Acta bot. bras. 22(1): 287-299. 2008

Agaricaceae Fr. (Agaricales, Basidiomycota) from areas of Atlantic Forest in Pernambuco, Brazil[1]

Felipe Wartchow[2,4], Jair Putzke[3] and Maria Auxiliadora de Queiroz Cavalcanti[2]

Received: July 20, 2006. Accepted: June 4, 2007

RESUMO – (Agaricaceae Fr. (Agaricales, Basidiomycota) em áreas de Mata Atlântica do Estado de Pernambuco, Brasil). O levantamento de Agaricaceae em áreas de Mata Atlântica na região metropolitana de Recife, Pernambuco, Brasil, revelou a ocorrência de nove espécies: *Agaricus* aff. *parasilvaticus* Heinem., *A. purpurellus* (F.H. Møller) F.H. Møller, *A. rufoaurantiacus* Heinem., *Leucoagaricus sulphurellus* (Pegler) B.P. Akers, *Leucocoprinus cretaceus* (Bull.: Fr.) Locq., *L. fragilissimus* (Ravenel) Pat., *Lepiota elaiophylla* Vellinga & Huijser, *L. erythrosticta* (Berk. & Broome) Sacc. e *Micropsalliota brunneosperma* (Singer) Pegler. Chave para identificação dessas espécies, descrições, ilustrações e comentários são apresentadas. *Micropsalliota brunneosperma* constitui nova referência para o Brasil.

Palavras-chave: Agaricales, neotrópicos, Nordeste Brasileiro, taxonomia

ABSTRACT – (Agaricaceae Fr. (Agaricales, Basidiomycota) from areas of Atlantic forest in Pernambuco State, Brazil). The survey of Agaricaceae in areas of the Atlantic Forest in the metropolitan region of Recife, state of Pernambuco, Brazil, revealed the presence of nine species: *Agaricus* aff. *parasilvaticus* Heinem., *A. purpurellus* (F.H. Møller) F.H. Møller, *A. rufoaurantiacus* Heinem., *Leucoagaricus sulphurellus* (Pegler) B.P. Akers, *Leucocoprinus cretaceus* (Bull.: Fr.) Locq., *L. fragilissimus* (Ravenel) Pat., *Lepiota elaiophylla* Vellinga & Huijser, *L. erythrosticta* (Berk. & Broome) Sacc. and *Micropsalliota brunneosperma* (Singer) Pegler. A key for identification of these species, descriptions, drawings and remarks are provided. *Micropsalliota brunneosperma* is reported for the first time for Brazil.

Key words: Agaricales, Neotropics, Northeast Brazil, taxonomy

Introduction

Agaricaceae Fr. *sensu* Singer (1986) includes 25 genera, most of them distributed over several continents and organized in four tribes: Leucocoprinae Singer, Agariceae Pat., Lepiotae Fayod and Cystodermatae Singer. According to Kirk *et al.* (2001), this family comprises 51 genera and 918 species, including several genera with gasteroid and secotioid basidiomata. Although some authors have considered species with light and those with dark spores to lie in two distinct families (Smith 1973; Bon 1993), molecular studies confirm the monophyly of this group, except for Cystodermateae (Johnson & Vilgalys 1998; Vellinga 2004a).

Some changes in this family occurred after Singer (1986): the revaluation of *Rugosospora* Heinem. (Guzmán *et al.* 1989; Franco-Molano 1995); the exclusion of the tribe Cystodermatae from Agaricaceae (Johnson & Vilgalys 1998; Vellinga 2004a); the inclusion of *Coprinus comatus* (O.F. Müll.: Fr.) Pers., *C. sterquilinus* (Fr.: Fr.) Fr. and *C. spadiceisporus* Bogart in this family (Redhead *et al.* 2001); the synonymization of *Macrolepiota* Singer section *Laevistipedes* (Pázmány) Bon with *Chlorophyllum* Massee (Vellinga 2002, 2003a; Vellinga & de Kok 2002; Vellinga *et al.* 2003); the synonymization of *Volvolepiota* Singer with *Macrolepiota* (Vellinga & Yang 2003; Vellinga *et al.* 2003); the transfer of *Melanophyllum* Velen. to the same clade as *Lepiota* (Pers.) Gray (Vellinga 2003b); the inclusion of the gasteroid genera of Lycoperdales and Tulostomatales (Agerer 2002; Moncalvo *et al.* 2002; Vellinga 2004a); the transfer of *Cystoagaricus* Singer to Psathyrellaceae (Singer) Redhead, Moncalvo & Vilgalys (Vellinga 2004a); and the confirmation of the

[1] Parte da Dissertação de Mestrado do primeiro Autor

[2] Universidade Federal de Pernambuco, Departamento de Micologia, Centro de Ciências Biológicas, Av. Prof. Nelson Chaves, s.n., 50670-901 Recife, PE, Brazil

[3] Universidade de Santa Cruz do Sul, Departamento de Biologia, 96815-900 Santa Cruz do Sul, RS, Brazil

[4] Corresponding author: fwartchow@yahoo.com.br

monophyly of *Leucoagaricus* (Locq.) ex Singer, *Leucocoprinus* Pat. and *Sericeomyces* Heinem., which can be treated as a single genus (Vellinga 2004a).

