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NEW SPECIES, NEW COMBINATIONS AND NEW RECORDS OF *VELIGASTER* (*SCLERODERMATACEAE*)

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GUZMAN G. & F.TAPIA -1995- New species, new combinations and new records of *Veligaster* (*Sclerodermataceae*). *Doc.Mycol*. 98-100 : 185-195

KEY-WORDS : *Veligaster*, *Sclerodermataceae*, new species.

ABSTRACT . The tropical or subtropical genus *Veligaster* Guzmán (*Sclerodermataceae*) is discussed, based on new observations on the subgelatinous patches of the exoperidium, both on the base of the globose part of the basidiome and on the upper part of the well developed stipe. In addition, *V. mexicanus* and *V. singaporensis* are described as new species from Mexico and Singapore, respectively. The new combinations *V. nitidum* (Berk)Guzmán & Tapia (a pantropical species), and *V. pseudostipitatum* (Petch)Guzmán & Tapia (known only from Sri Lanka), are proposed. Moreover, *V. columnaris* (Berk. & Br.)Guzmán is reported from a new locality in SW Asia. A key of the 6 known species in the genus is also provided.

RESUME : (Nouvelles espèces, combinaisons et données sur le genre *Veligaster* (*Sclerodermataceae*). Le genre tropical ou subtropical *Veligaster* Guzman (*Sclerodermataceae*) est discuté, sur la base de nouvelles observations concernant les flocons subgélatineux, tant à la base de la partie globuleuse du basidiome que sur la partie supérieure du pied, qui est bien développé. De plus, *V.mexicanus* et *V.singaporensis* sont décrits comme espèces nouvelle, respectivement du Mexique et de Singapour. Les nouvelles combinaisons *V.nitidum* (Berk.)Guzman & Tapia (une espèce pantropicale) et *V.pseudostipitatum* (Petch)Guzman & Tapia (connu seulement du Sri Lanka), sont proposées. Enfin, *V.columnaris* (Berk. & Br.)Guzman est signalé d'une nouvelle localité du Sud-Ouest asiatique. Une clé des 6 espèces connues dans le genre est aussi présentée (traduit par la rédaction).

INTRODUCTION :

While reviewing the stipitate collections of *Scleroderma* from the Botanic Garden of the Institute of Ecology at Xalapa, Mexico, partly earlier identified as *Scleroderma verrucosum* Pers. (Guzmán, 1970) or more recently as *S. tenerum* Berk. & M.A. Curtis (Guzmán, 1991; Chacón & Guzmán, 1995), the authors of the present paper noted on all collections the occurence of a subgelatinous patches of the exoperidium at the base of the globose part of the basidiome and on the upper part of the stipe. This feature relates firmly the specimens with

the genus *Veligaster* Guzmán (1969), and after the revision of Guzmán's notes on both generic concepts, taken in 1965-1969, and subsequent study of new records of *Veligaster*, the authors concluded that this genus is a good natural taxon based on the above-mentioned subgelatinous patches of the exoperidium, contrary to the opinion of Demoulin & Dring (1975), as it will be discussed later.

All the microscopic observations were made on sections mounted in 5 % KOH solution, cotton blue or lactophenol. In the size of the spores, lenght of the spines is included in the total diameter.

NEW SPECIES OF *VELIGASTER* :

***Veligaster mexicanus* Guzman & Tapia, sp. nov.** Figs. 1-4

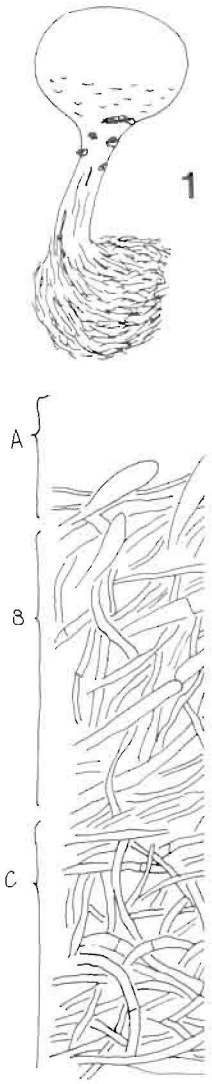
A Veligaster columnaris *(Berk. & Broome)Guzmán differt sporae (7-) 8-10 (-11) µm latae versus (8-) 10-12 (-13.5) µm latae. Ad terram in silva tropicali, Mexico, prope Chiapas, Ocozocuautla ad Apic-Pac, Parque Ecológico Laguna Bélgica, Palacios & Cabrera 2112 (holotypus CHIP; isotipus XAL).*

