Basidiospores (5.25) 6–8 (9.5) × 3.5–4 (7.78 ± 0.38 × 3.73 ± 0.36) µm, Q = 1.7–2.43, Q_m = 2.14, oblong-ellipsoid, thin-walled, hyaline, smooth, amyloid. Basidia (7.5) 11–16.5 × (6.5) 7–11 µm, clavate or obovoid, often with a short pedicel, bearing 4 sterigmata up to 2.5 µm long. Lamella-edge sterile. Cheilocystidia 11–29 (36) × 5–11.5 (13) µm, clavate or cylindrical, thin-walled, hyaline, with short, cylindrical or conical, apical excrescences (0.5–2 × 0.5–1 µm). pleurocystidia none. lamellar trama regular to subregular; hyphae 2.5–23.5 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. Subhymenium ramose. pileus trama subregular; hyphae 3.5–21 µm wide, thin-walled, hyaline, vinoid in Melzer's reagent. pileipellis a cutis overlaid by elements of universal veil; hyphae 2–11 µm wide, thin-walled, hyaline, with short, cylindrical excrescences (0.5–1 × 0.5–1 µm); terminal cells modified as acanthocysts, 26.5–48.5 × 9.5–19 µm, clavate or subglobose or obovoid or sphaero-pedunculate, often pedicellate, thin-walled, with short, conical excrescences (0.5–1.5 × 0.5 µm). universal veil composed of detersile acanthocysts, 26.5–52.5 × 21.5–40 µm, pyriform, utriform or clavate, thin-walled, with cylindrical or coarse excrescences (0.5–3.5 × 0.5–2.5 µm), often interconnected by thick-walled (0.5–1 µm), hyaline hyphae 1.5–7 µm wide. Pileus marginal cells 17.5–45 × 11–22 µm, clavate, ellipsoid, subglobose or obovoid, thin-walled, hyaline, with short, cylindrical excrescences (0.5–3.5 × 0.5–1 µm). stipitipellis a cutis; hyphae 1.5–8 µm wide, thin-walled, hyaline, smooth. caulocystidia 21.5–201 × 4–13.5 (20) µm, sinuoso-cylindrical at the base, gradually tapering to a pointed apex, thin-walled, hyaline, smooth, very rarely with smooth protrusion (branching) at the apex. Stipe basal cells 22–68.5 × 10–25 µm, subutriform, fusiform or ellipsoid or obovoid, thin- to thick-walled (0.5–1 µm), hyaline, with apical, cylindrical excrescences (0.25–2.5 × 0.5–1 µm). stipe trama vinoid in Melzer's reagent. clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered, on decaying leaves. July- September.

Additional collections examined:—INDIA. Kerala State: Kozhikode District, Cheruvannur, 1 August 2007, *D.M. Aravindakshan DM190*; Malappuram District, Calicut University Campus, 4 September 2007, *D.M. Aravindakshan DM209*; Palakkad District, Ottappalam, Pozhathil Mana, 8 July 2010, *D.M. Aravindakshan DM453*, *D.M. Aravindakshan DM455*.

Notes:—The absence of cherocytes on both the primordium and the pileus and the presence of smooth caulocystidia indicate that the present species belongs to stirps *Adscendens* of sect. *Sacchariferae*.

The key to the worldwide species of sect. *Sacchariferae* (Desjardin 1995) leads *M. apala* to *M. triplotricha* owing to its 4-spored basidia, very long caulocystidia that lack spinulae over the entire length, cystidia of basal disc often with scattered apical spinulae, and white or pale-coloured basal disc. But *M. triplotricha* differs from *M. apala* in having smaller basidiomata (stipe up to 16 mm long) that grow on woody dicotyledonous debris, a papillate pileus, somewhat broader basidiospores (up to 5.7 µm wide), much longer acanthocystidioid terminal cells (up to 100 µm long) of the pileipellis, and stipe basal cells that are similar to the caulocystidia. *Mycena*

hawaiiensis is also comparable owing to its large acanthocysts (64 µm long), but that species differs in having smaller basidiomata, slightly narrower basidiospores, 2-spored basidia, much shorter caulocystidia, and cystidia of basal disc that are morphologically similar to caulocystidia. *Mycena adscendens* differs from *M. apala* in having somewhat smaller basidiomata, non-pseudocollariate lamellae, large basidiospores (8.3–11.2 × 4.8–6.4 µm), 2-spored basidia (4-spored in *M. adscendens* var. *carpophila* (J.E. Lange) Desjardin), ventricose cheilocystidia with simple or branched rostrum (up to 26 µm long), somewhat smaller caulocystidia (up to 110 µm long), and generally smooth stipe basal cells. In addition, *M. adscendens* grows on woody dicotyledonous debris or on conifers.

XIV. ***Mycena*** section ***Spinosae*** Aravind. & Manim., Mycosphere 4 (5): 931 (2013).

Basidiomata small to medium-sized. Pileus dry or viscid, sometimes with a separable pellicle, covered with fine pubescence, cream white, yellow, olivaceous, grey or greyish brown, translucent-striate. Lamellae adnate, or with a decurrent tooth, rarely psuedocollariate, arcuate, or vein-like, white, grey or yellowish with paler or darker edge. Stipe hollow, fragile or filiform, pruinose or pubescent, rarely glabrous, base with fine radiating fibrils, rarely insititious or rooting. Basidiospores ellipsoid, amyloid or inamyloid. Basidia 2- or 4-spored. Cheilocystidia clavate, cylindrical or fusoid, smooth or with excrescences. Pleurocystidia absent. Hyphae of the pileipellis with diverticulations. Pileocystidia originating either from the pileipellis or from the pileus trama, thin-walled, hyaline, smooth. Hyphae of the stipitipellis smooth, rarely with excrescences. Caulocystidia absent or if present similar to pileocystidia, rarely thick-walled.

Type species:—*Mycena mridula* Aravind. & Manim.

Two species belonging to this section were found during this study.

Key to the species

1. Cheilocystidia non-exudative and with excrescences; basidiospores 7–9 × 3–4.5 µm, oblong-ellipsoid to subcylindrical, amyloid……48. ***Mycena mridula***

- Cheilocystidia exudative, smooth; basidiospores 7.5–10 × 3–4.5 µm, oblong, ellipsoid to subamygdaliform, inamyloid ……49. ***Mycena rasada***

48**.** ***Mycena mridula*** Aravind. & Manim., Mycosphere 4 (5): 932 (2013). Pl. 4 H; Fig. 48 A–F

Holotype:—INDIA. Kerala State: Kannur District, Kalarivathukkal, 17 June 2009, *D.M. Aravindakshan DM268*, K(M) 180393 (K!).

Basidiomata very small, delicate. Pileus 2.5–4.5 mm diam., conic when young, becoming convex with age; surface greyish at the centre and on the striations, whitish elsewhere, translucent-striate, with scattered spinules beset with a central hair; margin straight, entire when young, becoming fissile with age. Lamellae up to15 reaching the stipe, adnate, seceding, pale greyish, less than 0.5 mm thick, subdistant, with lamellulae of one length; edge finely torn, white, paler than the sides. Stipe 30–40 × 0.5 mm, central, terete, almost equal or s lightly tapering towards apex, hollow;

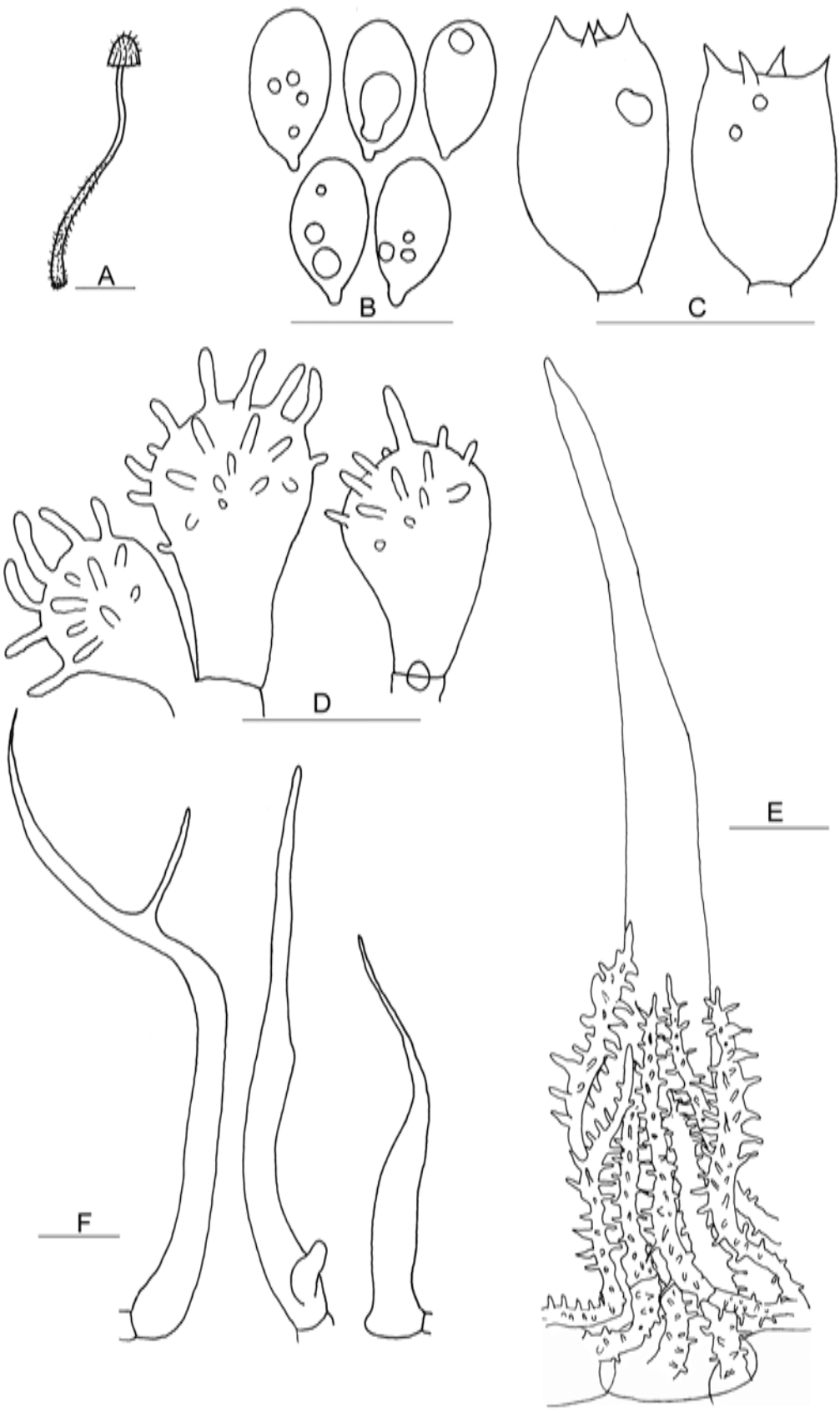


Figure 48. *Mycena mridula*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileocystidia covered with hyphae of the pileipellis; F, caulocystidia. Scale bars: A = 5 mm; B-F = 10 µm.

surface translucent, whitish to greyish, finely pubescent; base lacking both basal disc and basal mycelium. Context not conspicuous. Odour not distinctive. Taste not recorded.

Basidiospores (6) 7–9 (10) × 3–4.5 (8.28 ± 0.77 × 4.03 ± 0.41) µm, Q = 1.77–2.33, Q_m = 2.02, oblong-ellipsoid to subcylindrical, thin-walled, hyaline, smooth, strongly amyloid, with a few guttules. Basidia 11–13 × 6.5–7 µm, obovoid, bearing 4 sterigmata up to 3 µm long. Cheilocystidia 9.5–27.5 × 6-9.5 µm, clavate to cylindrical, thin-walled, hyaline, with cylindrical excrescences (1–3 × 1–1.5 µm). Pleurocystidia none. Lamellar trama regular to subregular; hyphae 2.5–17 µm wide, thin-walled, hyaline, very faintly vinoid in Melzer's reagent. Subhymenium pseudoparenchymatous. Pileus trama subregular; hyphae 13–24 µm wide, thin-walled, hyaline, very faintly vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 1–3 µm wide, thin-walled, hyaline, with excrescences (1–5 × 0.5–1 µm); pileocystidia 33–125 × 7–10 µm, narrowly conic or fusoid with an acuminate apex, thin-walled, densely covered with the narrow pileipellis hyphae towards the base and thus forming the spinules on the pileal surface. Stipitipellis a cutis of smooth hyphae with intercalary or terminal caulocystidia; hyphae 1.5–4.5 µm wide, thin-walled, hyaline. Caulocystidia 14–111.5 × 4.5–7 µm, narrowly conic with acuminate apex, often with apical or basal protrusions (8–28 × 1–3 µm), often branching, thin-walled. Stipe trama pale greyish in water, vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Scattered or in groups, on decaying leaves. June.

Notes:—Thin-walled, conic or fusoid pileocystidia with an acuminate apex and a base ensheathed with pileipellis hyphae are diagnostic features of this species. A taxonomic discussion on this species was provided by Aravindakshan & Manimohan (2013c).