The earliest records of Agaricaceae in Brazil were published by Montagne (1856), who described several species of *Agaricus sensu lato*, most of them now synonymized in other genera of Agaricales not currently included in Agaricaceae (Pegler 1990). During the twentieth century and in the present one, several works reported Agaricaceae from various Brazilian States: Theissen (1912), Singer (1953), Rick (1961), Raithelhuber (1987a; b; 1988), Franco-Molano (1995), Pereira (1998; 2000), Spielmann & Putzke (1998), Sobestiansky (2005) and Albuquerque *et al.* (2006) from Rio Grande do Sul; Heim (1957) and Pereira (1998) from Santa Catarina; Jezek (1973) from Rio de Janeiro; Bononi *et al.* (1981a; b; 1984), Grandi *et al.* (1984), Pegler (1997), Capelari & Gimenes (2004) and Capelari *et al.* (2006) from São Paulo; Capelari & Maziero (1988) from Rondônia; Singer (1973; 1989) and Singer & Aguiar (1986) from Amazonas and Pará; Muchovej *et al.* (1991) from Minas Gerais; Bononi (1992) from Acre; Heinemann & de Meijer (1996) and de Meijer (2001; 2006) from Paraná; Heinemann (1989; 1993) from Mato Grosso, Paraná, Rio de Janeiro and São Paulo. In Northeast Brazil, Kimbrough *et al.* (1994; 1995) reported *Chlorophyllum molybdites* (G. Mey.: Fr.) Massee, *Lepiota eyrthrosticta* (Berk. & Broome) Sacc. and *L. teipeitensis* Murrrill, and Maia *et al.* (2002) referred *Agaricus purpurellus* (F.H. Møller) F.H. Møller, *A. brunneostictus* Heinem., *Leucoagaricus meleagris* (J. Sowerby: Fr.) Singer [as *Leucocoprinus meleagris* (J. Sowerby) Locq.] and *Micropsalliota roseovinacea* Pegler (as "*M. roseovinaceus*"), all from Pernambuco.

This work presents species of *Agaricus* L.: Fr., *Leucoagaricus*, *Leucocoprinus*, *Lepiota* and *Micropsalliota* Höhn., collected in areas of Atlantic Forest of the metropolitan region of Recife, Pernambuco, Brazil.

Material and methods

Basidiomata were collected at the "Parque Estadual de Dois Irmãos" (7°55'43 S and 35°00'59" W), with 388 ha in the Municipality of Recife and at the "Reserva Ecológica da Mata do Sistema Gurjaú" (8°14'21" S and 35°03'00" W), with 1077 ha in the Municipality of Cabo de Santo Agostinho, both in Pernambuco State, Brazil (Secretaria Estadual de Ciência, Tecnologia e Meio Ambiente 2001) on July and August 2003, February and May to August 2004.

Usual techniques for the study of agarics were used (Singer 1986), and the colours of the basidiomata were named using Maerz & Paul (1950). The "Q" values represent the quotient of the length/width of the basidiospores, and for each specimen at least 20 were measured. For identification of species, Pegler (1972; 1977; 1983; 1986), Pegler & Rayner (1969), Heinemann (1961; 1977; 1983; 1989; 1993), Candusso & Lanzoni (1990) and Vellinga & Huijser (1997) were used.

The specimens studied were deposited at the Herbarium URM ("Departamento de Micologia, Universidade Federal de Pernambuco") and Herbarium HCB ("Departamento de Biologia, Universidade de Santa Cruz do Sul").

Results and discussion

Key to species of Agaricaceae known from areas of Atlantic Forest in Pernambuco State

1. Basidiospores pigmented 2
   2. Basidiospores dark green; endosporium thickening at the apex; cheilocystidia elongate and capitate ..... 9. *Micropsalliota brunneosperma*
   2. Basidiospores brown; endosporium not thickening at the apex; cheilocystidia clavate to piriform 3
      3. Universal veil well developed and persistent on the pileus and stipe; pileus with orange-brown squamules on its surface ..... 3. *Agaricus rufoaurantiacus*
      3. Universal veil not well developed on the pileus and stipe surfaces; pileus surface with purplish or light brown squamules 4
         4. Pileus with numerous, light brown squamules; stipe base without any evidence of colour change to yellow on handling ..... 1. *Agaricus* aff. *parasilvaticus*
         4. Pileus with purplish brown squamules; stipe base changing to yellow on handling ..... 2. *Agaricus purpurellus*

1. Basidiospores hyaline 5
5. Basidiospores dextrinoid, with metachromatic endosporium 6
6. Pileus surface strongly sulcate; context very thin or translucent; lamellae colour not changing when bruising; pleurocystidia absent 7
7. Basidioma sub-deliquescent, very thin and fragile; pileus surface with yellow squamules; basidiospores ellipsoid 10-12.5×7.5-8.8 µm, with the apical region short cylindrical ..... 6. *Leucocoprinus fragilissimus*
7. Basidioma not deliquescent; pileal surface with white, floccose squamules, at least when young; basidiospores ellipsoid 6.2-10×5-7.5 µm, without short cylindrical apical region ..... 5. *Leucocoprinus cretaceus*
6. Pileus surface not, or only indistinctly sulcate; context thick; lamellae color changing to bluish green when bruising; pleurocystidia present ..... 4. *Leucoagaricus sulphurellus*
5. Basidiospores dextrinoid, but endosporium not metachromatic 8
8. Basidiospores not truncate, ellipsoid to sub cylindrical; pileal surface sulphur-yellow with brown squamules ..... 7. *Lepiota elaiophylla*
8. Basidiospores spurred with truncate base; pileal surface white with pinkish squamules ..... 8. *Lepiota erythrosticta*

1. ***Agaricus* aff. *parasilvaticus*** Heinem., Bull. Jard. Bot. Brux. 32: 156. 1962.
Fig. 1-4

Pileus 29 mm, convex and broadly umbonate; surface composed of numerous minute light brown (M&P 13D10 "Tawny") squamules on cream ground, darker and entire over disc; margin entire, not sulcate. Lamellae free, membranous, moderately crowded, dark grey. Stipe 41×6 mm, central, cylindrical, swollen at base (-8 mm), cream, with small squamules on the lower part; rhizomorphs present. Annulus persistent, superior, membranous, light brown. Context fleshy in disc, thin near margin. Basidiospores 3.8-5×2.5-3.5 µm, in average 4.7×2.8 µm, Q = (1.28-)1.42-1.82(-2), ellipsoid in side view, smooth, with wall slightly thickened, brown. Basidia 13.8-17.5×5-6 µm, clavate, 4 sterigmata. Pleurocystidia absent. Cheilocystidia inconspicuous, 14-17×5-7.5 µm, broadly clavate or pyriform, thin-walled, hyaline. Pileipellis with repent hyphae 3-7.5 µm wide, thin-walled, with pale brown intracellular pigment. Hymenophoral trama regular. Clamp-connections absent.

Habitat: solitary on soil in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Cabo de Santo Agostino, Complexo do Gurjaú (Mata do Coxiu), 26/VIII/2003, *I.G. Baseia et al. s.n.* (URM 78671).