Basidiome 10-26 mm broad (when dry), globose, with a well developed cylindric or irregularly flattened, somewhat wrinkled, solid **stipe**, 12-18 x 2-5 mm (when dry). **Exoperidium** poorly developed at the upper part of the globose basidiome, brittle and thin (less than 1 mm thick when dry), smooth to somewhat velvety, slightly areolate towards the base, yellowish-brown to a irregularly straw vinaceous color, breaking into dark reddish brown subgelatinous, veil-like irregular **patches** on the base of the globose part and on the upper part of the stipe. **Endoperidium** straw-colored to pale brownish, smooth to subverrucose mainly toward the base of the globose part of the basidiome. All the peridium rubescent to vinaceous brown. **Base of the stipe** with a conspicuous well developed whitish mycelial mass. **Gleba** blackish brown to gray violet, fleshy and compact when immature (very hard when dry) to powdery at maturity. **Context** whitish to yellowish at the upper part of the basidiome, whitish to vinaceous-red in the stipe, mainly in the center, rubescent. KOH staining the peridium pale brownish-red (in dry specimens).

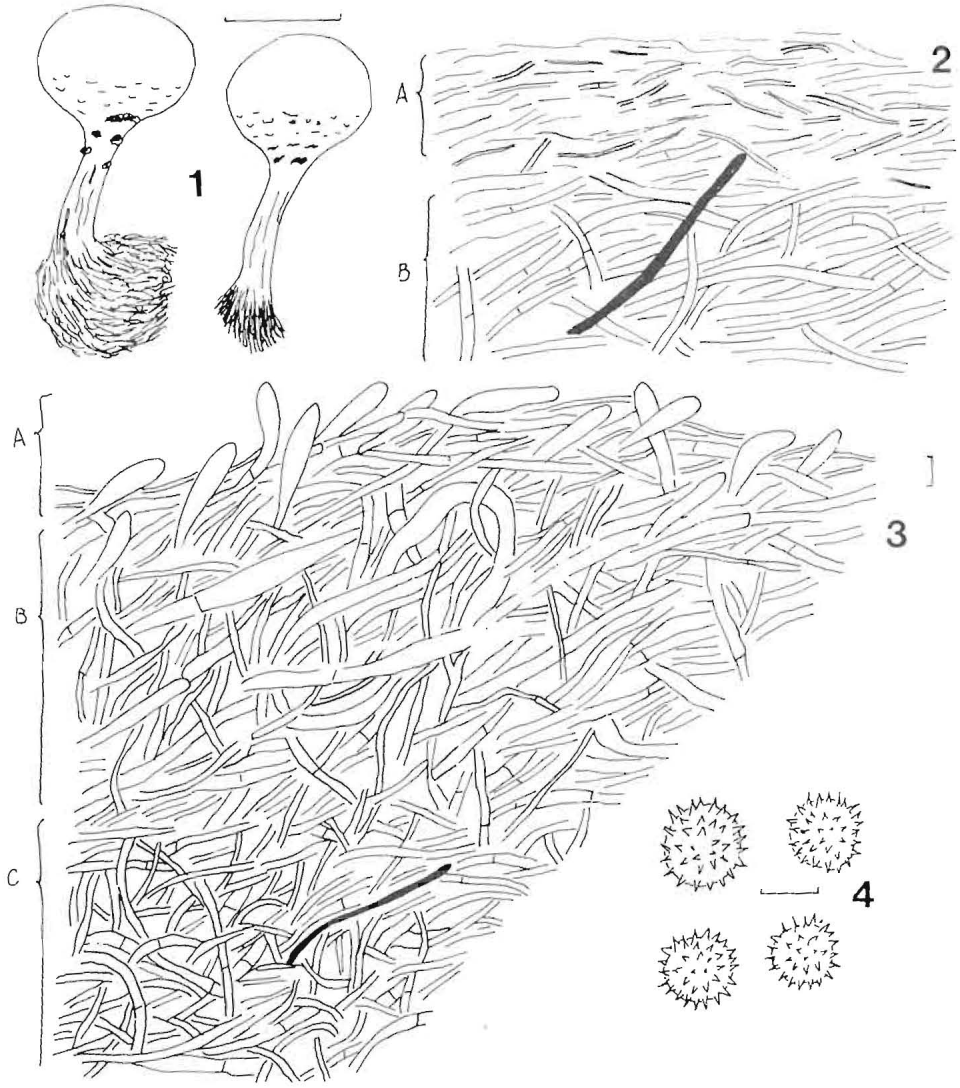
Spores (7-) 8-10 (-11) µm in diam., globose, yellowish brown, echinulate, the spines 0.8-1.5 µm long. **Exoperidium** at the upper part of the basidiome with semierect elements 7-9 µm diam and repent thin walled hyphae, 1.5-5 µm wide, yellowish-brown ; but in the subgelatinous patches of both the base of the globose part of the basidiome and the upper part of the stipe, as a gelatinous layer of repent thin walled hyphae, 1-2.5 µm wide, yellowish or brown yellowish. **Endoperidium** as a layer of hyaline or yellowish thin walled hyphae, 1-10 µm wide in the upper part of the basidiome and stipe. **Context** in the globose part of the basidiome with hyaline thin walled hyphae, 1.5-5 µm wide, in irregular arrangement ; in the stipe it is formed by hyaline thick-walled hyphae (up to 2 µm thick), 5-28 µm wide, in a pseudoparenchymatous arrangement. Lactiferous vermiform, 1.5-5 µm wide, yellow hyphae, present in the peridium. Clamp connections absent.