49. ***Mycena rasada*** Aravind. & Manim., Mycosphere 4 (5): 932 (2013). Pl. 4 I; Fig. 49 A–H

Holotype:—INDIA. Kerala State: Thrissur District, Peechi, 7 July 2010, *D.M. Aravindakshan DM447*, K(M) 180098 (K!).

Basidiomata small. Pileus 1.5–4.5 mm diam., 2–3 mm high, parabolic or hemispheric when young, becoming convex with age; surface dark brown (6F6) at the centre and on the striations, and greyish brown (6E4, 6D4, 5E4) elsewhere, translucent-striate, finely pubescent all over, with a separable pellicle; margin straight, finely hairy when young, becoming slightly undulate with age. Lamellae 8–13 reaching the stipe, narrowly adnate or adnate with a small decurrent tooth, whitish, 0.5 mm wide, subdistant, with lamellulae of 1–2 lengths; edge entire, concolourous with the sides, often with yellow resinous exudation. Stipe 7–45 × 0.25–0.5 mm, central, terete, slightly tapering towards apex, hollow; surface translucent, white, pubescent all over; base with strigose basal mycelium. Context not conspicuous, less than 0.5 mm wide, concolourous with the pileus. Odour and taste not recorded.

Basidiospores (6.5) 7.5–10 (11) × (2.5) 3–4.5 (9.21 ± 0.80 × 3.59 ± 0.61) µm, Q = 1.78–3.5, Q_m = 2.63, oblong, ellipsoid to subamygdaliform, thin-walled, hyaline, smooth, inamyloid. Basidia 13.5–19 (21.5) × 7–8.5 (13) µm, subcylindric to clavate, bearing 4 sterigmata up to 5 µm long. Lamella-edge sterile. Cheilocystidia (12) 14–38 × 3–6 µm, cylindrical to narrowly clavate, often with a subcapitate apex, thin-walled, exuding a yellowish, resinous substance in which basidiospores get attached. Pleurocystidia none. Lamellar trama subregular; hyphae 2–28 µm wide, thin-

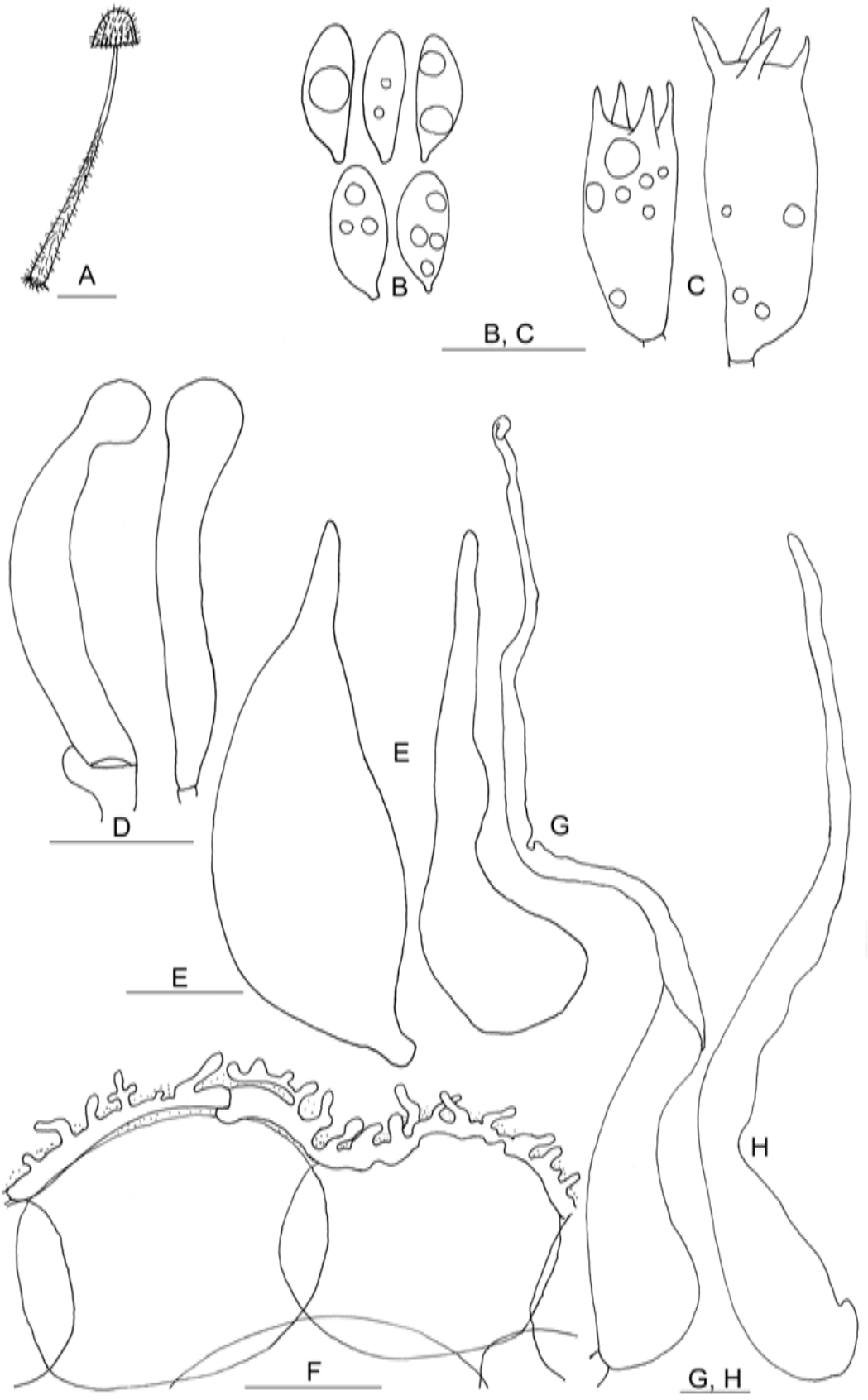


Figure 49. *Mycena rasada*: A, basidioma; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F, hyphae of the pileipellis; G, pileocystidia; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

walled, hyaline, inamyloid in Melzer's reagent. Subhymenium ramose. Pileus trama interwoven; hyphae 10–27 (35) µm wide, thin- to slightly (0.5 µm) thick-walled, pale greyish or brownish, very faintly vinoid in Melzer's reagent. Pileipellis a cutis, narrow; hyphae 1.5–4 µm wide, thin-walled, hyaline, slightly gelatinised, with simple or branched, short, cylindrical excrescences (1–4 × 0.5–2 µm); pileocystidia 40–206 × 10–25 µm, obclavate with a long, flexuous, gradually tapering apex, originate from the pileus trama, thin-walled, hyaline. Pileus marginal cells 38–160 × 12–17 µm, fusoid to obclavate, often with a tapering apex or a small beak, sometimes similar to pileocystidia, thin-walled, hyaline. Stipitipellis a cutis; hyphae 1.5–7.5 µm wide, thin-walled, hyaline or pale yellowish, smooth. Caulocystidia (18) 48–126 × (5.5) 10–19 µm, similar to pileocystidia, thin-walled, hyaline. Stipe trama very faintly vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

Habit, habitat and phenology:—Solitary or scattered, on decaying twigs. June-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Campus, 10 June 2009, *D.M. Aravindakshan DM245*; Palakkad District, Pattambi, Rayiranallur, 2 November 2010, *D.M. Aravindakshan DM514*, K(M) 180380.

Notes:—The presence of both diverticulate hyphae and thin-walled pileocystidia in the pileipellis warranted placement of this species in sect. *Spinosae* where it seems to be close to *M. setigera* Métrod. A detailed account of this species was provided by Aravindakshan & Manimohan (2013c).

XV. ***Mycena*** section ***Supinae*** Konrad & Maubl., Icones Selectae Fungorum 6: 274 (1934).

Basidiomata small to medium-sized. Pileus pruinose or puberulous to minutely floccose, glabrescent, variously coloured. Odour insignificant or none. Lamellae usually horizontal to arcuate, broadly adnate, rarely ascending, edge paler to whitish. Stipe pruinose or puberulous to floccose, base covered with white fibrils. Basidiospores globose to subglobose, amyloid. Basidia 2- or 4-spored. Cheilocystidia clavate to irregularly shaped, with short to very long and flexuous excrescences. Pleurocystidia absent. Hyphae of the pileipellis covered with warts or cylindrical excrescences. Hyphae of the stipitipellis diverticulate.

Type species:—*Mycena supina* (Fr.) P. Kumm.

Only one species belonging to this section was recorded during this study.

50. ***Mycena swaathiae*** Aravind. & Manim. *sp. nov*. Pl. 4 J; Fig. 50 A–H

MycoBank MB811175

Diagnosis:—Characterised by adnate or adnexed lamellae that soon seceding to become pseudocollariate; broadly ellipsoid to subglobose and amyloid basidiospores; cystidioid terminal cells of the pileipellis hyphae with subglobose or fusoid apex without or with excrescences; and distinct, easily detaching caulocystidia. Differing from *M. supina* in having a sterile lamella-edge, cystidioid hyphal ends of pileipellis, and caulocystidia.

Holotype:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 28 October 2008, *D.M. Aravindakshan DM233*, K(M) 188306 (K!).

Etymology:—Named after Swaathi, daughter of the first author, who accompanied her on many *Mycena* forays.

Basidiomata very small. Pileus 1.5–7 mm diam., 1–4 mm high, mostly parabolic, rarely convex or conic or hemispherical when young, becoming broadly parabolic or broadly convex to campanulate or convexo-campanulate, occasionally with a slightly depressed or scrobiculate disc with age; surface greyish brown (5D3) all over or greyish brown (6F6) or teak brown (6F5) or brown (6E5, 6E4) or hair brown (5E4) at the centre and on the striations, orange grey (6B2, 5B2) or off-whitish to whitish towards margin and brown (6E5) or light brown (6D4) or greyish brown (6D3) or brownish orange (5C3) or orange grey (5B2) elsewhere when young, becoming teak brown (6F5) or leather brown (6E6) or yellowish brown (5D5, 5D4) or greyish brown (5D3) at the disc and on the striations, greyish orange(5B3) to whitish towards margin and light brown (6D5) or greyish orange (5B4) or orange grey (5B2) or orange white (5A2) elsewhere with age, translucent-striate, wet, shiny, pruinose all over, densely so on the disc when young, becoming evenly distributed with age; margin slightly incurved and crenate to crenulate when young, becoming straight or upturned and dentate to finely torn or frequently eroded or fissile with age. Lamellae 11–18 reaching the stipe, adnate or adnexed, soon seceding and becoming pseudocollariate, whitish, thin, 0.5–1 mm wide, subdistant with lamellulae of 1–2 lengths; edge finely torn under a lens, concolourous with the sides. Stipe 3–20 × 0.5–1.25 mm, central, terete, almost equal when young, becoming broad at apex and base and thin at middle with age, hollow; surface translucent, white or yellowish white (4A2) or ivory (4B3) or orange white (5A2) when young, becoming greyish orange (5B2) with age; surface initially entirely pubescent becoming almost glabrous with age; base broad with white, strigose basal mycelium. Context 0.25–0.5 mm thick, concolourous with the pileus surface. Odour and taste not distinctive.

Basidiospores 6.5–9 (10) × 4.5–6.5 (7) (7.25 ± 0.54 × 5.88 ± 0.73) µm, Q = 1.08–1.6, Q_m = 1.35, ellipsoid to subglobose, smooth, thin-walled, hyaline, amyloid (inamyloid in two collections). Basidia 11–20 × 7–11 µm, subglobose to clavate, often very difficult to recover, 4-spored with sterigmata up to 6.5 µm long. Lamella-edge sterile. Cheilocystidia 12.5–29 × 10–21 µm, globose to subglobose or clavate, pedicellate or not, thin-walled, hyaline, with cylindrical excrescences (1.5–8 (13) × 0.5–1 (2) µm). Lamellar trama regular to subregular; hyphae 2.5–29 µm wide, inflated up to 52 µm, thin-walled, hyaline, vinoid to moderately vinoid in Melzer's reagent; subhymenium thin. Pleurocystidia none. Pileus trama interwoven; hyphae 11.5–40 µm wide, with pale brownish contents, slightly thick-walled (0.5 µm), vinoid to moderately vinoid in Melzer's reagent. Pileipellis a cutis; hyphae 5–16 µm wide, thin-walled, hyaline, with cystidioid hyphal ends, 85–225 × 8.5–41.5 µm, fusoid and smooth or with excrescences or subglobose with simple or rarely furcate excrescences (0.5–23 × 0.5–1.5 µm). Pileus marginal cells 15–36 × 6–27.5 µm, cylindrical or clavate or obovoid, thin-walled, hyaline, with cylindrical excrescences (0.5–4 × 0.5–1 µm). Stipitipellis a cutis; hyphae 1–4.5 µm wide, hyaline, thin- to slightly (0.25 µm) thick-walled, smooth. Caulocystidia scattered or in cluster 20.5–114 × 4.5–15 µm, clavate, obovate or cylindrical, with simple or rarely furcate, short or digitate excrescences (0.5–20 × 1.5–3 µm). Stipe trama vinoid in Melzer's reagent. Clamp connections seen on all hyphae.