Distribution: Venezuela (Heinemann 1962; Pegler 1983), Martinique, Trinidad (Pegler 1983). Brazil: Paraná (Heinemann 1993), São Paulo (Pegler 1997). This is the first record from Pernambuco.

Remarks: The small basidioma with small fibrillose squamules on the pileal surface and ellipsoid basidiospores place this species in section *Sanguinolenti* Jul. Schäff. & F.H. Møller (Heinemann 1977). A related species is *Agaricus earlei* Murrill, from Cuba, with indistinctly apiculate and ellipsoid basidiospores 5×3 µm (Murrill 1918). Freeman (1979) revised the type of *A. earlei* and reported basidiospores 4.5-5.5×3-3.8 µm. On the other hand, Pegler (1987) reported *A. earlei* as having larger basidiospores 6-7.5×3.4-4.2 µm and did not observe any trace of yellow colour in the exsiccate nor in the original illustration and placed this species near to *A. parasilvaticus*. This discrepancy on the size of basidiospores of *A. earlei* makes an exact comparison between this species and *A. parasilvaticus* imprecise or impossible without reviewing the types. In the collection studied there was no colour change to yellow in the fresh basidioma, and the microscopic characters agree with the description of *A. parasilvaticus* given by Pegler (1983).

2. ***Agaricus purpurellus*** (F.H. Møller) F.H. Møller, Friesia 4: 204. 1952.
Psalliota purpurella F.H. Møller, Friesia 4: 193. 1952.
Fig. 5-8

Pileus 18-45 mm, plane to sometimes broadly umbonate, purplish brown (M&P 8J7 "Liberia+") at the disc, disrupting into squamules on white or light grey ground. Lamellae free, membranous, crowded, greyish brown (M&P 7A8 "Rose Grey"). Stipe 40-75(-100)×3.5-4.5 mm, central, cylindrical, hollow,

swollen at the base (-6 mm), white, with concolorous squamules near the annulus, turning yellow at the base on handing. Annulus membranous, fragile, pendant, sub apical, white. Context thin, fleshy. Basidiospores 4.3-5(-5.3)×2.5-3.5 µm, on average 4.7×3.1 µm, Q = (1.36-)1.43-1.64(-1.81), short ellipsoid in side view, smooth, slightly thick-walled, brown. Basidia 15-20×6-7.5 µm, clavate or sub fusoid, 2 to 4 sterigmata. Pleurocystidia absent. Cheilocystidia rare, 15-25×7.5-10 µm, broadly clavate to sub piriform, thin-walled, hyaline. Pileipellis with ascendant hyphae, terminal elements 22-52×6-10 µm, cylindrical, with violaceous-brown content. Hymenophoral trama regular. Clamp-connections absent.

Habitat: scattered on soil in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Cabo de Santo Agostinho, Complexo do Gurjaú (Mata do Xangô), 19/VII/2004, *F. Wartchow 17/2004* (URM 78680); Complexo do Gurjaú (Mata do Café), 3/VIII/2004, *F. Wartchow 20/2004* (URM 78679); Complexo do Gurjaú (Mata do São Braz), 3/VIII/2004, *F. Wartchow 21/2004* (URM 78678).

Distribution: Trinidad (Heinemann 1961), Kenya (Pegler 1977), Martinique (Pegler 1983). Brazil: São Paulo (Pegler 1997).

Remarks: This species of the subgenus *Flavoagaricus* Heinem. is recognized by the purplish squamules on the pileus and the size of the spores (Heinemann 1961). Maia *et al.* (2002) reported this species from Pernambuco State based on herbarium registers, but the exsiccate under the name *Agaricus purpurellus* (URM 75672) has basidiospores (5-)5.5-7.5(-8)×3.5-4.8 µm, similar in size to the spores of *A. goossensiae* Heinem. from Africa (Heinemann 1956; Pegler 1969), a species related to *A. purpurellus* (Pegler 1977).

3. ***Agaricus rufoaurantiacus*** Heinem., Kew Bull. 15: 242. 1961.
Fig. 9-12

Pileus 29 mm, convex to broadly umbonate, surface with numerous verrucose orange-brown (M&P 11L12 "Orange Rufous") squamules on pale cream (M&P 9B2 "Polar Bear") ground. Lamellae free, membranous, crowded, brown (M&P 7A10 "New Coccoa, Natal Brown, Mahal+"). Stipe 45×4 mm, central, cylindrical, swollen at base (-6 mm), pallid cream, covered with numerous squamules, concolorous with pileal squamules. Veil forming dense squamules on pileus and stipe surface. Annulus persistent, pendant, membranous, sub apical, cream. Context thin, fleshy. Basidiospores 4-5×2.5-3.7 µm, on average 4.7×3 µm, Q = (1.33-)1.4-1.67(-1.81), ellipsoid to rarely ovoid in side view, smooth, slightly thick-walled, brown in deposit. Basidia 12.5-18×5-6.5 µm, clavate to sub fusoid, 4 sterigmata. Pleurocystidia absent. Cheilocystidia 13.5-20×5-7.5 µm, clavate to broadly clavate, thin-walled, hyaline. Pileipellis with trichoderm layer of narrow and parallel hyphae having segments 15-37×5-8 µm, with light brown then orange-brown content. Hymenophoral trama regular. Clamp-connections absent.

Habitat: solitary in sandy soil in a tropical forest.