Habitat and distribution : Gregarious on soil, in a tropical evergreen forest, at 850 m altitude. Known only from the type locality.

Material examined : **MEXICO**, STATE OF CHIAPAS, road Ocozocuautla to Apic-Pac (Malpasado Dam),



Figs. 1-4.- *Veligaste*
exoperidium, B : end
the top of the globose
(scale bar 20 mm in 1



Figs. 1-4.- *Veligaster mexicanus* (Holotype). 1 : Basidiomes. 2 : A patch of the stipe (A : exoperidium, B : endoperidium). 3 : Exoperidium (A), endoperidium (B) and context (C) at the top of the globose part. 4 : spores .
(scale bar 20 mm in 1 ; 10 µm in 2 & 3 ; and 6 µm in 4).

Laguna Bélgica Ecological Park, Oct. 12, 1992, *Palacios & Cabrera* 2112 (holotype CHIP, isotype XAL).

Discussion : This species is close to *V.columnaris* which differs by its larger spores [(8-) 10-12 (-13.5) µm in diam.) and is known only from Sri Lanka and Java. It is also close to *V. singaporensis* from Singapore (see below), with spores (10-) 12-15 (-18) µm diam.

***Veligaster singaporensis* Guzmán & Tapia, sp. nov.** Figs. 5-7

A Veligaster columnaris *(Berk. & Broome)Guzmán differt in globosae fructificatio 40-60 mm latae et stipes 25-30 mm latae, sporae (10-) 12-15 (-18) µm latae, et hyphae exoperidiris 7-17 mm latae. Holotypus: Flippmann 6020, Singapore (K).*

This species is close to *V. columnaris* from which it differs by more robust basidiomes, up to 80 mm high, with the globose part 40-60 mm wide, and pyriform stipe 25-30 mm diam. The base of the globose part and the upper part of the stipe is cracked at maturity in small vinaceous-brown subgelatinous irregular patches, which represent the well developed exoperidium. The context is white and rubescent to reddish dark or blackish when cutting.

Spores (10-) 12-15 (-18) µm diam, globose, echinulate, spines 1.5-4.5 µm long, yellowish-brown. Exoperidium at the subgelatinous patches, as a gelatinous vinaceous-brown layer, with repent hyphae 5-15 µm diam, thin walled. Endoperidium with thin to thick walled hyaline hyphae, which protrude into the surface at the upper part of the basidiome, as pyriform or cylindric elements, thin or thick walled, 6-17 µm wide. Context formed by thin or thick walled hyaline hyphae, 2-6 µm wide, in irregular arrangement. Lactiferous vermiform, 1.5-4 µm wide yellow elements are present in the peridium layers. Clamp connections absent.
Material examined : **SINGAPORE**, Singapore, Botanic Garden, Aug. 7, 1920, *Flippmann* 6020 (holotype K, as *Scleroderma* sp.; also on Lloyd Herbarium at BPI, as *Scleroderma* sp.).