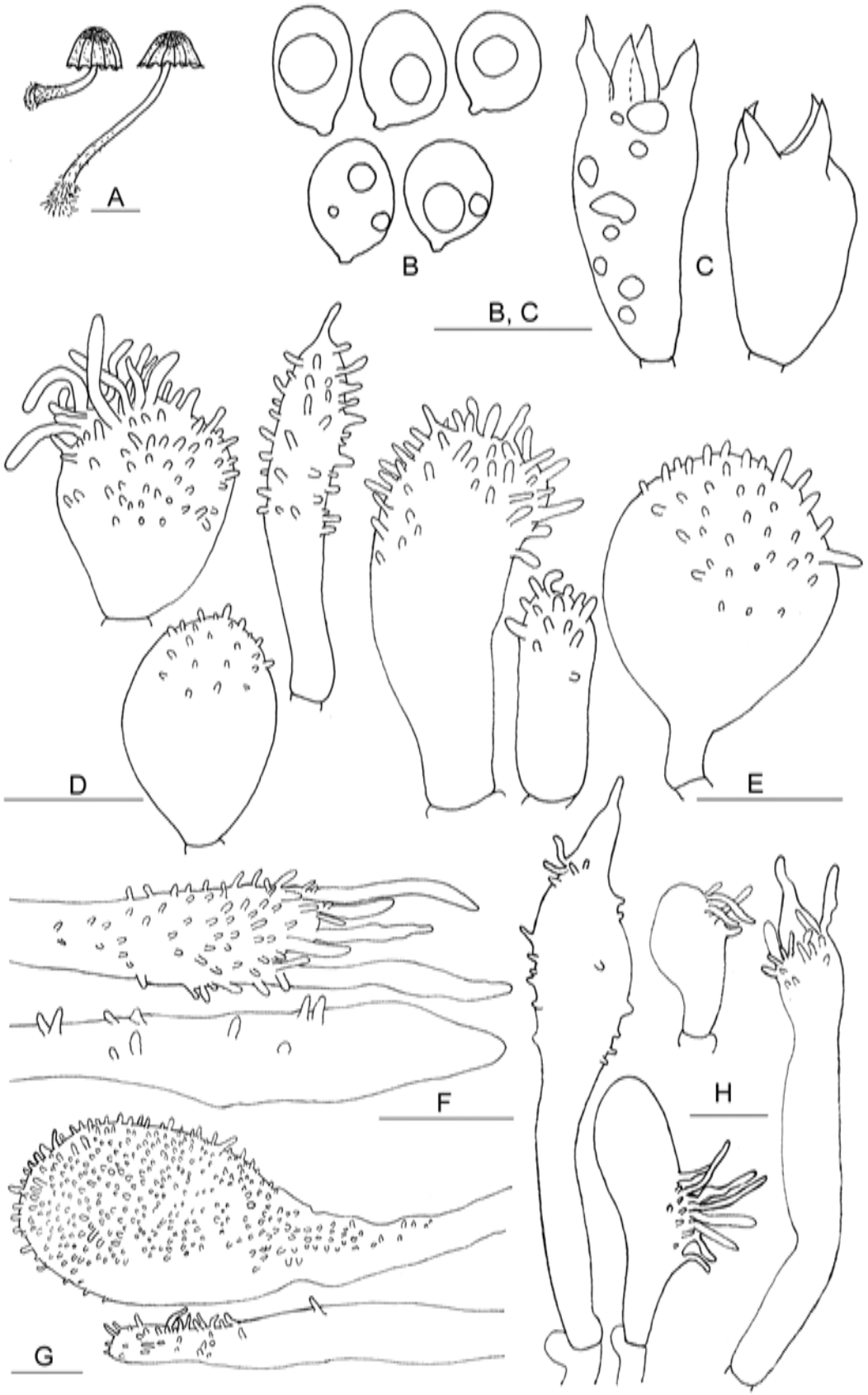


Figure 50. *Mycena swaathiae*: A, basidiomata; B, basidiospores; C, basidia; D, cheilocystidia; E, pileus marginal cells; F & G, cystidioid hyphal ends of the pileipellis; H, caulocystidia. Scale bars: A = 5 mm; B-H = 10 µm.

Habit, habitat and phenology:—In groups, on the bark of various standing trees, on decaying logs and on decaying *Vateria indica* fruits. June, September-November.

Additional collections examined:—INDIA. Kerala State: Malappuram District, Calicut University Botanical Garden, 1 June 2006, *D.M. Aravindakshan DM2*; 15 June 2009, *D.M. Aravindakshan DM251*; 17 June 2011, *D.M. Aravindakshan DM524*; Thiruvananthapuram District, Palode, TBGRI Campus, 8 September 2009, *D.M. Aravindakshan DM300*; Kozhikode District, Beypore, 13 November 2009, *D.M. Aravindakshan DM355*, K(M) 188307.

Notes:—Characters such as the subglobose, amyloid basidiospores, the concolourous lamella-edge, the non-separable pellicle and the sparsely ornamented cheilocystidia lead *M. swaathiae* to sect. *Supinae*. Within this section, characters such as the clavate, 6–20 µm wide cheilocystidia that are covered with unbranched, fairly short, cylindrical excrescences, and a pileus that never shows violaceous, purplish or bluish-grey colours lead it to *M. supina*, known from Europe. *Mycena supina* shows some similarity to *M. swaathiae* in having a corticolous habitat, small, gregarious, brown basidiomata, similar number of lamellae, and a minutely puberulous to glabrescent stipe and in lacking pleurocystidia. But *M. supina* differs from *M. swaathiae* in having almost globose basidiospores, narrower cheilocystidia, a heterogeneous lamella-edge, diverticulate hyphae of the pileipellis and in lacking both cystidioid hyphal ends of pileipellis hyphae and caulocystidia.

Apart from *M. supina*, currently the sect. *Supinae* incorporates five American species (*M. corticalis* A.H. Sm., *M. meliigena* (Berk. & Cooke) Sacc., *M. fera* Maas Geest. & de Meijer, *M. globulispora* Maas Geest. & de Meijer and *M. recessa* Maas Geest. & de Meijer) and four European species (*M. pseudocorticola* Kühner, *M. venustula* Quél., *M. juniperina* Aronsen, and *M. cupressina*). All these *Mycena* species of the sect. *Supinae*, except *M. globulispora*, *M. recessa* and *M. cupressina*, differ from *M. swaathiae* in having diverticulate hyphae in the pileipellis and stipitipellis. *Mycena globulispora* is similar to *M. swaathiae* only in having smooth pileipellis hyphae with inflated terminal cells. In all other aspects, that species is different. Similarly, *M. recessa* and *M. cupressina* are similar to *M. swaathiae* only in having smooth stipitipellis hyphae and caulocystidia with excrescences. In all other macroscopic and microscopic characters, those two species are different from *M. swaathiae*.

PLATE 1: A, *Mycena rohitha*; B, *M. kanika*; C, *M. kamala*; D, *M. patala*; E, *M. sukshma*; F, *M. zikhara*; G, *M. kapotha*; H, *M. nirbala*; I, *M. sirayuktha*; J, *M. deeptha*; K, *M. snigdha*. Scale bars: A-E, G-K = 5 mm; F = 1 mm.

PLATE 2: A, *Mycena lomaza*; B, *M. parnaja*; C, *M. ziragra*; D, *M. rajatha*; E, *M. aruna*; F, *M. profusa*; G, *M. kapila*; H, *M. lohitha*; I, *M. babruka*; J, *M. mulika*; K, *M. sravaka*; L, *M. vamana*; M, *M. sandra*; N, *M. niranjana*; O, *M. nimna*. Scale bars: A-O = 5 mm.

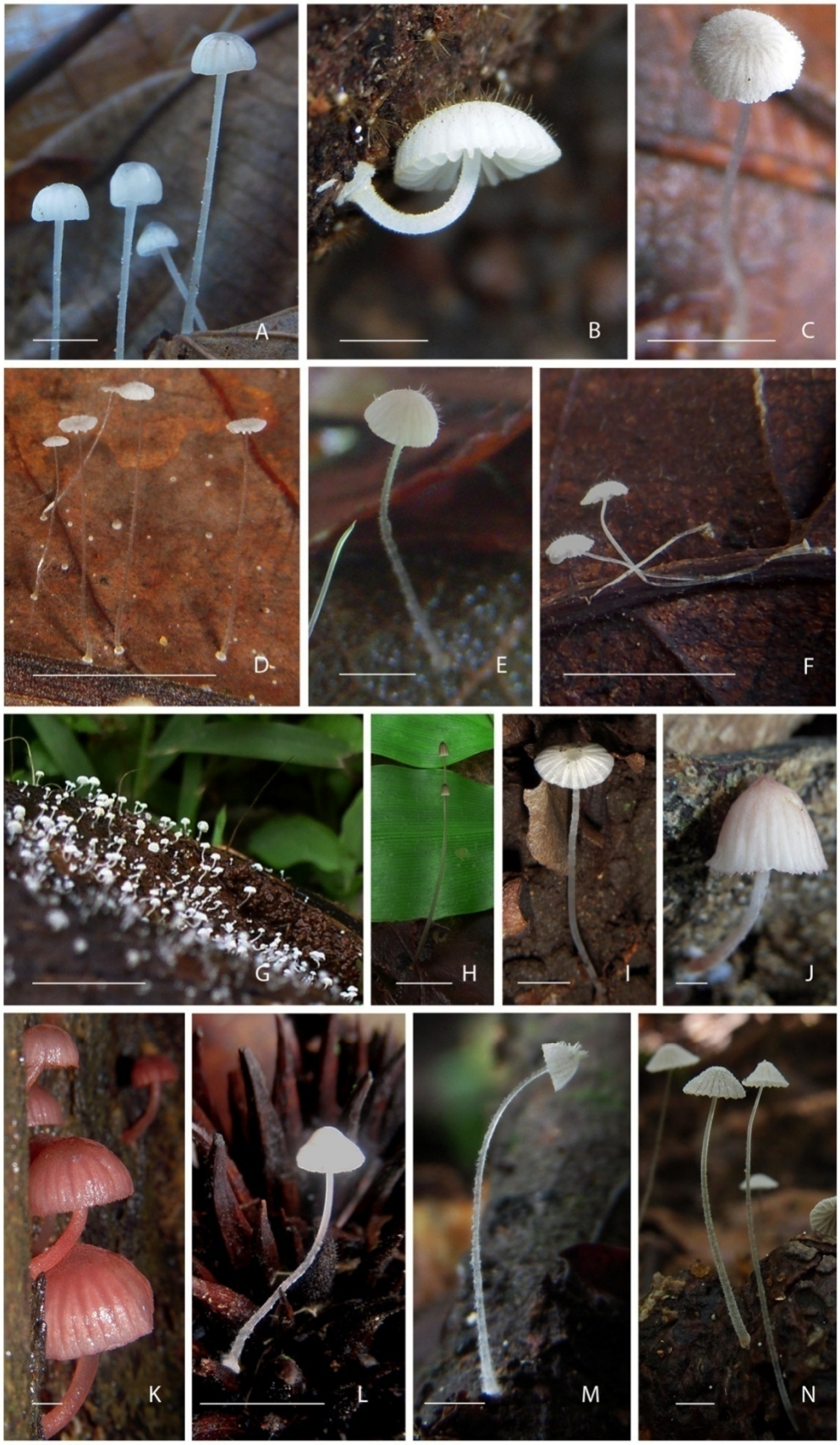


PLATE 3: A, *Mycena vimala*; B, *M. lomavritha*; C, *M. lomamaya*; D, *M. jatila*; E, *M. saloma*; F, *M. pelava*; G, *M. amala*; H, *M. saparna*; I, *M. samula*; J, *M. valkaja*; K, *M. pingala*; L, *M. albinea*; M, *M. spinosissima*; N, *M. silvana*. Scale bars: A-N = 5 mm.

PLATE 4: A, *Mycena delicata*; B, *M. roseotincta*; C, *M. globispora*; D, *M. distincta*; E, *M. alphitophora*; F, *M. furfuracea*; G, *M. apala*; H, *M. mridula*; I, *M. rasada*; J, *M. swaathiae*. Scale bars: A = 1 mm; B-J = 5 mm.

6

General observations

Distribution

Mycena species were found throughout Kerala State, from sea level to high ranges (about 2000 m). However, about half of the collections made during this study were collected from the Calicut University Campus as the authors had the opportunity to carry out intensive collection at this locality. Most of the distant areas were visited only a few times and this limited the number of collections from such areas. As most of the species recorded in this study are new to science, no meaningful comparison between the diversity of mycenas in this geographical region and that of other parts of the world including the adjacent Sri Lanka can be done. For example, Pegler (1986), in his agaric flora did not record any species in section *Fragilipedes* from Sri Lanka although in Kerala, seven species represent this section.

Like some earlier workers who studied *Mycena* (Hedger *et al*. 1995; Maas Geesteranus & de Meijer 1997), we noticed that the species of section *Sacchariferae* (ten species), outnumbered those of all other sections. In terms of number of species recorded, the remaining sections in the descending order are: section *Fragilipedes* (seven species), section *Hiemales* (six species), sections *Basipedes* and *Longisetae* (five species each), section *Adonideae* (three species), sections *Exornatae*, *Galactopoda*, *Polyadelphia*, *Rubromarginatae* and *Spinosae* (two species each), sections *Calodontes*, *Hygrocyboideae*, *Radiatae* and *Supinae* (one species each).