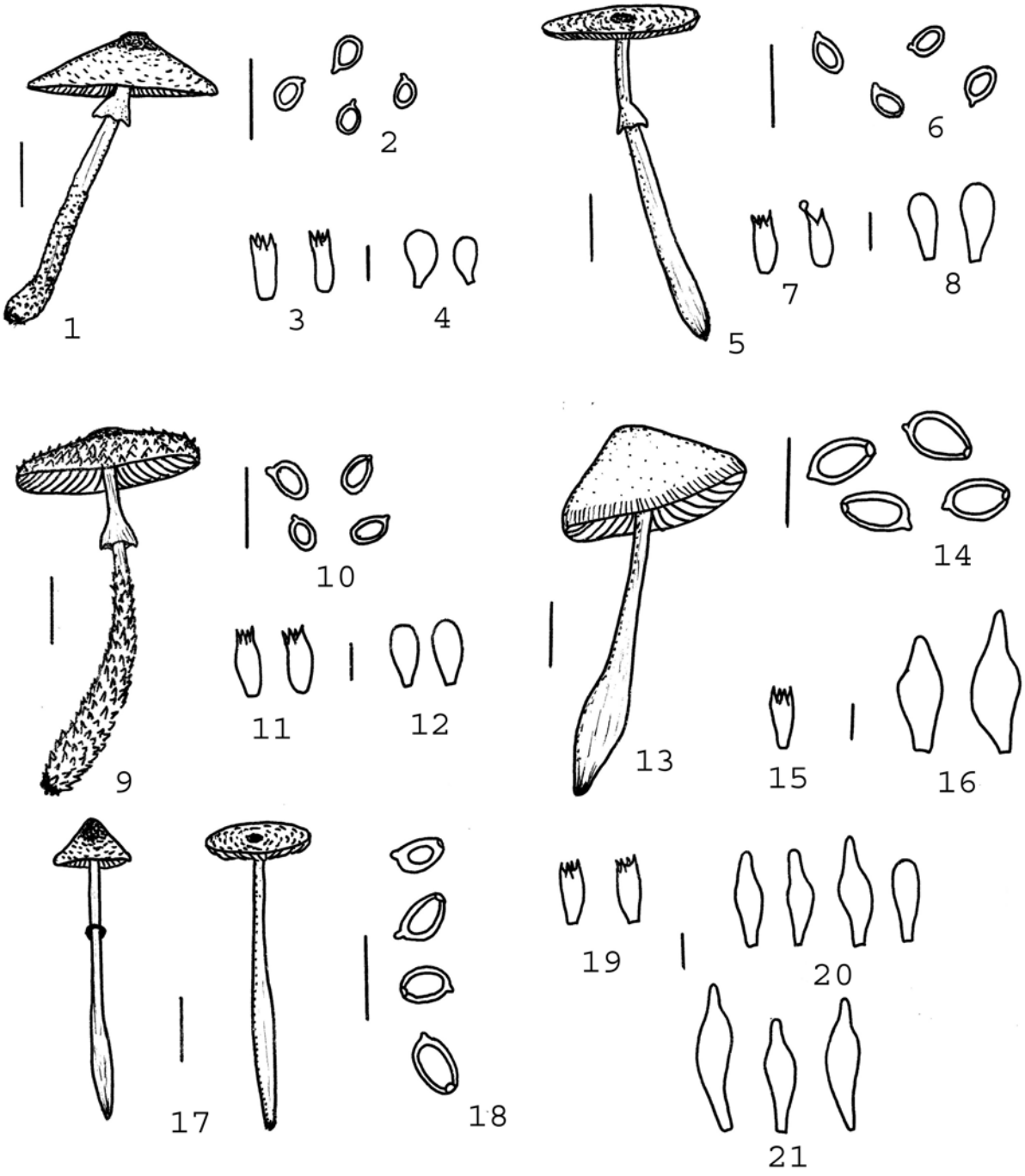
Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/VII/2004, *F. Wartchow 25/2004* (URM 78666).

Distribution: Trinidad (Heinemann 1961; Pegler 1983), Martinique (Pegler 1983). Brazil: São Paulo (Pegler 1997). This is the first record of *A. rufoaurantiacus* from Pernambuco.

Remarks: This species of the subgenus *Lanagaricus* Heinem., described from Trinidad (Heinemann 1961), has been recorded from the Lesser Antilles (Pegler 1983) and São Paulo State, Brazil (Pegler 1997) with slightly larger spores 4.5-5.5×3.6-4 µm. *Agaricus ochraceosquamulosus* Heinem. differs in the colour of the pileal scales, its slightly larger basidiospores (5.1-5.7×3.6-4 µm) and broader pileipellis hyphae (Heinemann 1961). The Schäffer's reaction was not tested in this specimen; in the type material the reaction is negative (Heinemann 1961). In the collections from the Lesser Antilles a positive reaction was observed on the material by Pegler (1983).

4. ***Leucoagaricus sulphurellus*** (Pegler) B.P. Akers in Akers *et al.*, Mycotaxon 76: 48. 2000.
Leucocoprinus sulphurellus Pegler, Kew Bull. Add. Ser. 9: 420. 1983.
Fig. 17-21

Pileus (8-)13-21 mm wide, campanulate then plane, sulphur yellow (M&P 10J1 "Sulphur Y, Citrus) with small greyish brown (M&P 16A4 "Rose Taupe") squamules, with margin indistinctly sulcate. Lamellae free, membranous, close, sulphur yellow (M&P 10J1 "Sulphur Y, Citrus), discolouring greenish blue when bruised. Stipe 28-40×2.5-3.5 mm, central, cylindrical, sometimes attenuate at base, glabrous, smooth, concolorous with pileus and lamellae. Annulus small and fragile, concolorous with stipe. Context thin, fleshy. Basidiospores 6.2-7.2×3.7-5 µm, on average 6.6×4.3µm, Q= (1.39-)1.5-1.76(-1.81), ellipsoid in side



Figures 1-20. 1-4. *Agaricus* aff. *parasilvaticus* Heinem. 1. Basidioma. 2. Basidiospores. 3. Basidia. 4. Cheilocystidia. 5-8. *Agaricus purpurellus* (F.H. Møller) F.H. Møller. 5. Basidioma. 6. Basidiospores. 7. Basidia. 8. Cheilocystidia. 9-12. *Agaricus rufoaurantiacus* Heinem. 9. Basidioma. 10. Basidiospores. 11. Basidia. 12. Cheilocystidia. 13-16. *Leucocoprinus cretaceus* (Bull.: Fr.) Locq. 13. Basidioma. 14. Basidiospores. 15. Basidium. 16. Cheilocystidia. 17-21. *Leucoagaricus sulphurellus* (Pegler) B.P. Akers. 17. Basidiomata. 18. Basidiospores. 19. Basidia. 20. Cheilocystidia 21. Pleurocystidia. Scaly bar is 10 mm for the basidiomata and 10 µm for microscopic features.

view, dextrinoid, metachromatic, smooth, with small germ pore, thick-walled, hyaline. Basidia 15-18× 7-10 µm, clavate, with 4 sterigmata. Pleurocystidia 30-50(-62)×8-12(-15) µm, fusoid-mucronate, thin-walled, hyaline. Cheilocystidia 23-37×8-12 µm, inflated-clavate to occasionally fusoid, with sub mucronate to mucronate apex, thin-walled, hyaline. Pileipellis as cutis, with terminal elements (13-)15-35(-42)×5-10 µm, cylindrical to clavate. Hymenophoral trama regular. Clamp-connections absent.