Discussion : The studied collections were first considered by Guzmán (1969) as *Veligaster columnaris*, but according to the large size of basidiomes, spores and hyphae of the endoperidium, this material can be well separated from that species into the new species described above.

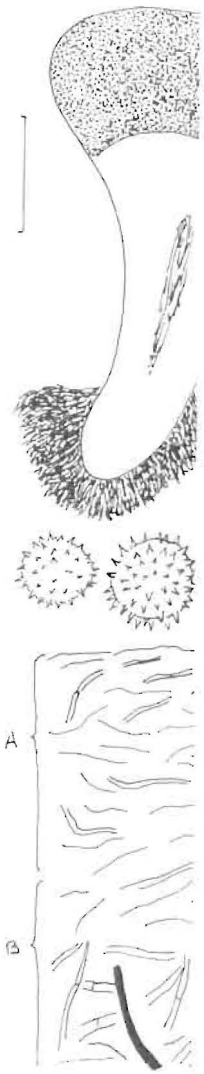
***Veligaster nitidum* (Berk.) Guzmán & Tapia, comb. nov.** Figs. 8-11 & 15-16

≡ *Scieroderma nitidum* Berk., *Kew Jour. Bot.* 6: 173, 1854. (Basionym)
= *S. tenerum* Berk. & M.A. Curtis, *Jour.Linn.Soc. (Bot.)* 10: 346, 1869[1] .

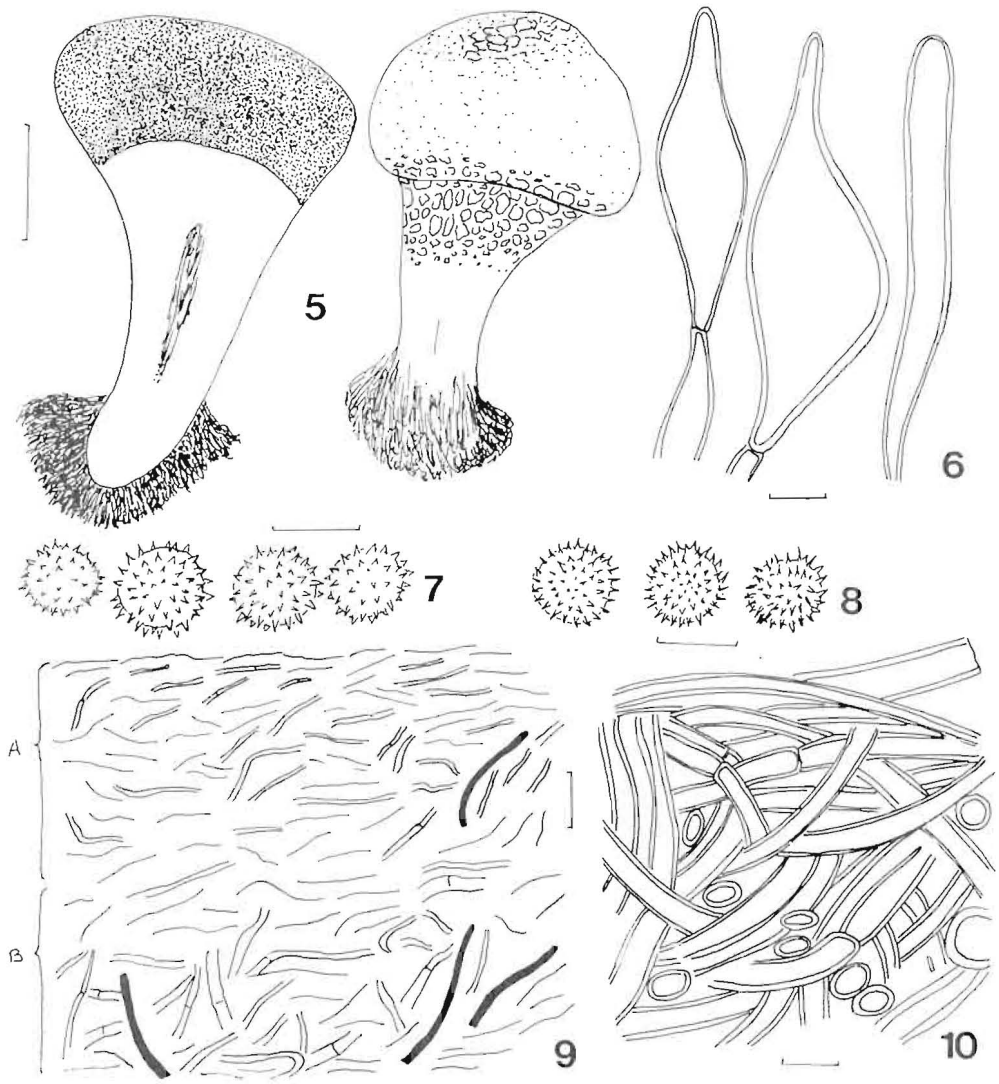
The subgelatinous veil-like patches of the exoperidium on the base of the globose part of the basidiome and on the upper part of the stipe, place this taxon in the genus *Veligaster*, although those patches are difficult to observe in very young and old basidiomes.