One major problem the authors confronted was the limited number of collections/ specimens of several species. This limitation has been noticed by Maas Geesteranus & de Meijer (1997) and Corner (1972) in their studies on the genus as well. As Corner (1972) aptly remarked, 'it is unsatisfactory to describe species from single gatherings, but this is the fate of the mycologists in the tropics…it is his duty to assist in indicating what there is to be found'. The present authors also had to describe several species based on poor material for the sake of documenting the biodiversity of this region.

Effect of climatic conditions

In Kerala, the occurrence of mycenas largely depends on the monsoonal showers. Unlike the case of most other agarics, days of continuous heavy rain are often needed for the appearance of mycenas. Due to this reason, summer months never yielded mycenas in spite of sporadic summer showers. Usually one or two bright days after a period of heavy rain, provided good number of mycenas. The basidiomata last for one or two days and then disappear. Some small, delicate species belonging to section *Sacchariferae* cannot survive even low rain fall and they typically fruit in dry days following heavy rain. The corticolous (bark-inhabiting) mycenas flourished only during rainy days of southwest monsoon. Other habitats also support the fruiting of mycenas well in this season. Therefore, most of the *Mycena* species were collected during the southeast monsoon.

Habitat specificity

Many of the mycenas observed during the present study showed high habitat specificity. Eighteen *Mycena* species (*M. patala, M. sukshma, M. zikhara, M. nirbala, M. sirayuktha, M. lomaza, M. parnaja, M. aruna, M. lohitha, M. vimala, M. lomamaya, M. jatila, M. pelava, M. saparna, M. delicata, M. alphitophora, M. apala, M. mridula*) are strictly foliicolous. Among them, *M. patala* is exclusively associated with decaying *Chrysophyllum cainito* leaves and are collected only from the Calicut University Botanical Garden. Eight species (*M. rohitha, M. kamala, M. ziragra, M. vamana*, *M. sandra*, *M. niranjana*, *M. nimna*, *M. lomavritha*) grew exclusively on the bark of standing trees. Eight species (*M. kanika, M. rajatha, M. kapila, M. sravaka*, *M. valkaja, M. spinosissima, M. silvana, M. rasada*) grew on decaying bark as well as on decaying twigs. Five species (*M. profusa, M. babruka, M. saloma, M. distincta, M. furfuracea*) grew on both decaying bark and decaying leaves. *Mycena snigdha, M. pingala* and *M. globispora* were found growing on decaying twigs as well as on bark of standing trees. *Mycena mulika* and *M. samula* were associated with roots of some herbaceous plants. Two species *M. amala* and *M. albinea* grew on the woody shells of fruits of some trees. *Mycena deeptha* and *M. roseotincta* were seen on both decaying fruits and decaying leaves. *Mycena kapotha* was both corticolous and foliicolous while *M. swaathiae* was found on decaying fruit-shells, decaying twigs and barks and on the bark of standing trees.

The size of basidiomata also varied with habitat. The basidiomata of *Mycena kapotha* that grew on bark were much smaller than those that grew on decaying leaves. Basidiomata of most of the mycenas occur in a scattered or gregarious manner. *Mycena kapila*, *M. sravaka*, *M. samula* and *M. valkaja,* however, are unique owing to their solitary habit. One remarkable observation made during the present study is that some species of *Mycena* (e.g., *M. lomavritha* and *M. profusa*) exhibit a change of colour of the lamella-edge with time/age.

Microscopic observations

The use of alcohol as a wetting agent prior to staining was found useful for detaching structures such as hyphae and cystidia during the microscopic analysis of dried material. The use of higher concentrations (≥ 5%) of KOH seems to expand the size of microscopic structures by 1 µm and is not recommended for *Mycena*. It was noticed in this study that the reaction of Melzer's reagent on the basidiospore wall is not a fully reliable taxonomic character and recent molecular studies of Harder *et al*. (2011) support this observation. Some collections of the same species from different localities showed either amyloid or inamyloid basidiospores as in the case of *M. spinosissima* and *M. swaathiae*. The presence of both 2- and 4-spored basidia in a single specimen was not observed in this study. But such basidia were observed in different collections of a single species as noted by Maas Geesteranus (1992a, b). In support of the view of Desjardin *et al*. (2010), the present observations reveal that loop-like clamp connections can no longer be used to differentiate between the two sections *Ingratae* and *Exornatae*.

7

References

Anonymous 1992. Truete arter i Norge. Red data list. Direktoratet for naturforvaltning. DN-Rapport 1992-6: 1–96.

Antonín V, Maas Geesteranus RA. 1998. *Mycena cupressina*, a new species of section *Supinae* from Italy. Persoonia 16 (4): 545–547.

Aqueveque P, Anke T, Anke H, Sterner O, Becerra J, Silva M. 2005. Favolon B, a new triterpenoid isolated from the Chilean *Mycena* sp. strain 96180. Journal of Antibiotics 58 (1): 61–64. http://dx.doi.org/10.1038/ja.2005.7

Aravindakshan DM, Manimohan P. 2010. *Amparoina spinosissima*: a continental Asian record and some taxonomic observations. Mycotaxon 114: 49–54. http://dx.doi.org/10.5248/114.49

Aravindakshan DM, Manimohan P. 2011. *Mycena* sect. *Longisetae*: a new species, a new name, and an addition. Mycotaxon 117: 239–246. http://dx.doi.org/10.5248/117.239

Aravindakshan DM, Manimohan P. 2012. A new species of *Mycena* sect. *Polyadelphia* from southern India. Mycosphere 3 (2): 241–243. http://dx.doi.org/10.5943/mycosphere/3/2/7

Aravindakshan DM, Manimohan P. 2013a. A new species of *Mycena* sect. *Exornatae* and some taxonomic observations. Mycosphere 4 (1): 146–150.

http://dx.doi.org/10.5943/mycosphere/4/1/9

Aravindakshan DM, Manimohan P. 2013b. *Mycena* sect. *Galactopoda:* two new species, a key to the known species and a note on the circumscription of the section. Mycosphere 4 (4): 653–659. http://dx.doi.org/10.5943/mycosphere/4/4/1

Aravindakshan DM, Manimohan P. 2013c. A new section and two new species of *Mycena*. Mycosphere 4 (5): 930–935. http://dx.doi.org/10.5943/mycosphere/4/5/5

Aravindakshan DM, Manimohan P. 2014. Three new species of *Mycena* sect. *Longisetae* Mycosphere 5 (2): 290–297. http://dx.doi.org/10.5943/mycosphere/5/2/3

Aravindakshan DM, Kumar TKA, Manimohan P. 2012. A new bioluminescent species of *Mycena* sect. *Exornatae* from Kerala State, India. Mycosphere 3 (5): 556–561. http://dx.doi.org/10.5943/mycosphere/3/5/4

Aronsen A. 1994. Two new mycenas of section *Fragilipedes* from southern Norway. Persoonia 15 (4): 531–535.

Aronsen A. 1996. *Mycena juniperina*, a new member of section *Supinae* from Norway. Persoonia 16 (2): 257–259.

Aronsen A. 2009. *Mycena cretata*, a new member of sect. *Fragilipedes* from southern Norway. Österreichische Zeitschrift für Pilzkunde 18: 69–75.

Aronsen A, Gulden G. 2007. Two new species of *Mycena* from alpine sites in Norway. Mycological Progress 6 (1): 1–6. http://dx.doi.org/10.1007/s11557-006-0518-5

Aronsen A, Maas Geesteranus RA. 1990. *Mycena oligophylla*, another new species from southern Norway. Persoonia 14 (2): 183–188.

Aronsen A, Maas Geesteranus RA. 1997. *Mycena agrestis*, a new species of section *Fuliginellae* from southern Norway. Persoonia 16 (3): 397–400.

Aronsen A, Perry BA. 2011. *Mycena guldeniana* - a new alpine species from Norway. Mycotaxon 118: 187–195. http://dx.doi.org/10.5248/118.187

Babos M. 1979. Auf Sumpfpflanzen lebende *Agaricales*-Arten. Studia Botanica Hungarica 13: 7–13.

Bas C. 1990. *Tricholomataceae* R. Heim ex Pouz. In: Bas C, Kuyper TW, Noordeloos ME, Vellinga EC. (eds.) Flora Agaricina Neerlandica 2. A. A. Balkema, Rotterdam, pp. 65–133.

Bäuerle J, Anke T. 1980. Antibiotics from the genus *Mycena* and *Hydropus scabripes*. Planta Medica 39: 195–196.

Bäuerle J, Anke T, Jente R, Bosold F. 1982. Antibiotics from *Basidiomycetes* XVI. Antimicrobial and cytotoxic polyines from *Mycena viridimarginata* Karst. Archives of Microbiology 132 (2): 194–196. http://dx.doi.org/10.1007/bf00508730

Beardslee HC, Coker WC. 1924. The Mycenas of North Carolina. Journal of the Elisha Mitchell Scientific Society 40: 49–91.

Becker U, Erkel G, Anke T, Sterner O. 1997. Puraquinonic acid, a novel inducer of differentiation of human HL-60 promyelocytic leukemia cells from *Mycena pura* (Pers. ex Fr.). Natural Product Letters 9 (3): 229–236. http://dx.doi.org/10.1080/10575639708048319

Bendiksen E. 1987. *Mycena alphitophora* - flower pot species new to Norway. Agarica 8 (16): 13–18.

Berg AP van den, Berg-Blok AE van den, Noordeloos ME, Uljé CB. 2000. A new species and a new section of the genus *Mycena* from the Netherlands. Persoonia 17 (3): 481–485.

Berkeley MJ. 1850. Decades of fungi XXV-XXX, Sikkim Himalayan Fungi, collected by Dr. JD Hooker. Hooker's Journal of Botany and Kew Miscellany 2: 76–88.

Berkeley MJ. 1852. Decades of fungi XXXVII-XXXVIII, Sikkim & Khassya Fungi. Hooker's Journal of Botany and Kew Miscellany 4: 97–107.

Berliner MD. 1961a. Diurnal periodicity of luminescence in three basidiomycetes. Science 134 (3481): 740. http://dx.doi.org/10.1126/science.134.3481.740

Berliner MD. 1961b. Studies in fungal luminescence. Mycologia 53 (1): 84–90. http://dx.doi.org/10.2307/3756133

Bermudes D, Petersen RH, Nealson KH. 1992. Low level bioluminescence detected in *Mycena haematopus* basidiocarps. Mycologia 84 (5): 799–802.

Bhavanidevi S, Nair MC. 1983. Addition to Indian *Agaricales*. In: Kaul TN, Kapoor BM. (eds.) Indian Mushroom Science-II. CSIR, New Delhi, pp. 371–374.

Bigelow HE. 1976. Studies on New England Agarics I. Rhodora 78 (813): 120–134.

Bigelow HE, Barr ME. 1969. Contribution to the fungus flora of northeastern North America V. Rhodora 71 (786): 177–203.

Björn LO, Ghiradella H. 2008. Bioluminescence. In Björn LO. (ed.) Photobiology: The Science of Life and Light. Springer, New York, pp. 591–615. http://dx.doi.org/10.1007/978-0-387-72655-7_23

Blackwell M, David C, Barker SA. 2001. The presence of glycine betaine and the dextrinoid reaction in basidiomata. Harvard Papers in Botany 6 (1): 35–41.

Boa ER. 2004. Wild edible fungi: A global overview of their use and importance to people. Non-wood forest products 17: 1–147.

Boberg J, Finlay RD, Stenlid J, Näsholm T, Björn D, Lindahl BD. 2008. Glucose and ammonium additions affect needle decomposition and carbon allocation by the litter degrading fungus *Mycena epipterygia*. Soil Biology and Biochemistry 40 (4): 995–999. http://dx.doi.org/10.1016/j.soilbio.2007.11.005

Boisselier-Dubayle MC, Perreau-Bertrand J, Lambourdiere J. 1996. The genetic variability in wild populations of *Mycena rosea*. Mycological Research 100 (6): 753–758. http://dx.doi.org/10.1016/s0953-7562(96)80210-3

Bon M, Chevassut G. 1989. Agaricomycetes from the district "Languedoc- Ce- vennes" (France). Documents Mycologiques 75: 25–48.

Bonsdorff von T, Aronsen A. 2011. *Mycena agrestis*, a new species to Finland. Sienlehti 63 (1): 22–24.

Bougher NL. 2009. Two intimately co-occurring species of *Mycena* section *Sacchariferae* in south-west Australia. Mycotaxon 108: 159–174. http://dx.doi.org/10.5248/108.159

Buchanan MS, Steglich W, Anke T. 1999. Strobilurin N and two metabolites related to chorismic acid from the fruit bodies of *Mycena crocata* (*Agaricales*). Zeitschrift für Naturforschung C 54 (7-8): 463–468. http://dx.doi.org/10.1515/znc-1999-7-801

Cannon PF, Kirk PM. (eds.). 2007. Fungal families of the world. CABI publishing, Wallingford, UK, 456 p.