Habitat: solitary on soil in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/II/2004, *L. Ryvarden & F. Wartchow s.n.* (URM 78662, HCB 18237); Cabo de Santo Agostinho, Complexo do Gurjaú (Mata do Café), 21/VI/2004, *F. Wartchow 10/2004* (URM 78677).

Distribution: Lesser Antilles (Pegler 1983), Bolivia (Moreno-Arroyo *et al.* 2001), Colombia (Vasco-Palacios *et al.* 2005). Brazil: São Paulo (Pegler 1997). *L. sulphurellus* is reported for the first time in Pernambuco.

Remarks: This species is characterized by the sulphur yellow basidioma, the lamellae discolouring when bruising, size of the spores and the presence of pleurocystidia (Pegler 1983). Moreno-Arroyo *et al.* (2001) did not report pleurocystidia in "*Leucocoprinus* cf. *sulphurellus*" from Bolivia, which leaves open to question their assignment to *L. sulphurellus*. The presence of pleurocystidia in *Leucoagaricus* has also been reported in *L. viridiflavoides* B.P. Akers from North America (Akers *et al.* 2000), *L. americanus* (Peck) Vellinga and *L. barssii* (Zeller) Vellinga from Europe and North America (Vellinga 2000). *L. pleurocystidiatus* Migliozzi & Testoni (2000) is probably a synonym of *L. barssii* (Vellinga personal correspondence).

5. ***Leucocoprinus cretaceus*** (Bull.: Fr.) Locq., Bull. Mens. Soc. Linn. Lyon 14: 93. 1945.
Agaricus cretaceus Bull., Herbier de la France 8: tab. 374. 1788.
Fig. 13-16

Pileus 14-30 mm wide, ovoid when young then broadly convex, umbonate in maturity, white, with numerous floccose squamules in young basidiomata (not abundant at maturity); margin sulcate. Lamellae free, membranous, sub close, white. Stipe 52-78×3-4 mm, central, fusiform bulbous 5.5-6.5 mm wide, white or cream, with floccose squamules and pseudorrhiza present. Annulus membranous, sub apical, white, fragmenting in older basidiomata. Context thin, fleshy. Basidiospores (5-)6.2-10×(4.5-)5-7 µm, on average 9.4×6 µm, Q = (1.4-)1.5-1.75(-1.91), ellipsoid in side view, dextrinoid, metachromatic, smooth, thick-walled with germ pore, hyaline. Basidia 13-17.5×6-7 µm, 4 sterigmata. Pleurocystidia absent. Cheilocystidia, e.g., 33×17.5 µm, inflated-clavate, with long mucro, thin-walled, hyaline. Pileipellis with interwoven hyphae having terminal segments 40-105(-130)×8-22(-27) µm, clavate to cylindrical, hyaline. Hymenophoral trama trabecular. Clamp-connections absent.

Habitat: sub gregarious in unidentified, living, dicotyledonous tree in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/II/2004, *F. Wartchow s.n.* (URM 78667, HCB 18240 as "*Leucocoprinus cepaestipes*").

Distribution: tropics (Baker & Dale 1951; Vellinga 2004b), Europe (Josserand 1955; Candusso & Lanzoni 1990). Brazil: Rio Grande do Sul (Sobestiansky 2005). This is the first record for Pernambuco.

Remarks: This tropical species, macroscopically characterized by floccose white squamules on the pileus and inflated fusiform bulbous stipe, is frequently reported as growing on greenhouse and compost heaps from Europe (Josserand 1955; Candusso & Lanzoni 1990 as *L. cretatus*).

Two phenetically close species are known: *Leucocoprinus squamulosus* (Mont.) Pegler, with exannulate and non-inflated stipe (Pegler 1983), and *L. cepistipes* (J. Sowerby: Fr.) Pat., with ochraceous to light brown squamules on pileus surface (Candusso & Lanzoni 1990). This species was initially identified as *L. cepistipes sensu* Dennis (1952).

6. ***Leucocoprinus fragilissimus*** (Ravenel) Pat., Essai Taxon. 171. 1900.
Hiatula fragilissima Ravenel in Berkeley & Curtis, Ann. Mag. Nat. Hist. ser II 12: 422. 1853.
Fig. 22-24

Basidiomata extremely fragile. Pileus 5-24 mm wide, convex then plane and depressed, yellow (M&P 9D1), cracking into small squamules on white ground, translucent, except at disc, plicate striate, sub-deliquescent. Lamellae free, membranous, moderately close, white. Stipe 49-91×1-2 mm, central, cylindrical, glabrous, yellow. Context membranous except in disc. Annulus persistent, attached to upper half of stipe, membranous, yellow. Basidiospores 10-12.5× 7.5-8.8 µm, on average 11.3×7.8 µm, Q = 1.33-1.67, broadly ellipsoid with short cylindrical region terminated

by broad germ pore in side view, strongly dextrinoid, metachromatic, smooth, thick-walled, hyaline. Hymenial structure not recovered. Pileipellis with loose sphaerocysts 28-40×20-35 µm and cylindrical elements 45-100×7.5-15 µm, with all elements hyaline.

Habitat: solitary on soil and leaves in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/II/2004, *B.T. Goto et al. s.n.* (URM 78665).

Distribution: Southern parts of North America (Morgan 1907; Smith & Weber 1982; Kimbrough 2000), Sri Lanka (Pegler 1972; 1986), Galapagos Islands (Reid *et al.* 1981), Lesser Antilles (Pegler 1983), Japan (Hongo 1986), Italy (Ballero & Contu 1991), Vietnam (Patouillard 1892; Yang 2000). Brazil: Rio Grande do Sul (Theissen 1912; Albuquerque *et al.* 2006), Rondônia (Capelari & Maziero 1988), São Paulo (Pegler 1997). This is the first record for Pernambuco.

