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The Lycoperdaceae of North Central Florida.II. The genera *Bovistella*, *Langermannia* and *Morganella*

by

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Abstract: Four species of Lycoperdaceae of North Central Florida are described: *Bovistella radicata* (Mont.) Pat.; *Morganella velutina* (Berk. ex Mass.) Kreisel & Dring; *M. fuliginea* (Berk. & Curt.) Kreisel & Dring; and *Langermannia bicolor* (Lév.) Demoulin & Dring. A short discussion on the taxonomic position of the latter genus is included.

The present paper is the second of the series concerning the Lycoperdaceae of North Central Florida by Morales & Kimbrough (1978). Here we describe the only species of *Bovistella* collected in North Central Florida and emphasize the differences between this genus and *Lycoperdon* as recognized by Kreisel (1967). At the same time we emend the typographic error in the general key for the Florida genera of Lycoperdaceae by Morales & Kimbrough (1978), where *Lycoperdon* was erroneously cited as lacking a pseudocolumella.

There is also only one species of *Langermannia* in North Central Florida and we name it after Demoulin & Dring (1975). We discuss briefly its taxonomic position and controversial points of view concerning the nature of the exoperidium of the genus. Unfortunately we do not have immature material to state our opinion.

As far as we know, there are only two species of *Morganella* in Florida: *M. subincarnata* has its southern range in North Carolina as suggested by Kreisel & Dring (1967) and the collections referring to that species are misidentifications.

MATERIAL AND METHODS

The material and methods used throughout this work are the same as described in the former paper (Morales & Kimbrough, 1978).

Bovistella MORGAN

Fructifications epigeal, subglobose to turbinate; surface covered by a dense, floccose, somewhat persistent coating which usually becomes aggregated into slender spines or particles, but may be merely granulose; wall of spore case delicate,

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opening by an apical pore and collapsing as spores escape; subgleba persistent, cellular, cup-shaped above and definitely limited by a pseudodiaphragm; pseudocolumella absent; capillitium free, short, several times dichotomously branched, the main stem thicker than the diameter of the spores, the branches tapering; spores globose to oval, smooth or echinulate, with a thin hyaline envelope.

This genus was first described by Morgan (1892) as a puffball that has the peridium of a *Lycoperdon* and the capillitium of a *Bovista*; it differs from the latter in having a persistent, well developed sterile base.

Lloyd (1902) was of the opinion that the sterile base was not a good character to separate *Bovistella* from *Bovista* and proposed to distinguish them by the habit; *Bovista* being a genus which at maturity breaks away from the point of attachment, whereas in *Bovistella* the fungus remains attached as is the case in *Lycoperdon*. In a later paper (1905), he emended *Bovistella* by including all species that show the combined characters of possessing a rooting base and having pedicellate spores, and in 1906 he included in the genus all species having a rooting base and either pedicellate spores or a capillitium of the *Bovista* type.

Cunningham (1944) rejected the genus on the grounds that some species examined by him could be placed under *Bovista* as well as under *Bovistella*, since specimens in the same collection may or may not possess a rooting base. According to him all species of *Bovistella* should be placed in the genus *Bovista*; Bottomley (1948) in his study of the Gasteromycetes of South Africa was of the same opinion.

Zeller (1949) distinguished *Bovistella* by its persistent rooting base, in contrast with the tumbling habit of *Bovista*; on the other hand, the European workers (Perdeck, 1950; Smarda, 1958) separate both genera in the following manner:

Capillitium *Lycoperdon* type	*Lycoperdon*
Capillitium *Bovista* type	
Fruiting body with subgleba	*Bovistella*
Fruiting body without subgleba	*Bovista*

After the monographic study of *Bovista* made by Kreisel (1967), several characteristics as follows can be used to tell those genera apart:

1. Subgleba compact or absent; exoperidium mycelial or vesiculose; pseudocolumella and pseudodiaphragm absent.
   2. Capillitium interwoven (including the transitional forms)
      Bovista subgenus *Globaria*
   2. Capillitium in separate units
      Bovista subgenus *Bovista*
1. Subgleba cellular; exoperidium vesiculose
   3. Capillitium interwoven, pseudocolumella present; pseudodiaphragm absent
      Lycoperdon
   3. Capillitium in separate units; pseudocolumella absent; pseudodiaphragm present
      Bovistella

There is only one species of *Bovistella* in Florida, *B. radicata*.