Cejp K. 1930. Revise středoevropských druhů skupiny *Mycena-Omphalia*. Spisy vydávané prírodovedeckou fakultou Karlovy University. Publications de la faculté des sciences de l'Université Charles 104: 1–157.

Chard JM, Gray TRG, Frankland JC. 1985. Use of anti-*Mycena galopus* serum as an immunofluorescence agent. Transactions of the British Mycological Society 84 (2): 243–249. http://dx.doi.org/10.1016/s0007-1536(85)80075-9

Chew ALC, Desjardin DE, Tan YS, Musa MY, Sabaratnam V. 2015. Bioluminescent fungi from Peninsular Malaysia-A taxonomic and phylogenetic overview. Fungal Diversity 70 (1): 149–187. http://dx.doi.org/10.1007/s13225-014-0302-9

Chew ALC, Tan YS, Desjardin DE, Musa MY, Sabaratnam V. 2013. Taxonomic and phylogenetic re-evaluation of *Mycena illuminans*. Mycologia 105 (5): 1325–1335. http://dx.doi.org/10.3852/13-009

Chew ALC, Tan YS, Desjardin DE, Musa MY, Sabaratnam V. 2014. Four new bioluminescent taxa of *Mycena* sect. *Calodontes* from Peninsular Malaysia. Mycologia 106 (5): 976–988. http://dx.doi.org/10.3852/13-274

Clough JM. 1993. The strobilurins, oudemansins, and myxothiazols, fungicidal derivatives of β-methoxyacrylic acid. Natural Products Report 10: 565–574. http://dx.doi.org/10.1039/np9931000565

Cooper JA. 2014. New species and combinations of some New Zealand agarics belonging to *Clitopilus*, *Lyophyllum*, *Gerhardtia*, *Clitocybe*, *Hydnangium*, *Mycena*, *Rhodocollybia* and *Gerronema*. Mycosphere 5 (2): 263–288. http://dx.doi.org/10.5943/mycosphere/5/2/2

Corner EJH. 1954. Further descriptions of luminous agarics. Transactions of the British Mycological Society 37 (3): 256–271. http://dx.doi.org/10.1016/s0007-1536(54)80009-x

Corner EJH. 1969 Larger fungi of the Solomon Island. Philosophical Transactions of the Royal Society of London, B. Biological Sciences 255 (800): 579. http://dx.doi.org/10.1098/rstb.1969.0029

Corner EJH. 1972. *Boletus* in Malaysia. Government Printing Office/ Botanic Gardens, Singapore, 263 p.

Corner EJH. 1994. Agarics in Malesia. I. Tricholomatoid. II Mycenoid. Beihefte zur Nova Hedwigia 109: 1–271.

Courtecuisse R. 1985. Interesting rare or new macrofungi III. Some species of *Mycena*, *Hemimycena* and *Mycenella* (Basidiomycetes, Tricholomataceae) rare in north France. Agarica 6 (12): 108–123.

Courtecuisse R. 1986a. Interesting rare or new macrofungi IV. *Tricholomatales*. Documents Mycologiques 16: 23–46.

Courtecuisse R. 1986b. *Mycena diosma* Krieglsteiner & Schwöbel 1982 espèce nouvelle pour France. Avec un essa de cle de determination des mycénes à odour raphanoid. Bulletin de la Société Mycologique Dauphiné-Savoie 100: 23–28.

Courtecuisse R, Guinberteau J. 1985. *Mycena chlorantha* fo. *caespitosa* Courtecuisse et Guinberteau fo. nov. Documents Mycologiques 16 (61): 51–54.

de Meijer RJ, Aldenkamp FJ, Jansen AE. 1988. Resorption of cesium radionuclides by various fungi. Oecologia 77 (2): 268–272. http://dx.doi.org/10.1007/bf00379197

Davidson JE. 1930. Notes on the *Agaricaceae* of Vancouver (B. C.) District: I. *Mycologia* 22 (2): 80–93. http://dx.doi.org/10.2307/3753736

Dennis RWG. 1955. The larger fungi in the north-west highlands of Scotland. Kew Bulletin 10 (1): 111–126. http://dx.doi.org/10.2307/4113927

Dennis RWG. 1961. Fungi Venezuelani: IV *Agaricales*. Kew Bulletin 15: 67–156. http://dx.doi.org/10.2307/4115784

Dennis RWG. 1964. The fungi of the Isle of Rhum. Kew Bulletin 19 (1): 77–127. http://dx.doi.org/10.2307/4108295

Dennis RWG, Reid DA, Spooner B. 1977. The fungi of the Azores. Kew Bulletin 32 (1): 85–136. http://dx.doi.org/10.2307/4117263

Desjardin DE. 1993. Notes on *Mycena cylindrospora* and *Eomycenella echinocephala*. Mycologia 85 (3): 509–513. http://dx.doi.org/10.2307/3760711

Desjardin DE. 1995. A preliminary accounting of the worldwide members of *Mycena* sect. *Saccharíferae*. Bibliotheca Mycologica 159: 1–89.

Desjardin DE, Bessette AE. 1997. A new *Mycena* from New York. Mycotaxon 62: 299–303.

Desjardin DE, Braga-Neto R. 2007. *Mycena lacrimans*, a rare species from Amazonia, is bioluminescent. Edinburgh Journal of Botany 64 (3): 275–281. http://dx.doi.org/10.1017/s0960428607004763

Desjardin DE, Hemmes DE. 2001. *Agaricales* of the Hawaiian Islands-7. Notes on *Volvariella*, *Mycena* sect. *Radiatae*, *Physalacria*, *Porpolama* and *Stropharia*. Harvard Papers in Botany 6 (1): 85–103.

Desjardin DE, Horak E. 2002. *Agaricales* of Indonesia. 4. *Mycena* sect. *Longisetae* with comments on allied species. Sydowia 54 (2): 142–156.

Desjardin DE, Boonpratuang T, Hywel-Jones N. 2002. An accounting of the worldwide members of *Mycena* sect. *Longisetae*. Fungal Diversity 11: 69–85.

Desjardin DE, Capelari M, Stevani C. 2007. Bioluminescent *Mycena* species from São Paulo, Brazil. Mycologia 99 (2): 317–331. http://dx.doi.org/10.3852/mycologia.99.2.317

Desjardin DE, Flegel TW, Boonpratuang T. 2004. *Basidiomycetes*. In: Jones EBC, Tantichareon M, Hyde KD (eds.) Thai Fungal Diversity. BIOTEC, Thailand, pp. 37–49.

Desjardin DE, Oliveira AG, Stevani CV. 2008. Fungi bioluminescence revisited. Photochemical and Photobiological Sciences 7: 170–182. http://dx.doi.org/10.1039/b713328f

Desjardin DE, Perry BA, Lodge DJ, Stevani C, Nagasawa E. 2010. Luminescent *Mycena*: new and noteworthy species. Mycologia 102 (2): 459–477. http://dx.doi.org/10.3852/09-197

Eckblad FE, Gulden G. 1974. Distribution of some macromycetes in Norway. Norwegian Journal of Botany 21: 285–301.

Eijk GWV. 1975. Drosophilin, a methyl ether from *Mycena megaspora*. Phytochemistry 4: 2506. http://dx.doi.org/10.1016/0031-9422(75)80375-x

Emmett EE. 1992a. British *Mycena* species-1. Mycologist 6 (2): 72–76. http://dx.doi.org/10.1016/s0269-915x(09)80453-9

Emmett EE. 1992b. British *Mycena* species-2. Mycologist 6 (3): 114–122. http://dx.doi.org/10.1016/s0269-915x(09)80589-2

Emmett EE. 1992c. British *Mycena* species-3. Mycologist 6 (4): 165–173. http://dx.doi.org/10.1016/s0269-915x(09)80559-4

Emmett EE. 1993a. British *Mycena* species-4. Mycologist 7 (1): 4–11. http://dx.doi.org/10.1016/s0269-915x(09)80615-0

Emmett EE. 1993b. British *Mycena* species-5. Mycologist 7 (2): 63–67. http://dx.doi.org/10.1016/s0269-915x(09)80644-7

Emmett EE. 1993c. British *Mycena* species-6. Mycologist 7 (4): 176–180. http://dx.doi.org/10.1016/s0269-915x(09)80391-1

Engler M, Anke T, Sterner O. 1998. Tintinnadiol, a sphaeroane diterpene from fruiting bodies of *Mycena tintinnabulum*. Phytochemistry 49 (8): 2591–2593. http://dx.doi.org/10.1016/s0031-9422(98)00258-1

Esteve-Raventós F, Barrasa JM. 2009. *Mycena subinsignis*, a new speices from highland heaths of Central Spain. Cryptogamie Mycologie 30: 153–159.

Esteve-Raventós F, Villarreal M, Barrasa JM, Ortega A. 2001. *Mycena dunicola*, a striking new species from the Iberian peninsula. Mycotaxon 80: 307–313.

Farook VA, Khan SS, Manimohan P. 2013. A checklist of agarics (gilled mushrooms) of Kerala State, India. Mycosphere 4 (1): 97–131. http://dx.doi.org/10.5943/mycosphere/4/1/6

Frankland JC. 1982. Biomass and nutrient cycling by decomposer basidiomycetes. In: Frankland JC, Hedger JN, Swift MJ (eds.) Decomposer basidiomycetes: Their biology and ecology. Cambridge University Press, Cambridge, pp. 241–261.

Frankland JC. 1998. Fungal succession-unraveling the unpredictable. Mycological Research 102 (1): 1–15. http://dx.doi.org/10.1017/s0953756297005364

Frankland JC, Bailey AD, Gray TRG, Holland AA. 1981. Development of an immunological technique for estimating mycelial biomass of *Mycena galopus* in leaf litter. Soil Biology and Biochemistry 13 (2): 87–92. http://dx.doi.org/10.1016/0038-0717(81)90001-8

Fries EM. 1821. Systema Mycologicum. Ex Officina Berlingiana, Lund, Greifswald, 520 p. http://dx.doi.org/10.5962/bhl.title.5378

Fukasawa Y, Osono T, Takeda H. 2005. Decomposition of Japanese beech wood by diverse fungi isolated from a cool temperate deciduous forest. Mycoscience 46 (2): 97–101. http://dx.doi.org/10.1007/s10267-004-0215-7

Fukasawa Y, Osono T, Takeda H. 2009. Effects of attack of saprobic fungi on twig litter decomposition by endophytic fungi. Ecological Research 24: 1067–1073. http://dx.doi.org/10.1007/s11284-009-0582-9

Gardezi SRA. 2003. Mushrooms of Kashmir IV. Asian Journal of Plant Sciences 2 (15–16): 1126–1134. http://dx.doi.org/10.3923/ajps.2003.1126.1134

Ghosh A, Frankland JC, Thurston CF, Robinson CH. 2003. Enzyme production by *Mycena galopus* mycelium in artificial media and in *Picea sitchensis* F1 horizon needle litter. Mycological Research 107 (8): 996–1008. http://dx.doi.org/10.1017/s0953756203008177

Gray SF. 1821. A natural arrangement of British plants 1. Baldwin, Cradock and Joy, London, 824 p.

Grgurinovic CA. 2003. The Genus *Mycena* in South-Eastern Australia. Fungal Diversity Research Series 9: 1–329.

Guzmán G, Allen JW, Gartz J. 1998. A worldwide geographic distribution of the neurotropic fungi, an analysis and discussion. Annali del Museo Civico di Rovereto 14: 189–280.

Halama M, Chachula P, Rutkowski R. 2014. *Mycena juniperina* (*Agaricales*, *Basidiomycota*), New for the Polish and Central European Mycobiota. Polish Botanical Journal 59 (1): 109–116. http://dx.doi.org/10.2478/pbj-2014-0008

Han SK, Oh SH, Kim HJ. 2010. Eight unrecorded higher fungi identified at the Korea National Arboretum. Mycobiology 38 (2): 81–88. http://dx.doi.org/10.4489/myco.2010.38.2.081

Harder CB, Læssøe T, Kjøller R, Frøslev TG. 2010. A comparison between ITS phylogenetic relation and morphological species recognition within *Mycena* section *Calodontes* in Northern Europe. Mycological progress 9: 395–405. http://dx.doi.org/10.1007/s11557-009-0648-7

Harder CB, Lodge DJ, Petersen RH, Hughes KW, Blanco JC, Frøslev TG, Læssøe T. 2011. Amyloidity is not diagnostic for species in the *Mycena pearsoniana* complex (*Mycena* sectio *Calodontes*). Mycological Progress: 1–8. http://dx.doi.org/10.1007/s11557-011-0782-x

Harder CB, Læssøe T, Frøslev TG, Ekelund F, Rosendahl S, Kjøller R. 2013. A three-gene phylogeny of the *Mycena pura* complex reveals 11 phylogenetic species and shows ITS to be unreliable for species identification. Fungal Biology 117: 764–775. http://dx.doi.org/10.1016/j.funbio.2013.09.004

Harttig U, Anke T, Scherer A, Steglich W. 1990. Leaianafulvene, a sesquiterpenoid fulvene derivative from cultures of *Mycena leaiana*. Phytochemistry 29 (12): 3942–3944. http://dx.doi.org/10.1016/0031-9422(90)85368-p

Hatanaka SI, Katayama H. 1975. L-y-propylideneglutamic acid and related compounds from *Mycena pura*. Phytochemistry 14 (5–6): 1434–1436. http://dx.doi.org/10.1016/s0031-9422(00)98647-3

Hautzel R, Anke H, Sheldrick WS. 1990. Mycenon, a new metabolite from a *Mycena* species TA 87202 (*Basidiomycetes*) as an inhibitor of isocitrate lyase. The Journal of Antibiotics 43 (10): 1240–1244. http://dx.doi.org/10.7164/antibiotics.43.1240

Hedger J, Lodge DJ, Dickson G, Gitay H, Laessøe T, Watling R. 1995. The BMS expedition to Cuyabeno, Ecuador: An introduction. Mycologist 9: 146–148. http://dx.doi.org/10.1016/s0269-915x(09)80002-5

Hemmes DE, Desjardin DE. 2002. Mushrooms of Hawaii - An Identification Guide. Ten speed press, California, 212 p.