Remarks: This is a very delicate species, with a widespread tropical distribution, easily recognized by its yellowish squamules, sub-deliquescent basidioma and size and shape of the basidiospores (Pegler 1983).

7. ***Lepiota elaiophylla*** Vellinga & Huijser, Bol. Gr. Micol. G. Bres. 40: 462. 1997.
Fig. 25-29

Pileus 13-15 mm wide, plane-convex with small but conspicuous umbo, brown (M&P 14F8 "Mosul") over disc, otherwise brown surface disrupting into small squamules on cream (M&P 9D2 "Cream") ground, with remnants of veil on margin. Lamellae free, membranous, close, lemon yellow (M&P 19K2 "Citron-Green"). Stipe 22-23×1-2.5 mm, central, cylindrical, concolorous with pileus, with brown (M&P 14F8 "Mosul") squamules, lacking true annulus, white rhizomorphs present. Context thin, fleshy. Smell sweetish. Basidiospores 6-7.5×2.5-3.8 µm, on average 6.8×3.5 µm, Q = (1.5-)1.67-2.5(-3), ellipsoid to sub-cylindrical in side view, some with slight suprahilar depression, dextrinoid, thin-walled, hyaline. Basidia 15-20×6-7.5 µm, clavate, 4 sterigmata. Pleurocystidia absent. Cheilocystidia 17.5-27.5×5-10 µm, clavate to occasionally sub-fusoid, thin-walled, hyaline. Pileipellis a trichoderm, with terminal elements 30-190× 8.5-17 µm, cylindrical to sub-fusoid, erect to sub-erect, moderately thick-walled, with yellowish brown intracellular content. Hymenophoral trama sub-regular. Clamp-connections present.

Habitat: solitary on soil among litter in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 31/VII/2003, *I.G. Baseia et al. s.n.* (URM 78654).

Distribution: in greenhouses in Europe (Breitenbach & Kranzlin 1995 as *L. xanthophylla*; Vellinga & Huijser 1997; Pidlich-Aigner *et al.* 2001), probably East Africa (Pegler 1977, but see Vellinga & Huijser 1997). Brazil: Paraná (de Meijer 2006). This species is reported for the first time from Pernambuco.

Remarks: The material differs from *Lepiota xanthophylla* P.D. Orton mainly by the absence of a layer of clavate elements in the pileipellis (Vellinga & Huijser 1997). The Brazilian collection agrees with the description of *L. xanthophylla sensu* Pegler (1977), particularly in spore size. Vellinga & Huijser (1997) suggested that Pegler's East African material may be *L. elaiophylla* Vellinga & Huijser, mainly by the shape of the cheilocystidia and size and shape of the pileipellis hyphae.

Other species with yellowish lamellae and clamps on hyphae occur in the Neotropics: *L. parvispora* Dennis from Venezuela (Dennis 1961), *L. flavidocana* Pegler from the Lesser Antilles (Pegler 1983) and *L. xanthophylloides* Singer from Pará State, North Brazil (Singer 1973 as *L. xanthophylla*). However, all of them are reported to bear spores predominantly or entirely lesser than 6 µm long. In *L. ochraceolamellata* Dennis, clamp-connections are absent (Dennis 1961). Other species cited by Vellinga & Huijser (1997) are reported by them as poorly documented, mostly regarding to the presence or absence of clamp-connections and structure of the pileipellis.

Recent molecular studies report that *Lepiota elaiophylla, L. subincarnata* J.E. Lange and *L. brunneoincarnata* Chodat & Martín belong to a group containing amanitin (Vellinga 2003b), the same mycotoxin found in *Amanita phalloides* and allies (Lampe 1979).

Lepiota elaiophylla was previously reported from greenhouses (Vellinga & Huijser 1997). In this work, it is reported for the second time in a natural habitat from the Neotropics.

8. ***Lepiota erythrosticta*** (Berk. & Broome) Sacc., Syll. Fung. 5: 62. 1887.
Agaricus erythrostictus Berk. & Broome, Journ. Linn. Soc. Bot. 11: 508. 1871.
Fig. 30-34

Pileus 4-14 mm wide, subglobose to plane, obtusely umbonate; pink (M&P 3C10 "Congo Pink+") over disc, otherwise with surface disrupting into small squamules on white ground; margin entire, not sulcate. Lamellae free, membranous, crowded, white. Stipe 24-38×

2-3 mm, cylindrical, with pink (M&P 6L9 "Garnet Brown") squamules on white surface; rhizomorphs present. Annulus ephemeral, sub-apical. Basidiospores 6-8.3×2.5-3.5 µm, on average 7.5×3 µm, Q = (1.5-)1.76-3(-3.5), spurred, with truncate base, dextrinoid, smooth, thin-walled, hyaline. Basidia 15-20×5-6.2 µm, clavate, 2 or 4 sterigmata. Pleurocystidia absent. Cheilocystidia inconspicuous, 30-38×6-10 µm, clavate or fusoid, thin-walled, hyaline. Pileipellis as trichoderm, with terminal elements 30-105×8-15(-17.5) µm, fusoid, clavate to cylindrical, sometimes capitate, ranging from having light yellowish brown intracellular pigment to being nearly colourless, with wall slightly thickened. Hymenophoral trama regular. Clamp-connections present.

Habitat: solitary on soil in tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/II/2004, *T.B. Gibertoni et al. s.n.* (URM 78661; HCB 18235).

Additional material examined: **BRAZIL**. **Pernambuco**: Recife, Campus UFPE, 5/VI/1995, *J. Kimbrough & J. Kimbrough s.n.* (URM 75744).

Distribution: Sri Lanka (Pegler 1972; 1986), Papua New Guinea (Horak 1980), Trinidad (Dennis 1952), Martinique, Guadeloupe, Trinidad and West Africa (Pegler 1983). Brazil: Pernambuco (Kimbrough e*t al.* 1995), Paraná (de Meijer 2001).