Bovistella radicata (MONT.) PAT.
(Figs. 1-5)

Fructifications subglobose to top-shaped, 2.9-6.2 cm broad, smooth to plicate around point of attachment, attached to soil by a thick rooting base 1.6 cm or more long; surface over upper flattened part covered with a coating of slender spines, which may become united at their tips into compound warts or fascicles, much granular to furfuraceous material present between them, toward the margin and down the sides the spines become less distinct and finally the surface is merely furfuraceous, white at first, yellowish near maturity, wearing away irregularly to expose the thin papery, brown (buckthorn brown, tawny olive or clay to Saccardo's umber, R); spore sac membrane, which eventually opens by a pore or slit that enlarges to expose most of the gleba; gleba white, then yellowish to olive and finally Dresden brown, sepia, Saccardo's umber, tawny olive or old gold to Isabella color (R); sterile base well developed, occupying most of the narrowed part of the fructification and extending up to the sides to form a sort of cup in which the gleba is situated, and separated from it by a pseudodiaphragm (Fig. 2). Spores oval, smooth, 3.6 - 6.25 x 3.1 - 4.25 μm, with a thin hyaline envelope and a hyaline pedicel up to 20 μm long (Fig. 3); capillitium of separate units, much branched and branches often quite gnarled, main axis up to 10 μm in diameter, ultimate branches tapered to acute or some tapered rather abruptly, filaments often sinuous and round, pitted (Figs. 4-5).

Specimens examined: No data about habitat, Florida, Mrs. Noble,? date (NY, identified as *Bovistella ohiensis*). ALACHUA COUNTY: No data about habitat, Gainesville, E. West, (FLAS 15756). On the ground in mesophytic hammock, Gainesville, R. Singer, 20 March 1943 (FH 1809). On sandy ground along the road in pine flats, Kelley's Hammock near Gainesville, R. Singer, 29 June 1943 (FH 2422). In open field, Gainesville, W. A. Murrill, 7 April 1944 (TENN 16087 and NY). No data about habitat, La Grosse, G.F. Weber, 4 August 1951 (FLAS 45979). Sugarfoot Hammock, Gainesville, A.S. Rhoads, 5 September 1954 (FLAS 44819). On grass, Gainesville, J.W. Kimbrough, 21 September 1970 (MIM 19). COLUMBIA COUNTY: Under live oak, Camp O'Leno, W.A. Murrill, November 1939 (FLAS 20080).

Discussion: The capillitium of *Bovistella radicata* is very variable in the abundance of pores since the same gleba may be composed of a proportion of poreless hyphae and some others with pores.

Langermannia ROSTKOVIUS

Fructifications medium to large, globose or subglobose, attached to the soil by a slender mycelial cord when young and becoming detached at maturity; exoperidium a white, thin, smooth cortex which peels off at maturity; endoperidium papery, smooth, dehiscing irregularly from the top; gleba compact, homogeneous; sterile base absent or vestigial. Spores globose, apedicellate, smooth or ornamented; capillitium easily separable from the peridium and composed of long, interwoven, branching filaments that break up into short segments.

The genus has the characteristics of *Calvatia* except that the sporocarps lack a significant sterile base, are weakly rooted so that they become detached at maturity, and have the peridium cracking off equally over the whole surface, leaving the compact, closely woven gleba completely naked.

The name *Lanopila* was first proposed by Fries (1849) for a plant collected by Wahlberg in South Africa. There are five described species, the two most closely allied being *L. bicolor* (Lév.). Pat. and *L. Wahlbergii* Fries, because both have rough spores.

Lloyd (1923) said that the latter two were one and the same species, but he used the name *Lanopila bicolor* rather than *Lanopila Wahlbergii*, because the former is well represented in the Museum of Paris, whereas no authentic specimen of the latter is known to exist.

Fischer (1933) recorded *L. bicolor* as a distinct species from *L. Wahlbergii*, and Swoboda (1937) stated that the difference between both species lies in the color of the gleba, reddish brown in *L. bicolor* and fuliginose in *L. Wahlbergii* although their synonymy was still an open question.