Hennings P. 1901. Fungi Indiae Orientalis II. Hedwigia 40: 323–342.

Hering TF. 1982. Decomposing activity of basidiomycetes in forest litter. In: Frankland JC, Hedger JN, Swift MJ (eds.), Decomposer basidiomycetes: Their biology and ecology. Cambridge University Press, Cambridge, pp. 213–225.

Herring PJ. 1994. Luminous fungi. Mycologist 8 (4): 181–183. http://dx.doi.org/10.1016/s0269-915x(09)80193-6

Hibbett DS, Grimaldi D, Donoghue MJ. 1997a. Fossil mushrooms from miocene and cretaceous ambers and the evolution of homobasidiomycetes. American Journal of Botany 84 (7): 981–991. http://dx.doi.org/10.2307/2446289

Hibbett DS, Pine EM, Langer E, Langer G, Donoghue MJ. 1997b. Evolution of gilled mushrooms and puffballs inferred from ribosomal DNA sequences. Proceedings of the National Academy Sciences USA 94 (22): 12002–12006. http://dx.doi.org/10.1073/pnas.94.22.12002

Hibbett DS, Binder M, Wang Z, Goldman Y. 2003. Another fossil agaric from Dominican amber. Mycologia 95 (4): 685–687. http://dx.doi.org/10.2307/3761943

Hintikka V. 1970. Studies on white-rot humus formed by higher fungi in forest soils. Communicationes Instituti Forestalis Fenniae 69: 1–68.

Hitchcock P, Gray TRG, Frankland JC. 1997. Production of monoclonal antibody specific to *Mycena galopus* mycelium. Mycological Research 101 (9): 1051–1059. http://dx.doi.org/10.1017/s0953756297003602

Hoekstra EJ, Verhagen FJM, Field JA, Leer Ed WBD, Brinkman Th. UA. 1998. Natural production of chloroform by fungi. Phytochemistry 49 (1): 91–97. http://dx.doi.org/10.1016/s0031-9422(97)00984-9

Horak E. 1968. Synopsis generum Agaricalium. Beirträge zur Kryptogamenflora der Schweiz 13: 1–741.

Horak E. 1978. *Mycena rorida* (Fr.) Quél. and related species from the southern hemisphere. Berichte der Schweizerischen Gesellschaft 88: 20–29.

Horak E. 1980a. Indian *Boletales* and *Agaricales*, Revisions and New taxa. Sydowia 33: 88–110.

Horak E. 1980b. Taxonomy and distribution of two little known, monotypic genera of *Agaricales*: *Amparoina*, *Cystoagaricus*. Sydowia 33: 64–70.

Ing B. 1992. A provisional red data list of British fungi. Mycologist 6 (3): 124–128. http://dx.doi.org/10.1016/s0269-915x(09)80591-0

Isobe M, Takahashi H, Usami K, Hattori M, Nishigohri Y. 1994. Bioluminescence mechanism on new systems. Pure and Appilied Chemistry 66 (4): 765–772. http://dx.doi.org/10.1351/pac199466040765

Jaeger RJR, Spiteller P. 2010. Mycenaaurin A, an antibacterial polyene pigment from the fruiting bodies of *Mycena aurantiomarginata*. Journal of Natural Products 73 (8): 1350–1354. http://dx.doi.org/10.1021/np100155z

Jente R, Bosold F, Bäuerle J, Anke T. 1985. Tetra-acetylenic metabolites from *Mycena viridimarginata*. Phytochemistry 24 (3): 553–559. http://dx.doi.org/10.1016/s0031-9422(00)80765-7

Jin J, Hughes KW, Petersen RH. 2001. Phylogenetic relationship of *Panellus* (*Agaricales*) and related species based on morphology and ribosomal large subunit DNA sequences. Mycotaxon 79: 7–21.

Kauffman CH. 1917. Tennessee and Kentucky fungi. Mycologia 9 (3): 159–166. http://dx.doi.org/10.2307/3753332

Kaya A. 2006. Macrofungi from Andirin (Kahramanmaraş) District. Turkey Journal of Botany 30: 85–93.

Kirk PM, Cannon PF, Minter DW, Stalpers JA. (eds.). 2008. Dictionary of the Fungi, 10th edition. CAB International, Oxfordshire, UK, 771 p.

Kornerup A, Wanscher JH. 1978. Methuen handbook of colour, 3rd edition. Eyre Methuen, London, 252 p.

Kremer S, Sterner O, Anke T. 1992. Degradation of pentachlorophenol by *Mycena avenacea* TA 8480—identification of initial dechlorinated metabolites. Zeitschrift für Naturforschung *C* 47 (7–8): 561–566.

Kühner R. 1926. Contribution à l'étude des Hyménomycètes et spécialement des Agaricacés. Le Botaniste 17: 1–215.

Kühner R. 1930. Un nouveau groupe d'Agarics leucosporés. Bulletin Mensuel de la Société Linnéenne de Lyon 9: 67–72.

Kühner R. 1931. Utilisation de la réaction iodée dans la classification des *Mycena*. Bulletin Bimensuel de la Société Linnéenne de Lyon 16: 122–127.

Kühner R. 1938. Le Genre *Mycena*. Encyclopedie Mycologique 10: 1–710.

Kühner R. 1980. Les hyménomycètes agaricoïdes. Numéro special du Bulletin de la Société Linnéenne de Lyon 49: 1–1027.

Kummer P. 1871. Der Führer in die Pilzkunde. Verlag von C. Luppe's Bucchhandlung in Zerbst, 146 p. http://dx.doi.org/10.5962/bhl.title.50494

Lange J. 1914. Studies on the agarics of Denmark I. Dansk Botanisk Arkiv Udgivet Af Dansk Botanisk Forening 1 (5): 1–40.

Largent DL. 1973. How to Identify Mushrooms to Genus I: Macroscopic Features. Mad River Press Inc., Eureka, 148 p.

Largent DL, Johnson D, Watling R. 1977. How to Identify Mushrooms to Genus III: Microscopic Features. Mad River Press Inc., Eureka, 86 p.

Lindahl BD, Ihrmark K, Boberg J, Trumbore SE, Högberg P, Stenlid J, Finlay RD. 2007. Spatial separation of litter decomposition and mycorrhizal nitrogen uptake in a boreal forest. New Phytologist 173 (3): 611–620. http://dx.doi.org/10.1111/j.1469-8137.2006.01936.x

Lindeberg G. 1985. Stimulation of some litter-decomposing basidiomycetes by shikimic acid. Physiologia Plantarum 65 (1): 9–14. http://dx.doi.org/10.1111/j.1399-3054.1985.tb02351.x

Lodge DJ. 1988. Three new *Mycena* species (*Basidiomycota*: *Tricholomataceae*) from Puerto Rico. Transactions of the British Mycological Society 91 (1): 109–116. http://dx.doi.org/10.1016/s0007-1536(88)80011-1

Lodge DJ. 1996. Two undescribed species related to *Mycena ixoxantha* in Ecuador. Mycologist 10 (2): 56–57. http://dx.doi.org/10.1016/s0269-915x(96)80096-6

Lodge DJ, Perry BA, Desjardin DE. 2004. *Mycena* sect. *Hygrocyboideae* in the mountains of Dominican Republic. Memoirs of The New York Botanical Garden 89: 131–139.

Maas Geesteranus RA. 1978. Clamp connections at the cheilocystidia in *Mycena*. Persoonia 10 (1): 129–135.

Maas Geesteranus RA. 1985. Studies in Mycenas 177. Section *Radiatae* remodelled. Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen Series C 88: 413–417.

Maas Geesteranus RA. 1992a. Mycenas of the Northern Hemisphere. I. Studies in Mycenas and other papers. North-Holland, Amsterdam, 391 p.

Maas Geesteranus RA. 1992b. Mycenas of the Northern Hemisphere. II. Conspectus of the Mycenas of the Northern Hemisphere. North-Holland, Amsterdam, 493 p.

Maas Geesteranus RA. 1992c. Two new Mycenas of section *Insignes* from the Netherlands. Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen 95 (4): 469–472.

Maas Geesteranus RA. 1992d. Some Mycenae of the Himalayan foothills. Persoonia 15 (1): 33–53.

Maas Geesteranus RA. 1995. Three new European species of *Mycena*. Proceedings of the Koninklijke Nederlandse Akadademie van Wetenschappen 98 (1): 55–61.

Maas Geesteranus RA. 1997. *Mycena schildiana*, a new species from Italy. Persoonia 16 (3): 412–414.

Maas Geesteranus RA, Hausknecht A. 1994. *Mycena dura,* a new species of sect. *Calodontes* subsect. *Purae* from Austria. Österreichische Zeitschrift für Pilzkunde 3: 5–8.

Maas Geesteranus RA, Hausknecht A. 1995. *Mycena pallescens*, a new species of sect. *Fragilipedes* from La Réunion (France, Africa). Österreichische Zeitschrift für Pilzkunde 4: 51–54.

Maas Geesteranus RA, Hausknecht A. 1996. Two new *Mycena* species from La Réunion (France, Africa). Österreichische Zeitschrift für Pilzkunde 5: 237–243.

Maas Geesteranus RA, Hausknecht A. 1998. Two striking mycenas from the southern hemisphere. Österreichische Zeitschrift für Pilzkunde 7: 123–128.

Maas Geesteranus RA, Hausknecht A. 1999. A new *Mycena* of sect. *Hiemales* from La Réunion (France, Africa). Österreichische Zeitschrift für Pilzkunde 8: 1–3.

Maas Geesteranus RA, Horak E. 1993. *Mycena acrocephala*, a new member of section *Adonideae* from Sikkim. Persoonia 15 (3): 341–343.

Maas Geesteranus RA, Horak E. 1995. *Mycena* and related genera from Papua New Guinea and New Caledonia. Bibliotheca Mycologica 159: 143–229.

Maas Geesteranus RA, de Meijer AAR. 1997. Mycenae Paranaenses. Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen Afdeling Natuurkunde 97: 1–164.

Maas Geesteranus RA, de Meijer AAR. 1998. Further mycenas from the state of Paraná, Brazil. Persoonia 17 (1): 29–46.

Maas Geesteranus RA, Münzmay Th. 1997. *Mycena valida*, a new member of section *Fragilipedes* from Germany. Persoonia 16 (3): 415–417.

Maas Geesteranus RA, Ovrebo CL. 1997. A new species and a new section of *Mycena* from Costa Rica. Persoonia 16 (3): 393–395.

Manimohan P, Leelavathy KM. 1988a. New agaric taxa from southern India. Transactions of the British Mycological Society 91 (4): 573–576. http://dx.doi.org/10.1016/s0007-1536(88)80028-7

Manimohan P, Leelavathy KM. 1988b. *Mycena indica,* a new species from southern India. Mycologia 80 (6): 861–862. http://dx.doi.org/10.2307/3807569

Manimohan P, Leelavathy KM. 1989. Two new varieties of *Mycena alphitophora* from southern India. Mycological Research 93 (1): 118–120. http://dx.doi.org/10.1016/s0953-7562(89)80150-9

Manimohan P, Vrinda KB, Leelavathy KM. 1988. Rare agarics from Southern India. Kavaka 16: 50–56.

Manjula B. 1983. A revised list of the agaricoid and boletoid basidiomycetes from India and Nepal. Proceedings of the Indian Academy of Sciences (Plant Sciences) 92 (2): 81–213.

Matheny PB, Judd M, Curtis JM, Hofstetter V, Aime MC, Moncalvo JM, Ge ZW, Yang ZL, Slot JC, Ammirati JF, Baroni TJ, Bougher NL, Lodge DJ, Kerrigan RW, Seidl MT, Aanen DK, DeNitis M, Daniele GM, Desjardin DE, Kropp BR, Norvell LL, Parker A, Vellinga EC, Vilgalys R, Hibbett DS. 2006. Major clades of *Agaricales*: a multilocus phylogenetic overview. Mycologia 98 (6): 982–995. http://dx.doi.org/10.3852/mycologia.98.6.982

Matheny PB, Wang Z, Binder M, Curtis JM, Lim YW, Nilsson RH, Hughes KW, Hofstetter V, Ammirati JF, Schoch CL, Langer E, Langer G, McLaughlin DJ, Wilson AW, Frøslev T, Ge ZW,

Kerrigan RW, Slot JC, Yang ZL, Baroni TJ, Fischer M, Hosaka K, Matsuura K, Seidl MT, Vauras J, Hibbett DS. 2007. Contributions of *rpb2* and *tef1* to the phylogeny of mushrooms and allies (*Basidiomycota*, *Fungi*). Molecular Phylogenetics and Evolution 43: 430–451. http://dx.doi.org/10.1016/j.ympev.2006.08.024

McCracken DA, Dodd JL. 1971. Molecular structure of starch-type polysaccharides from *Hericium ramosum* and *Hericium coralloides*. Science 174 (4007): 419. http://dx.doi.org/10.1126/science.174.4007.419

Métrod G. 1949. Les Mycènes de Madagascar (*Mycena*, *Corrugaria*, *Pterospora*). Laboratoire de Cryptogamie du Museum National d'Histoire Naturelle, Paris, 146 p.