Remarks: *Lepiota erythrosticta* belongs to the group with *Lepiota* having spurred spores and elongate elements in the pileipellis (Horak 1980). Pereira (2000) reported five species with this spore shape, all from southern Brazil, and two have similar pileus surface colour: *L. pyrrhaes* (Berk. & Broome) Sacc., with shorter squamules hyphae (Horak 1980); and *L. apicepigmentata* A.B. Pereira with filiform hyphae having dark pigment at their apex (Pereira 1998; 2000).

The purplish colour indicated by Dennis (1952) and Pegler (1972; 1983; 1986) for *L. erythrosticta*, was not observed in the Brazilian material, but Horak (1980) reported that the colour of the cap surface turns pink in mature basidiomata.

Horak (1980) did not accept the distribution of *L. erythrosticta* from the Caribbean, as indicated by Dennis (1952), restricting the present species to Indomalaya and Australasia. Nevertheless, Pegler (1983) reported this species from the Lesser Antilles, and Kimbrough *et al.* (1995) and de Meijer (2001) reported it from Brazil, confirming the occurrence of this species in the Neotropics.

9. ***Micropsalliota brunneosperma*** (Singer) Pegler in Pegler & Rayner, Kew Bull. 23: 369. 1969.

Lepiota brunneosperma Singer, Lilloa 25: 279. 1952. Fig. 35-39

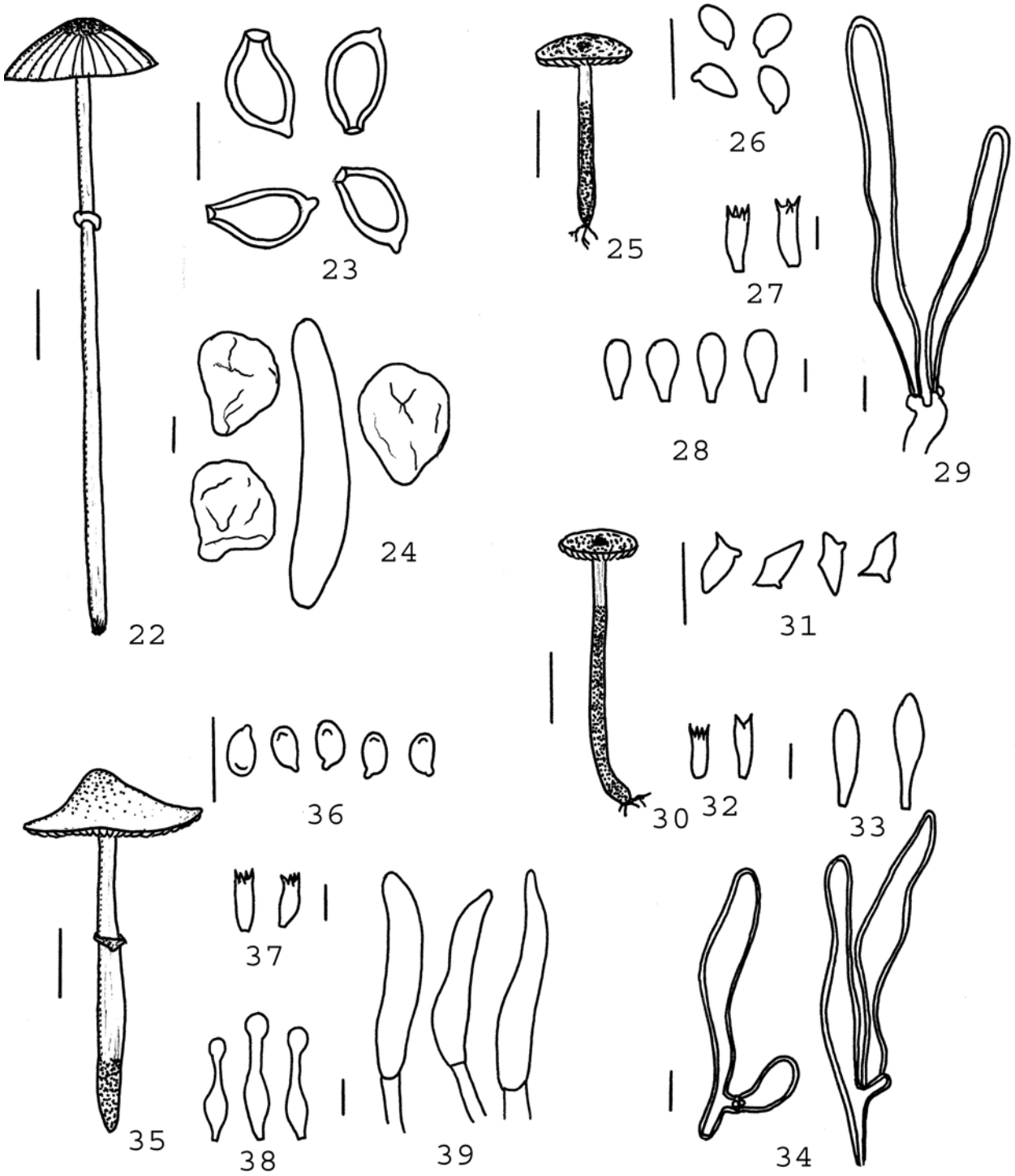
Entire basidioma dark purplish brown in dried specimens. Pileus 32 mm wide, convex, umbonate, with surface purple (M&P 3G1 "Corinthian Pink") over disc, disrupting into very small squamules on greyish brown (M&P 12A2 "Moonmist") background, with margin not sulcate and not striate. Lamellae free, membranous, close, brown (M&P 7A12 "Cochin, Moccasin+, Argus Brown"). Stipe 56×4 mm, central, cylindrical above, attenuate at base, pale cream (M&P 9B2 "Polar Bear"), with dark brown (M&P 8E9 "Negro") fibrillose squamules, mainly at base. Annulus persistent, pale cream (M&P 9B2 "Polar Bear") with brown (M&P 8A10 "Sepia") margin, membranous. Context thin, fleshy, unchanging. Basidiospores 4.6-6.2×2.5-4 µm, on average 5.2×3.2 µm, Q = (1.25-).47-1.92(-2), amygdaliform in side view, smooth, with wall slightly thickening at apex, dark green in KOH. Basidia 13.5-17.5×5-6 µm, clavate, 4 sterigmata. Pleurocystidia absent. Cheilocystidia abundant, 25-50×2.5-5.5(-6) µm, predominantly fusoid, some ventricose, capitate (3.5-6 µm width), thin walled, hyaline. Pileipellis with erect hyphae, with terminal elements 25-95× 5-17(-20) µm and having sub-acute apex and purplish-brown contents. Hymenophoral trama regular. Clamp-connections absent.