According to Ahmad (1950), the *Lanopila* collected in the Panjab plains has the color of the gleba of *Lanopila bicolor*, but its internal morphology is entirely different from the one described by Swoboda (1937) for this species; Ahmad concluded that little reliance could be placed in Swoboda's observations, as he had only two dried specimens at his disposal, and tentatively named the Indian species *L. Wahlbergii*.

In 1962 Kreisel said that the correct name for both *Lanopila* Fries and *Lasiosphaera* Reichardt is *Langermannia* Rostkovius, because it was first described in 1839. Dring (1964) proposed a new combination, *Langermannia wahlbergii* (Fries) Dring for the species collected in west tropical Africa.

Homrich & Wright (1973), reporting the species from South America, used again the name *Lanopila bicolor* "until more conclusive evidence is presented that their type species are congeneric".

On the other hand, Demoulin & Dring (1975) proposed a new combination, *Langermannia bicolor*, since the type material of *Lanopila wahlbergii* is presumed no longer to exist, and there is a possible alternative name which would have priority, *Bovista bicolor* Lév., described in 1846 by Léveillé. This is the only one we are using to describe Florida specimens.

Langermannia bicolor (LEV.) DEMOULIN & DRING
(Figs. 8,9,12)

Fructifications globose or irregularly subglobose, 2-8.5 cm in diameter, attached to the soil by a slender mycelial cord; hypogeous, but emerging and

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Fig. 1 *Bovistella radicata*

Fig. 2 *Bovistella radicata*, sterile base

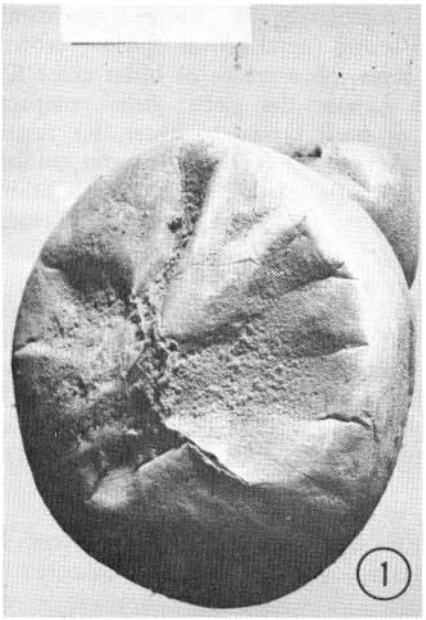
Fig. 3 *Bovistella radicata*, spores x 1250