Miersch J, Penke D, Robich G. 2006. *Mycena handkeana*, a new member of section *Fragilipedes* from Germany. Österreichische Zeitschrift für Pilzkunde 15: 181–186.

Miersch J, Rödel T. 2011. *Mycena plicatula*, eine neue Art von der Insel La Réunion (Frankreich, Afrika). Österreichische Zeitschrift für Pilzkunde 20: 5–12.

Milata V. 2008. Naturally occurring enolethers. Acta Chimica Slovaca 1 (1): 221–237.

Mitchel DH, Smith AH. 1978. Notes on Colorado Fungi III: new and interesting mushrooms from the Aspen Zone. Mycologia 70 (5): 1040–1063. http://dx.doi.org/10.2307/3759137

Miyamoto T, Cha JY, Igarashi T. 1996. A new record of *Mycena picta* from Japan. Mycoscience 37: 463–466. http://dx.doi.org/10.1007/bf02461005

Miyamoto T, Igarashi T, Takahashi K. 1998. Notes on three species of *Mycena* new to Japan from *Picea* forests of Hokkaido. Mycoscience 39 (3): 337–342. http://dx.doi.org/10.1007/bf02464018

Miyamoto T, Igarashi T, Takahashi K. 2000. Lignin-degrading ability of litter-decomposing basidiomycetes from *Picea* forests of Hokkaido. Mycoscience 41 (2): 105–110. http://dx.doi.org/10.1007/bf02464317

Mohanan C. 2011. Macrofungi of Kerala. KFRI Handbook No. 27, Kerala Forest Research Institute, India, 597 p.

Moncalvo JM, Lutzoni FM, Rehner SA, Johnson J, Vilgalys R. 2000. Phylogenetic relationships of agaric fungi based on nuclear large subunit ribosomal DNA sequences. Systematic Biology 49 (2): 278–305. http://dx.doi.org/10.1093/sysbio/49.2.278

Moncalvo JM, Vilgalys R, Redhead RA, Johnson JE, James TY, Aime MC, Hofstetter V, Verduin SJW, Larsson E, Baroni TJ, Thorn RG, Jacobsson S, Clémençon H, Miller Jr OK. 2002. One hundred and seventeen clades of euagarics. Molecular Phylogenetics and Evolution 23: 357–400. http://dx.doi.org/10.1016/s1055-7903(02)00027-1

Moreno G, Heykoop M. 1998. *Mycena cistophila*, a new mediterranean species from Spain. Österreichische Zeitschrift für Pilzkunde 7: 29–32.

Moreno G, Heykoop M. 2002. *Mycena pseudopicta* (J.E. Lange) Kühner, a rare graminicolous species growing on Poaceae. Revista Catalana de Micologia 24: 271–275. http://publicacions.iec.cat/repository/pdf/00000167%5C00000057.pdf

Moreno G, Heykoop M, de la Osa LR. 1998. *Mycena gladiocystis*, a rare foliicolous species growing on Quercus ilex. Österreichische Zeitschrift für Pilzkunde 8: 9–13. http://www.landesmuseum.at/pdf_frei_remote/OestZPilz_8_0009-0013.pdf

Mori K, Kojima S, Maki S, Hirano T, Niwa H. 2011. Bioluminescence characteristics of the fruiting body of *Mycena chlorophos*. Luminescence 26 (6): 604–610. http://dx.doi.org/10.1002/bio.1280

Murrill WA. 1912. The Agaricaceae of Tropical North America: V. Mycologia 4 (2): 72–83. http://dx.doi.org/10.2307/3753543

Murrill WA. 1916a. *Pleurotus, Omphalia, Mycena*, and *Collybia* Published in North American Flora. Mycologia 8 (4): 218–221. http://dx.doi.org/10.2307/3753527

Muskett AE, Cairns H, Carrothers EN, Muskett NE. 1934/1935. Further contributions to the fungus flora of Ulster. Proceedings of the Royal Irish Academy, Section B: Biological, Geological, and Chemical Science 42: 41–54.

Natarajan K, Narayanan K, Ravindran C, Kumaresan V. 2005. Biodiversity of agarics from Nilgiri Biosphere Reserve, Western Ghats, India. Current Science 88 (12): 1890–1893.

Niitsu H, Hanyuda N. 2000. Fruit body production of a luminous mushroom, *Mycena chlorophos*. Mycoscience 41: 559–564. http://dx.doi.org/10.1007/bf02460921

Niitsu H, Hanyuda N, Sugiyama Y. 2000. Cultural properties of a luminous mushroom, *Mycena chlorophos*. Mycoscience 41: 551–558. http://dx.doi.org/10.1007/bf02460920

Niveiro N, Popoff O, Desjardin DE, Albertó E. 2012. *Mycena moconensis*, a new species in section *Polyadelphia* from Argentina. Mycotaxon 119: 167–173. http://dx.doi.org/10.5248/119.167

O'Brien HE, Parrent JL, Jackson JA, Moncalvo JM, Vilgalys R. 2005. Fungal community analysis by large-scale sequencing of environmental samples. Applied and Environmental Microbiology 71: 5544–5550. http://dx.doi.org/10.1128/aem.71.9.5544-5550.2005

O'Kane DJ, Lingle WL, Porter D, Wampler JE. 1990. Localization of bioluminescent tissues during basidiocarp development in *Panellus stypticus*. Mycologia 82 (5): 595–606. http://dx.doi.org/10.2307/3760050

Ogura-Tsujita Y, Gebauer G, Hashimoto T, Umata H, Yukawa T. 2009. Evidence for novel and specialized mycorrhizal parasitism: the orchid *Gastrodia confusa* gains carbon from saprotrophic *Mycena*. Proceedings of the Royal Society Biological sciences B 276: 761–767. http://dx.doi.org/10.1098/rspb.2008.1225

Osono T. 2003. Effects of prior decomposition of beech leaf litter by phyllosphere fungi on substrate utilization by fungal decomposers. Mycoscience 44 (1): 41–45. http://dx.doi.org/10.1007/s10267-002-0078-8

Osono T, Takeda H. 2001. Organic chemical and nutrient dynamics in decomposing beech leaf litter in relation to fungal ingrowth and succession during three year decomposition processes in a cool temperate deciduous forest in Japan. Ecological Research 16 (4): 649–670. http://dx.doi.org/10.1046/j.1440-1703.2001.00426.x

Osono T, Takeda H. 2002. Comparison of litter decomposing ability among diverse fungi in a cool temperate deciduous forest in Japan. Mycologia 94 (3): 421–427. http://dx.doi.org/10.2307/3761776

Osono T, Fukasawa Y, Takeda H. 2003. Roles of diverse fungi in Larch needle-litter decomposition. Mycologia 95 (5): 820–826. http://dx.doi.org/10.2307/3762010

Pegler DN. 1977. A preliminary agaric flora of East Africa. Kew Bulletin Additional Series 6, London, 615 p.

Pegler DN. 1983. Agaric flora of the Lesser Antilles. Kew Bulletin Additional Series 9, London, 668 p.

Pegler DN. 1986. Agaric flora of Sri Lanka. Kew Bulletin Additional Series 12, London, 519 p.

Pegler DN. 1990. *Agaricales* of Brazil Described by J. P. F. C. Montague. Kew Bulletin 45 (1): 161–177. http://dx.doi.org/10.2307/4114445

Pegler DN, Young TWK. 1971. Basidiospore morphology in the *Agaricales*. Beihefte zur Nova Hedwigia 35: 1–210.

Perry BA, Desjardin DE. 1999. "*Mycena californiensis*" resurrected. Mycotaxon 70: 495–505.

Persoon CH. 1797. Tentamen Dispositionis Methodicae Fungorum in Classes, Ordines Genera et Familias. Leipzig, 76 p. http://dx.doi.org/10.5962/bhl.title.42674

Persoon CH. 1801. Synopsis Methodica Fungorum, 2 parts. Göttingen, 706 p.

Peters S, Spiteller P. 2006. Chloro- and bromophenols from cultures of *Mycena alcalina*. Journal of Natural Products 69 (12): 1809–1812. http://dx.doi.org/10.1021/np0603368

Peters S, Spiteller P. 2007. Sanguinones A and B, blue pyrroloquinoline alkaloids from the fruiting bodies of the mushroom *Mycena sanguinolenta*. Journal of Natural Products 70 (8): 1274–1277. http://dx.doi.org/10.1021/np070179s

Peters S, Jaeger RJR, Spiteller P. 2008. Red pyrroloquinoline alkaloids from the mushroom *Mycena haematopus*. European Journal of Organic Chemistry 2008 (2): 319–323. http://dx.doi.org/10.1002/ejoc.200700739

Petersen RH, Hughes KW, Lickey EB, Kovalenko AE, Morozova OV, Psurtseva NV. 2008. A new genus, *Cruentomycena*, with *Mycena viscidocruenta* as type species. Mycotaxon 105: 119–136.

Poinar GO Jr., Singer R. 1990. Upper Eocene gilled-mushroom from the Dominican Republic. Science 248: 1099–1101. http://dx.doi.org/10.1126/science.248.4959.1099

Rao DV, Tewari JP. 1987. Production of oxalic acid by *Mycena citricolor*, causal agent of the American leaf spot of coffee. Phytopathology 77: 780–785. http://dx.doi.org/10.1094/phyto-77-780

Rao DV, Tewari JP. 1989. Occurrence of magnesium oxalate crystals on lesions incited by *Mycena citricolor* on coffee. Phytopathology 79: 783–787. http://dx.doi.org/10.1094/phyto-79-783

Rassi P, Kaipiainen H, Mannerkoski H, Stahls G. 1992. Uhanalaisten eläinten ja kasvien seurantatoimikunnan mietintö (Report on the monitoring of threatened animals and plants in Finland). Ympäristöministeriö. Helsinki.

Redhead SA. 1984. Two fern-associated mushrooms, *Mycena lohwagii* and *M. pterigena*, in Canada. Le Naturaliste Canadien 111: 439–442.

Redhead SA. 1987. The *Xerulaceae* (*Basidiomycetes*), a family with sarcodimitic tissues. Canadian Journal of Botany 65 (8): 1551–1562. http://dx.doi.org/10.1139/b87-214

Redhead SA, Norvell LL. 1993. *Mycena gaultheri* rediscovered after 50 years. Mycotaxon 46: 97–104.

Redhead SA, Moncalvo JM, Vilgalys R, Desjardin DE, Perry BA. 2012. Index Fungorum 14:1. IF550101

Reijnders AFM. 1963. Les Problèmes du Développement des Carpophores des *Agaricales* et de quelques groupes voisins, W. Junk, Den Haag, 412 p.

Robich G. 1996. On a new species of *Mycena* from Spain. Persoonia 16 (2): 245–248.

Robich G. 2003. *Mycena* d' Europa. Associazione Micologica Bresadola, Fondazione Centro Studi Micologici. Trento, Vicenza, 728 p.

Robich G. 2006a. A revised key to the species of *Mycena* section *Fragilipedes* of the Northern Hemisphere. Persoonia 19 (1): 1–43.

Robich G. 2006b. *Mycena borellae* e *M. bambusae-pygmacea*, due nuove specie dall'Italia. Revista di Micologia 49 (3): 195–203.

Robich G. 2009. *Mycena albidoaquosipes*, a new species of section *Filipedes* (*Agaricales*,*Tricholomataceae*) from Austria. Österreichische Zeitschrift für Pilzkunde 18: 47–51.

Robich G, Hausknecht A. 2001. *Mycena mauritiana*, a new species of section *Roridae*. Österreichische Zeitschrift für Pilzkunde 10: 75–82.

Robich G, Hausknecht A. 2008. *Mycena dobraensis*, a new species of section *Filipedes* (*Agaricales*, *Tricholomataceae*) from Eastern Austria. Österreichische Zeitschrift für Pilzkunde 17: 41–46.