Habitat: solitary, on soil in a tropical forest.

Material examined: **BRAZIL**. **Pernambuco**: Recife, Mata de Dois Irmãos, 4/II/2004, *B.T. Goto et al. s.n.* (URM 78658).

Distribution: Argentina (Singer & Digilio 1952; Pegler 1977), Kenya (Pegler & Rayner 1969), Uganda, Trinidad (Pegler 1977), Galapagos Islands (Reid *et al.* 1981). This is the first record of *M. brunneosperma* from Brazil.

Remarks: Heinemann (1983) placed this complex species in two distinct groups: Group IV, with pileus (10-)20-70 mm wide, and Group III with smaller pileus, 2-20(-30) mm wide. He also considered the allied *Micropsalliota cephalocystis* (Heinem.) Heinem. as an independent species, in Group III. The latter species was originally described as *Agaricus cephalocystis* Heinem. from Trinidad, which was considered as belonging to the subgenus *Conioagaricus* Heinem. It was characterized by a delicate and sub-membranous pileus, basidiospores 5.3-6.5×3.3-3.8 µm, and capitate cheilocystidia 25-35×4-5.5 µm (Heinemann 1961).



Figures 22-43. 22-24. *Leucocoprinus fragilissimus* (Ravenel) Pat. 22. Basidioma. 23. Basidiospores. 24. Elements of the pileipellis. 25-29. *Lepiota elaiophylla* Vellinga & Huijser. 25. Basidioma. 26. Basidiospores. 27. Basidia. 28. Cheilocystidia. 29. Elements of the pileipellis. 30-34. *Lepiota erythrosticta* (Berk. & Broome) Sacc. 30. Basidioma. 31. Basidiospores. 32. Basidia. 33. Cheilocystidia. 34. Elements of the pileipellis. 35-39. *Micropsalliota brunneosperma* (Singer) Pegler. 35. Basidioma. 36. Basidiospores. 37. Basidia. 38. Cheilocystidia. 39. Elements of the pileipellis. Scaly bar is 10 mm for the basidiomata and 10 μm for microscopic features.

Pegler (1977) regarded this species as a synonym of *M. brunneosperma*. Singer described the dark-spored *Lepiota brunneosperma* as having basidiospores 5.8-6.5×3.7-4.4 µm and large capitate cheilocystidia, 37-45×3.5-5.8 µm (Singer & Digilio 1952).

Our collection has narrower basidiospores than *M. brunneosperma* according to Heinemann's key (1989); but the size and shape of the cystidia, the thick wall difficult to discern at the apex of the spores, the dark colour of the pileus and the squamules of the stipe all support our determination of the Brazilian material.

Other species of *Micropsalliota* occur in the Americas: *M. vinaceoumbrinus* (A.H. Sm.) Heinem. from the U.S.A. has broader basidiospores, 6.2-7.3×4.8-5.4 µm (Smith 1944); *M. violaceosquamulosus* (R.E.D. Baker & W.T. Dale) Heinem. from Trinidad & Tobago has a densely scaly stipe, brown basidiospores and cylindrical cheilocystidia (Heinemann 1961); *M. purpurea* Singer from Ecuador has much smaller basidiospores, 3.5-4.2×2.5 µm (Singer 1978); *M. cinnamomeopalida* Singer from Costa Rica (Singer & Gómez 1982) and similar taxa reported from India as *M.* cf. *cinnamomeopalida* lacks dark purplish colour on the pileus (Heinemann & Leelavathy 1991); the basidiospores of *M. roseovinacea* from Martinique have a homogeneous wall and cheilocystidia that are short cylindrical and capitate (Pegler 1983); *M. cardinalis* Heinem. from Argentina and *M. pruinosa* Heinem. from Rio de Janeiro State, Brazil, do not have pileus more than 10 mm wide (Heinemann 1989); *M. heinemanniana* Guzm.-Dáv., from Mexico has pleurocystidia (Guzmán-Dávalos 1992); and *M. subalpina* Guzm.-Dáv. & Heinem., also from Mexico, has a slender basidioma and a cream to chocolate-brown pileus (Guzmán-Dávalos & Heinemann 1994).

As observed, *Micropsalliota* has a wide distribution in tropical and temperate America. Other species have been recorded for Brazil: *M. arginea* (Berk. & Broome) Pegler & Rayner, *M.* cfr. c*ampestroides* (Heinem.) Heinem. and *M. cephalocystis* from Paraná State (Heinemann 1993), and *M. roseovinacea* from São Paulo State (Pegler 1997).

Recently, Maia *et al.* (2002), based on material deposited in URM, cited "*M. roseovinaceus* Pegler" as occurring in our region of interest. However, the exsiccatum revised (URM 75654) has basidiospores that are 5.3-7.4×4-4.5 µm, dextrinoid, metachromatic endosporium, lack a germ pore and are hyaline. In addition, the pileal surface is neither sulcate nor striate. Hence, the revised specimen is a typical *Leucoagaricus* and is necessary to exclude *M. roseovinacea* from the list of species known from Pernambuco.

Acknowledgements

The senior author is grateful to Dr. Leonor C. Maia for helping and support, Dr. Else C. Vellinga, Dr. Laura Guzmán-Dávalos for valuable comments about the manuscript; Dr. Reinhardt Agerer, Dr. Marcel Bon, Dr. Gastón Guzmán, Dr. Roy E. Halling, Mr. André A.R. de Meijer and Dr. Vicenzo Migliozzi for sending literature; Dr. Iuri G. Baseia, Dr. Leif Ryvarden, Dr. Tatiana B. Gibertoni, Mr. Bruno T. Goto and M.Sc. Sueli A.G. Soares for helping with the collections. Dr. Rodham E. Tulloss and Dr. Paul M. Kirk are acknowledged for English improvement. Thanks also to M.Sc. Vagner G. Cortez for preparation of the plates. This work was supported by CNPq.

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