Fig. 4 *Bovistella radicata*, capillitium x 400

Fig. 5 *Bovistella radicata*, capillitium x 1000

Fig. 6 *Morganella velutina*, spores x 1000

Fig. 7 *Morganella fuliginea*, spores x 1250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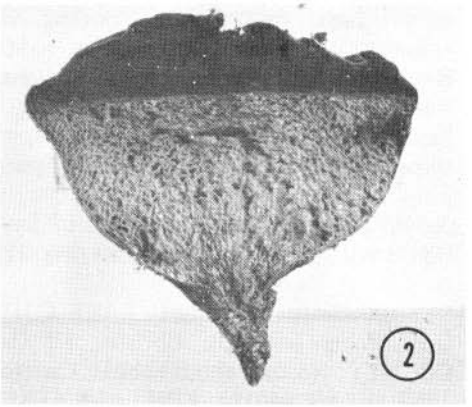
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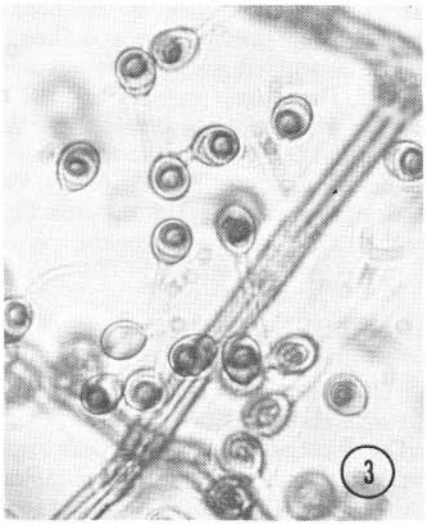
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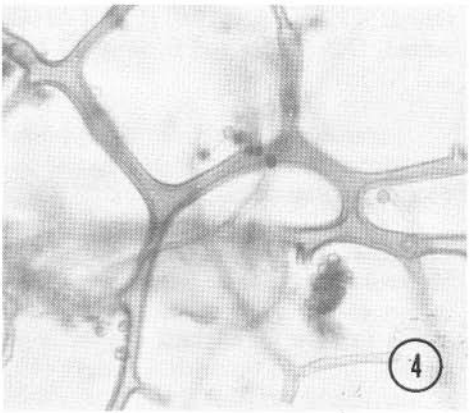
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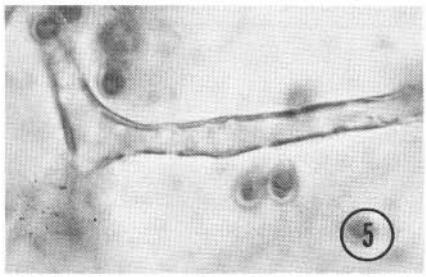
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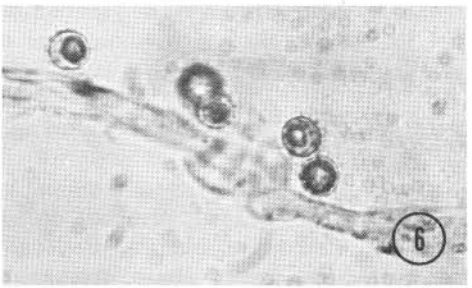
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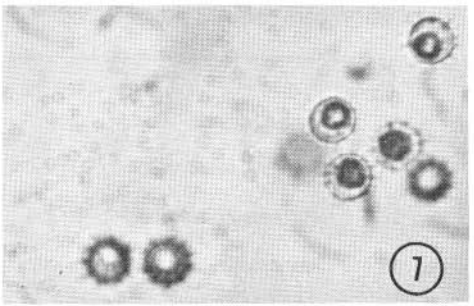
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detaching from the rhizomorph, so that they roll over the ground at maturity; exoperidium thin, white, peeling off completely in mature specimens; endoperidium papery cartilaginous, reddish brown (natal brown or clove brown, Hay's brown or Verona brown to warm sepia, olive brown or bister color R), wearing away tardily by weathering to expose the gleba; gleba compact, homogeneous, brown (sepia, olive brown or snuff brown to bister, R), fertile throughout, without a sterile base. Spores globose, 4.1-6.3μm in diameter, reddish brown in mass, verrucose, apedicellate, with a deBary bubble (Fig. 9); capillitium 3.6-4.9 μm in diameter, composed of long, interwoven, pitted, branching threads, that break up into short segments (Fig. 12).

Specimens examined: LAKE COUNTY: No data about habitat, Mt. Dora, G.F. Weber and J.R. Christie, 10 October 1952 (FLAS 44017). MARION COUNTY: No data about habitat. Carleton Grove, Citra, G.F. Weber, 22 November 1953 (FLAS 44016). PINELLAS COUNTY: In a private residence, Tampa, T. Oswalt, 27 February 1969 (FLAS 48462). POLK COUNTY: In citrus grove, Lake Alfred, G.F. Weber and E. West, 17 November 1949 (FLAS 40864, FLAS 40878 and NY).

Discussion: Swoboda (1937) pointed out that there were different reports in the literature concerning the spores of this species; the specimens collected in Florida have apedicellate spores.

Ahmad (1950) described *Lanopila bicolor* as having a completely pseudoparenchymatous exoperidium. Kreisel (1967) established as a difference between *Calvatia* and *Langermannia* the absence of a pseudoparenchymatous layer in the exoperidium of the latter genus. (Dr. V. Demoulin, (pers. comm. 1972), claims to have found such a layer in young specimens of *Langermannia gigantea* Batsch. per Pers. Homrich & Wright (1973) mention that the two outermost layers of the peridium that form the exóperidium of *Lanopila bicolor* (Lév.) Pat. (=*Langermannia bicolor* [Lév.] Demoulin & Dring) are composed of the same kind of hyphae. We do not have immature samples, only mature specimens already without exoperidia.