Robich G, Hausknecht A. 2009. *Mycena bhuglooi*, a new species of section *Sacchariferae* (*Agaricales*, *Tricholomataceae*) from Mauritius (Africa). Österreichische Zeitschrift für Pilzkunde 18: 7–14. http://www.landesmuseum.at/pdf_frei_remote/OestZPilz_18_0007-0014.pdf

Robich G, Miersch J, Karasch P. 2005. *Mycena haushoferi,* a new species of section *Intermediae* from Germany. Mycological Progress 4 (3): 257–264. http://dx.doi.org/10.1007/s11557-006-0129-1

Ronikier A. 2003. New record and distribution of *Mycena oregonensis* (*Agaricales, Basidiomycetes*) in Europe. Polish Botanical Journal 48 (2): 127–130. http://bomax.botany.pl/pubs/data/article_pdf?id=797

Ronikier A, Chachula P, Kujawa A. 2006. *Mycena tenuispinosa* (*Fungi*, *Agaricales*), a species new to Poland. Polish Botanical Journal 51 (2): 217–220. http://bomax.botany.pl/pubs/data/article_pdf?id=1745

Rosa AL, Saitta A, Compagno R, Venturella G. 2012. *Mycena pseudoinclinata*, new to Italy. Mycotaxon 120 (1): 133–137. http://dx.doi.org/10.5248/120.133

Roussel de HFA. 1806. Flore du Calvados et des terreins adjacens, composée suivant la méthode de M. Jussieu, 2nd edition, F. Poisson, 371 p. http://babel.hathitrust.org/cgi/pt?id=hvd.32044106411366;view=1up;seq=5

Saito T. 1957. Chemical changes in the beech litter under microbial decomposition. Ecological Review 14: 209–216.

Sarwal BM, Rawla GS. 1983. *Mycena indica* sp.nov. from India. Current Science 52: 564–565.

Sathe AV, Rahalkar SR. 1975. *Agaricales* from South West India-I. Biovigyanam 1 (1): 75–78.

Sathe AV, Sasangan KC. 1977. *Agaricales* from South-West India III. Biovigyanam 3 (1): 119–121.

Segedin BP. 1991. Studies in the *Agaricales* of New Zealand: some *Mycena* species in sections *Longisetae*, *Polyadelphia*, *Rubromarginatae*, *Galactopoda*, *Lactipedes* and *Calodontes*. New Zealand Journal of Botany 29 (1): 43–62. http://dx.doi.org/10.1080/0028825x.1991.10415542

Servi H, Akata I, Çetin B. 2010. Macrofungal diversity of Bolu Abant Nature Park (Turkey). African Journal of Biotechnology 9 (24): 3622–3628.

Sesli E. 2007. Preliminary checklist of macromycetes of the East and Middle Black Sea regions of Turkey. Mycotaxon 99: 71–74. http://www.mycotaxon.com/resources/checklists/sesli-v99-checklist.pdf

Shen JW, Ruan Y, Bing-Ji M. 2009. Diterpenoids of macromycetes. Journal of Basic Microbiology 49 (3): 242–255. http://dx.doi.org/10.1002/jobm.200800102

Shih YS, Chen CY, Lin WW, Kao HW. 2014. *Mycena kentingensis*, a new species of luminous mushroom in Taiwan, with reference to its culture method. Mycological Progress 13 (2): 429–435. http://dx.doi.org/10.1007/s11557-013-0939-x

Singer R. 1943. Das System der *Agaricales*. III. Annales Mycologici 41: 1–189

Singer R. 1951. The *Agaricales* (Mushroom) in Modern Taxonomy. Lilloa 22: 5–832.

Singer R. 1958. New genera of fungi VIII. Notes concerning the sections of the genus *Marasmius* Fr. Mycologia 50: 103–110.

Singer R. 1962a. The *Agaricales* in Modern Taxonomy, 2nd edition. J. Cramer, Weinheim, 915 p.

Singer R. 1962b. Diagnoses fungorum novorum Agaricalium II. Sydowia 15: 45–83.

Singer R. 1975a. Interesting and new species of basidiomycetes from Ecuador. Reprint of two parts, J. Cramer, Vaduz, 246 p.

Singer R. 1975b. The *Agaricales* in Modern Taxonomy, 3rd edition. F. Cramer, Vaduz, 912 p.

Singer R. 1986. The *Agaricales* in Modern Taxonomy, 4th edition. Koeltz Scientific Books, Koenigstein, 981 p.

Singer R. 1987. *Mycena theobromicola* (Murr.) Dennis, a fungus associated with cocoa pod rot. Mycologia 79 (3): 463–464. http://dx.doi.org/10.2307/3807472

Sivinsky J. 1981. Arthropods attracted to luminous fungi. Psyche 88 (3–4): 383–390. http://dx.doi.org/10.1155/1981/79890

Smith AH. 1937. Flora Agaricina Danica. Mycologia 29 (4): 554–556. http://dx.doi.org/10.2307/3754334

Smith AH. 1944. Interesting North American agarics. Bulletin of the Torrey Botanical Club 71 (4): 390–409. http://dx.doi.org/10.2307/2481312

Smith AH. 1947. North American Species of *Mycena*. University of Michigan Press, Ann Arbor, 521 p.

Smith AH. 1965. New and unusual basidiomycetes with comments on hyphal and spore wall reactions with Melzer's solution. Mycopathology and Mycological Applications 26: 385–402. http://dx.doi.org/10.1007/bf02049566

Stevenson G. 1964. The *Agaricales* of New Zealand: V. Kew Bulletin 19 (1): 1–59. http://dx.doi.org/10.2307/4108283

Suay I, Arenal F, Asensio FJ, Basilio A, Cabello MA, Diez MT, García JB, del Val AG, Gorrochategui J, Hernández P, Peláez F, Vicente MF. 2000. Screening of basidiomycetes for antimicrobial activities. Antonie van Leeuwenhoek 78: 129–139. http://dx.doi.org/10.1023/a:1026552024021

Swarts HJ, Teunissen PJM, Verhagen FJM, Field JA, Wijnberg JBPA. 1997. Chlorinated anisyl metabolites produced by basidiomycetes. Mycological Research 101 (3): 372–374. http://dx.doi.org/10.1017/s0953756296003036

Swift MJ. 1982. Basidiomycetes as component of forest ecosystem. In Frankland JC, Hedger JN, Swift MJ. (eds.), Decomposer Basidiomycetes: Their biology and ecology. Cambridge University Press, Cambridge, pp. 307–338.

Takahashi H. 1999. *Mycena auricoma,* a new species of *Mycena* section *Radiatae* from Japan, and *Mycena spinosissima,* a new record in Japan. Mycoscience 40 (1): 73–80. http://dx.doi.org/10.1007/bf02465677

Takahashi H. 2000. Two new species of *Mycena* from eastern Honshu, Japan. Mycoscience 41 (6): 545–549. http://dx.doi.org/10.1007/bf02460919

Takahashi H. 2007. Eight new species of the genus *Mycena* from central Honshu, Japan. Mycoscience 48 (6): 342–357. http://dx.doi.org/10.1007/s10267-007-0376-2

Tanaka I, Hongo T. 2003. Two new records of *Mycena* sect. *Sacchariferae* from Japan and type study of *Mycena cryptomeriicola* (sect. *Sacchariferae*). Mycoscience 44 (6): 421–424. http://dx.doi.org/10.1007/s10267-003-0134-z

Tewari JP, Browne LM, Ayer WA. 1984. The American leaf spot of Coffee. University of Alberta Agriculture and Forestry Bulletin 7: 66–68.

Thiers B. [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/

Thiers HD. 1958. The agaric flora of Texas. II. New taxa of white- and pink-spored agarics. Mycologia 50 (4): 514–523. http://dx.doi.org/10.2307/3756114

Trivedi TK. 1972. *Agaricales* of Nagpur-I. Botanique 3: 53–54.

Vahidi H, Kobarfard F, Namjoyan F. 2004. Effect of cultivation conditions on growth and antifungal activity of *Mycena leptocephala*. African Journal of Biotechnology 3 (11): 606–609. http://www.academicjournals.org/AJB

Vellinga EC. 1988. Glossary. In: Bas C, Kuyper ThW, Noordeloos ME, Vellinga EC (eds.) Flora Agaricina Neerlandica, vol 1. A. A. Balkema, Rotterdam, pp. 54–64.

Verhagen FJM, Swarts HJ, Kuyper TW, Wijnberg JBPA, Field JA. 1996. The ubiquity of natural adsorbable organic halogen production among basidiomycetes. Applied Microbiology and Biotechnology 45 (5): 710–718. http://dx.doi.org/10.1007/s002530050752

Villarreal M, Esteve-Raventós F. 1999. *Mycena conicoalba*, a new corticolous species from Spain. Österreichische Zeitschrift für Pilzkunde 8: 15–18.

Villarreal M, Esteve-Raventos F. 2000. *Mycena roseoquercina*, a new foliicolous species of *Quercus ilex*. Österreichische Zeitschrift für Pilzkunde 9: 23–26.

Villarreal M, Francisco A, Victor R. 2002. *Mycena pinophila*, a new species of *Mycena* section *Polyadelphia* from Spain. Mycotaxon 84: 331–336.

Villarreal M, Heykoop M, Maas Geesteranus RA. 1999. Further new species of *Mycena* from Spain II. Persoonia 17 (2): 235–244.

Villarreal M, Heykoop M, Esteve-Raventós F, Maas Geesteranus RA. 1998. Further new species of *Mycena* and a new section from Spain. Persoonia 16 (4): 527–535. http://www.repository.naturalis.nl/document/570208

Vydryakova GA, Gusev AA, Medvedeva SE. 2011. Effect of organic and inorganic toxic compounds on luminescence of luminous fungi. Applied Biochemistry and microbiology 47 (3): 293–297. http://dx.doi.org/10.1134/s0003683811010194

Walther V, Rexer KH, Kost G. 2001. The ontogeny of the fruit bodies of *Mycena stylobates*. Mycological Research 105 (6): 723–733. http://dx.doi.org/10.1017/s0953756201004038

Watling R, Gregory NM. 1980. Larger fungi from Kashmir. Nowa Hedwigia 32: 494–564.

Watling R, Turnbull E. 1998. *Cantherellaceae*, *Gomphaceae* and amyloid spored and xeruloid members of *Tricholmataceae* (excl. *Mycena*), British Fungus Flora-Agarics and Boleti 8. Royal Botanic Garden, Edinburgh, 189 p.

Weitz HJ, Ballard AL, Campbell CD, Killham K. 2001. The effect of culture conditions on the mycelial growth and luminescence of naturally bioluminescent fungi. FEMS Microbiology Letters 202 (2): 165–170. http://dx.doi.org/10.1111/j.1574-6968.2001.tb10798.x

Weitz HJ, Campbell CD, Killham K. 2002. Development of a novel, bioluminescence-based, fungal bioassay for toxicity testing. Environmental Microbiology 4 (7): 422–429. http://dx.doi.org/10.1046/j.1462-2920.2002.00315.x

Yamashita S, Hijii N. 2004. Relationship between seasonal appearance and longevity of fruit bodies of *Agaricales* and meteorological factors in a Japanese red pine forest. Journal of Forest Research 9 (2): 165–171. http://dx.doi.org/10.1007/s10310-003-0072-9

Yamashita S, Hijii N. 2006. Spatial distribution of the fruiting bodies of *Agaricales* in a Japanese red pine (*Pinus densiflora*) forest. Journal of Forest Research 11 (3): 181–189. http://dx.doi.org/10.1007/s10310-006-0204-0

Zamora JC, Català S. 2012. A new species of *Mycena* sect. *Saccharíferae* from the Iberian cushion-shaped *Genisteae*. Mycotaxon 122 (1): 361–368. http://dx.doi.org/10.5248/122.361

Zapf S, Werle A, Anke T, Klostermeyer D, Steffan B, Steglich W. 1995. 9-Methoxystrobilurins—A link between strobilurins and oudemansins. Angewandte Chemie 34 (2): 196–198. http://dx.doi.org/10.1002/anie.199501961

Zhang L, Chen J, Yali L, Gao C, Guo S. 2012. *Mycena* sp., a mycorrhizal fungus of the orchid *Dendrobium Officinale*. Mycological Progress 11 (2): 395–401. http://dx.doi.org/10.1007/s11557-011-0754-1

Zheng GYBL. 1986. Taxonomic studies on *Mycena* from Guangdong province of China. Acta Mycologica Sinica 6 (1): 8–14.

Zheng D, Olaya G, Köller W. 2000. Characterization of laboratory mutants of *Venturia inaequalis* resistant to the strobilurin-related fungicide kresoxim-methyl. Current Genetics 38: 148–155. http://dx.doi.org/10.1007/s002940000147

Index to names

Genera

Subgenera

Sections

Mycenas of Kerala

This treatise presents the results of a conventional morphology-based study on the diversity and taxonomy of the agaric genus *Mycena* (Mycenaceae, Agaricales, Basidiomycota, Fungi) as it occurs in Kerala State, India. A total of 50 species belonging to the genus that occur in Kerala are fully described. Keys are provided, wherever applicable, to sections, subsections and species of the genus encountered in Kerala. Species descriptions are supplemented with synonymy, author citations, collection data, and information on their known distribution. Photographs of basidiomata are given for all species. These are supplemented with habit sketches and line drawings of all the microscopic characters observed. In addition, an overview of the genus *Mycena* including its taxonomy, biology, ecology, economic importance and geographic distribution is provided. A synopsis of the infrageneric taxonomy of the genus also is presented.

The Authors

Dollymol Aravindakshan is currently a post-doctoral fellow at the University of Calicut, Kerala, India.

Patinjareveettil Manimohan is Professor at the University of Calicut.

SporePrint Books
Calicut, Kerala, India