This fungus was considered by Guzmán (1967) as *Scleroderma nitidum*, with *S.tenerum* as a synonym. However, Guzmán (1970) later considered *S. nitidum* as conspecific with *S. verrucosum*, and pointed out that tropical forms are well stipitate, whether temperate forms

[1] When this paper was in press, the authors received the type of *Scleroderma tenerum* from K. They found in it spores x (7-)9-11(-12) µm, and an exoperidium on the upper part of the stipe, as an obscurely gelatinous layer, formed by yellowish repent hyphae 1,5-3(-4) µm in diam. The authors thank the help of Dr.D.N.Pegler from K to sending the type.



Figs. 5-10.- 5-7 : endoperidium. 7 : and endoperidium (scale bar 20 mm i



Figs. 5-10.- 5-7 : *Veligaster singaporensis* (Holotype). 5 : Basidiomes. 6 : Elements of the endoperidium. 7 : Spores.- 8-10 : *V. nitidum* (Brown 609). 8 : Spores. 9 : Exoperidium (A) and endoperidium (B) at a patch of the stipe. 10 : Context of the stipe.
(scale bar 20 mm in 5 ; 7 µm in 6 ; 14 µm in 7 ; 10 µm in 8 & 9 ; and 15 µm in 10).

are sessile or pseudostipitate. Recently, Guzmán (1991) and Chacón & Guzmán (1995a) considered *S.tenerum* as a good species common in Mexico. Coker & Couch (1928) described the type of *S. tenerum* from Cuba (with a good picture), as a stipitate fungus, with spores (8-)8.5-10(-11) µm diam, and peridium scales as those of *S.verrucosum* and *S. lycoperdoides* Schwein., and they concluded that all these fungi are conspecific ; the accepted name for them was *S.lycoperdoides*. However, *S.lycoperdoides* is conspecific with *S.areolatum* Ehrenb. (Guzman, 1970). The type of *S. tenerum* seems lost, as noted by Guzmán (1970) [*but see the infrapaginal note on the preceeding page -inserted just before printing*], but the type of *S. nitidum* at K is in good condition, with a well developed stipe with some patches on the upper part, and spores (7-) 9-11 (-12) µm in diam. Lloyd (1924) presented a good picture (fig.2920) of the type of *S.nitidum*. Many references of *S.verrucosum* or *S. tenerum* from the tropics belong to *Veligaster nitidum*, as those of Ahmad (1952) and Dennis (1954,1970).

The studied material in the present paper, has basidiomes up to 50 mm high, and 10-40 mm wide in the globose part, with a well developed solid stipe, cylindric or flattened, frequently lacunose, with a conspicuous mycelial mass at the base. Exoperidium smooth to soon cracked in small to 1-2 mm wide adpressed squamules, fairly close, dark-brown, but as subgelatinous patches on the base of the globose part of the basidiome and on the upper part of the stipe, a feature difficult to observe in very young and old specimens. Endoperidium whitish to yellowish when seen between the squamules of the exoperidium. All the peridium rubescent to vinaceous red mainly when cut. Dehiscence in the upper part as irregular cracks and splits falling away, exposing the gleba. Gleba whitish and fleshy in young specimens to soon powdery and blackish-brown or greyish violet, with olivaceous tinges. KOH staining the peridium pale brownish-red (in dry specimens). Spores (7-) 8-11 (-12) µm in diam., globose, yellowish brown, echinulate, the spines 0.5-1.5 µm long. Exoperidium at the top of the globose part (in the scales) formed by erect or semierect and repent yellowish hyphae, thin to thick walled, 2-6 µm wide; in the subgelatinous patches formed by a gelatinous hyaline layer, with repent hyaline or yellowish thin walled hyphae, 0.5-2 µm wide. Endoperidium formed by hyaline to yellowish, thin walled 1-4 µm wide hyphae, in irregular arrangement, with an irregularly incrusted yellow-brown pigment. Context formed by hyaline to yellowish, thick walled hyphae (walls up to 2.5 µm thick), 3-20 µm wide, in irregular arrangement (those of the inner part of the stipe are wider than those of the globose basidiome). Lactiferous yellow hyphae, 1.5-3 µm wide, very common in the peridium. Clamp connections absent.