Morganella (ZELLER emend. KREISEL & DRING)

Fruiting bodies epigeous, seldom exceeding 3 cm major diameter, depressed globose to pear-shaped; peridium double; exoperidium velutinous, furfuraceous, granular-verrucose or spinulose, flesh-colored or deep red-brown to purplish black; endoperidium papery above, thickened below, flaccid, opening by an apical, irregularly torn mouth; subgleba compact or chambered (perhaps lacking in some

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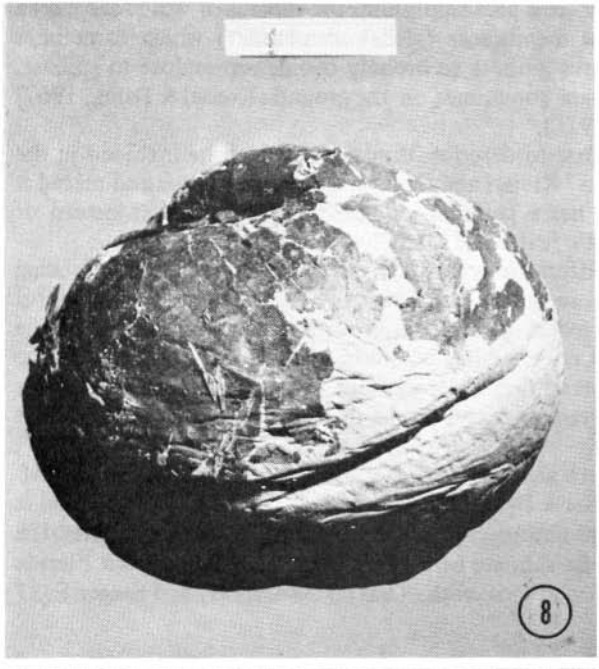
Fig. 8 *Langermannia bicolor*

Fig. 9 *Langermannia bicolor*, spores x 1250

Fig. 10 *Morganella velutina*

Fig. 11 *Morganella velutina*, setae of the exoperidium x 1250

Fig. 12 *Langermannia bicolor*, capillitium x 400.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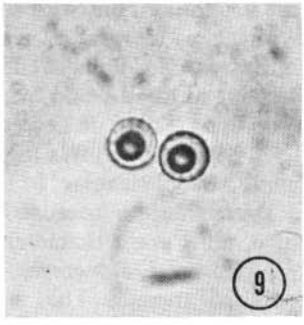
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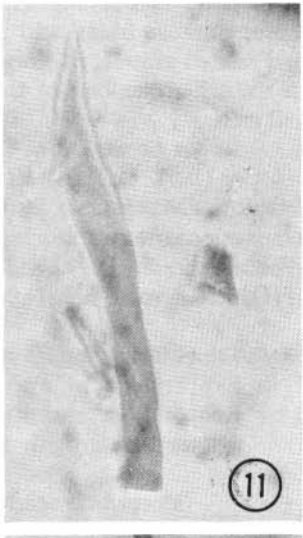
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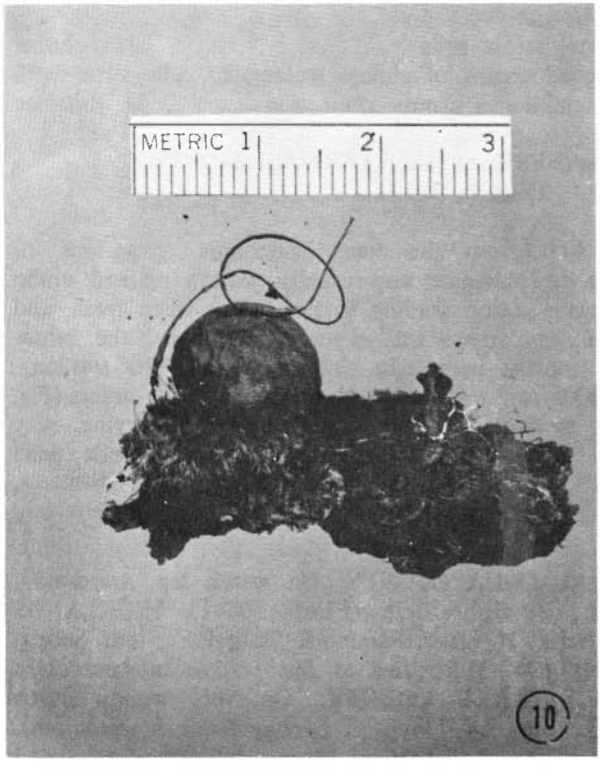
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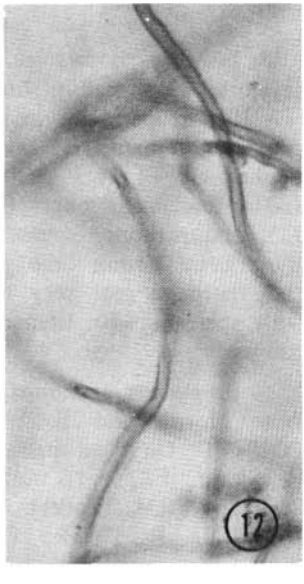
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poorly known species), without a diaphragm; mature gleba pulverulent, without a true capillitium, but with abundant paracapillitium, the threads of which are joined by hyaline, corrugated radial membranes (glebal membranes) which sometimes form a pseudocolumella; spores globose to broadly ovoid, verruculose to spinose. Growing on dead wood, perhaps sometimes on the ground (Kreisel & Dring, 1967) or on dung (Ponce de León, 1971).

Zeller (1948) was the first to describe *Morganella,* which he included in the family Mesophelliaceae. In 1967 Kreisel and Dring emended this genus and placed it in Lycoperdaceae because it has a peridium composed of two layers, instead of three, which is the characteristic feature of Mesophelliaceae.

However, *Morganella* differs from the rest of the Lycoperdaceae in lacking capillitial threads. The mature gleba consists only of paracapillitium, glebal membranes and spores. The glebal membranes are a non-cellular product of the Lycoperdaceae trama, and its presence is a common feature of the Lycoperdaceae and related groups. In *Morganella* they are persistent in the mature gleba, whereas in the other members of the family they become disrupted and unrecognizable at full maturity.

As far as we know, there are only two species of *Morganella* in Florida: *M. velutina* (Berk. ex Mass.) Kreisel & Dring, and *M. fuliginea* (Berk. & Curt.) Kreisel & Dring, easily separable by the nature of the exoperidium. We have examined the samples reported as *Morganella subincarnata* (Peck) Kreisel & Dring from Florida (Ponce de León, 1971) and found that both, Thaxter 3442 (FH) and Singer F237 (FH), belong to *M. velutina.*

Key to the Florida species of *Morganella:*

1. Exoperidium of elongate, setose cells . . . . . *M. velutina*
1. Exoperidium consisting of chains of almost rectangular cells, ofter with a lateral outgrowth resembling a clamp connection . . . . . *M. fuliginea*

Morganella velutina (BERK. ex MASS.) KREISEL & DRING
(Figs. 6, 10 11)

Fruiting bodies up to 3 cm diameter, lignicolous, gregarious or cespitose, depressed globose to pulvinate and usually with a marked umbo (Fig.10); exoperidium mahogany color shading to tan below when fresh, and cinnamon brown (R) when dry, persistent, densely velutinous, the setose hyphae are of two kinds: mostly irregularly club-shaped and 100 µm long, and a few much longer (200 µm), slender and tangled at their apices (Fig. 11); endoperidium smooth, or with a few wrinkles below on drying, very thin; gleba citrine drab or buffy brown (R), with a pseudocolumella small and flattened, not very well marked; spores globose, 3.6-4.5 µm in diameter, with spines up to 1 µm long, often with flattened tips (Fig.6); subgleba tan, compact.

Specimens examined: ALACHUA COUNTY: On rotten log, Arredondo, W.A. Murrill and E. West, 30 July 1938 (FLAS 20841). HIGHLANDS COUNTY: On dead palm trunk, Highland Hammock State Park, near Sebrig, R. Singer, F237, 16 August 1942 (Identified as *Lycoperdon subincarnatum* Peck by S.M. Zeller) (FH), LAKE COUNTY: On volt wood, Eustis 1897-1898. R. Thaxter. (Identified by Lloyd as *Lycoperdon subincarnatum*). (FH).

Discussion: The exoperidial structure serves to distinguish this from all other species of *Morganella.*

Morganella fuliginea (BERK. & CURT.) KREISEL & DRING
(Fig. 7)

Basidiocarps 1-2.5 cm broad and 1-1.5 cm high, depressed globose, attached to the substratum by a white cord mycelium; gregarious or cespitose on wood or soil rich in organic matter. Exoperidium consisting of brown to reddish brown (Verona brown or natal brown to bone brown, R) clusters of minute spines which are composed of chains of almost isodiametric cells, often with a lateral outgrowth resembling a clamp connection, falling at maturity; endoperidium pinkish buff to avellaneous (R), smooth, thin, papery, dehiscent by an irregular apical rupture.

Sterile base, very small or almost absent, white to light strawcolored to light brownish. Gleba cinnamon buff or clay (R), pseudocolumella not well marked. Spores globose, 3.6-4.9 μ in diameter, light yellowish brown with a DeBary bubble, with spines projecting from a thin hyaline envelope which surrounds the spores (Fig. 7).

Specimens examined: ALACHUA COUNTY: On oak log, Sanchez Hammock, E. West and W.A. Murrill, 8 August 1938 (FLAS 19460 and FLAS 19489). On hardwood log, Planera Hammock, E. West and W.A. Murrill, 26 October 1938 (FLAS 19468). LAKE COUNTY: Lake City, H. Hume, Lloyd 22893 (as *L. fuligineum*) (BPI).

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LITERATURE CITED

Ahmad, S.
1950. Studies in the Gasteromycetes. IV. The morphology of *Lanopila wahlbergii* Fr. Sydowia, 4: 39-43.

Bottomley, A.M.
1948. Gasteromycetes of South Africa. Bothalia, 4: 473-810.

Cunningham, G.B.
1944. The Gasteromycetes of Australia and New Zealand. Dunedin, N.Z. 236 p.

Demoulin, V., & D.M. Dring
1975 Gasteromycetes of Kivu (Zaire), Rwanda and Burundi. Bull. Jard. Bot. Nat. Belg., 45: 339-372.

Dring, D.M.
1964. Gasteromycetes of West Tropical Africa. C.M.I. Mycol. Papers, No. 98: 1-58.

Fischer, E.
1933. Gasteromyceteae, p. 1-122. *In* Engler und Prantl's Die Natürlichen Pflanzenfamilien, Ed. II, 7A.

Fries, E.M.
1849. Summa Vegetabilium Scandinaviae, 2: 442.

Homrich, María H., & J.E. Wright
1973. South American Gasteromycetes. The genera *Gastropila, Lanopila* and *Mycenastrum*. Mycologia, 65: 779-794.

Kreisel, H.
1962. Die Lycoperdaceae der Deutschen Demokratischen Republik. Feddes Repert., 64: 89-201.

Kreisel, H.
1967. Taxonomisch-pflanzengeographische Monographie der Gattung *Bovista*. Beih. Nova Hedwigia, 25: 1-244.

Kreisel, H., & D.M. Dring
1967. An emendation of the genus *Morganella* Zeller (Lycoperdaceae). Feddes Repert., 74: 109-122.

Lloyd, C.G.
1902. *Bovista* and *Bovistella*. Mycol. Notes No.9 (#173): 85.

Lloyd, C.G.
1905. The Lycoperdaceae of Australia, New Zealand and Neighboring Islands. Lloyd Library, Cincinnati, Ohio. 42 p.

Lloyd, C.G.
1906. The genus *Bovistella*. Mycol. Notes No.23: 277-292.

Lloyd, C.G.
1923. The genus *Lanopila*. Mycol. Notes No.68: 1177.

Morales, María I., & J.W. Kimbrough
1978. The Lycoperdaceae of North Central Florida. I. The genera *Calvatia* and *Disciseda*. Rev. Biol. Trop., 26: 227-236.

Morgan, A.P.
1892. North. American Fungi, The Gasteromycetes. Cincinn. Soc. Nat. Hist., 14: 141-148.

Perdeck, A.C.
1950. Revision of the Lycoperdaceae of the Netherlands. Blumea, 6: 480-516.

Ponce de León, P.
1971. Revision of the genus *Morganella* (Lycoperdaceae). Fieldiana Bot., 34: 37-44.

Šmarda, F.
1958. Lycoperdaceae, p. 257-377. *In* Flora CSR, ser. B, 1.

Swoboda, F.
1937. Uber den Frutchkörperbau und die systematische Stellung von *Lanopila* Fries. Ann. Mycol., 35: 1-14.

Zeller, S.M.
1948. Notes on certain Gasteromycetes, including two new orders. Mycologia, 40: 639-668.

Zeller, S.M.
1949. Keys to the orders, families and genera of the Gasteromycetes. Mycologia, 41: 36-58.