Material examined : **COSTA RICA**, near Alajuela, Los Cartagos, July 13, 1937, *Hatch* 106 (FH as *Scleroderma verrucosum*). *MEXICO*, STATE OF CHIAPAS, road Ocozocuautla to Apic-Pac (Malpaso Dam), Laguna Bélgica Ecological Park, Nov. 16, 1984, *Guzmán* 24803 (XAL); Sept. 26, 1993, *Guzmán* 30726 (XAL). STATE OF VERACRUZ, Region of Los Tuxtlas, S of San Martin Volcano, eastern of Vaxin Hill, Jul. 11, 1972, *Guzmán* 10330 (ENCB, as *Scleroderma verrucosum*); 5 km N of Río Blanco, Pico del Aguila, Aug. 30, 1985, *Pérez-Moreno* 60 (XAL). Road Chiconquiaco to Santa Rita, Jul. 10, 1966, *Herrera* (MEXU as *Scleroderma verrucosum*); Huatusco to Maromillas, Puentecilla, Aug. 16, 1983, *Chacón* 1308 (XAL). Region of Xalapa, old road to Coatepec, Ecological Park and Botanic Garden, Jul. 23, 1981, *Brown* ; Sept. 14, 1981; *Brown* 643; Oct. 12, 1981, *Brown* 105; May 27, 1982, *Brown* 425; Jun. 2, 1982, *Brown* 462; 470; 500; Jul. 15, 1982, *Brown* 513; Aug. 31, 1982, *Brown* 580; 602;718; Sept. 2, 1982, *Brown* 609; Sep. 9, 1982, *Brown* 637; 699; 708; 709; 717; Dec. 14, 1982, *Brown* 776; Oct. 7, 1986, *Chacón* 3836; Jul. 2, 1993, *Chacón* 4690; Aug. 18, 1983, *Chacón* 1363; Jun. 12, 1985, *Chacón* 2795; Jun.20, 1991, *Chacón* 4506; Jul.14-15, 1993, *Chacón* 4686; 4727; Jan. 20, 1984, *Chan* 16; Jul. 2, 1981, *López* 1417; Jul. 15, 1983, *Sampieri* 12; May 23, 1990, *Palacios* 5; Jul.6, 1993, *Rubio* 4; Aug. 18, 1983, *Delgadillo* 57; Jul. 2, 1981, *Garcia* 309; Aug.12, 1986, *Bandala* 989; Jul. 7, 1985, *Montoya* 139; Oct. 6, 1986, *Montoya* 911; Sept. 19,

1986, *Anell* 677; Nov. 22, 1983, *Anell* 21; Jul. 6, 1981, *Guzmán* 19319; Aug. 1, 1981, *Guzmán* 20085-A; Nov. 20, 1992, *Guzmán* 30616; SE of Botanic Garden, Ejido Benito Juárez, Jul. 7, 1983, *Chacón* 1139; near Casa Conecalli DIF, Jul. 17, 1990, *Murrieta* 151; Aug. 27, 1991, *Tapia* 857; 2 km W of Las Hayas, Aug. 21, 1984, *Chacón* 2553; Jun. 29, 1989, *Bandala* 1527; near La Pitaya, Zoncuantla,Oct. 13, 1993, *Guzmán* 30801; May 19,1994, *Guzmán* 30900; Jun.4, 1994, *Guzmán* 30907; 30926; Aug. 15, 1994, *Guzmán* 30931; Jul.1, 1995, *Guzmán* 31176; Jul. 16, 1995, *Guzmán* 31237; near Banderilla, La Martinica Hill, Jul. 7, 1981, *García* 357; May 26, 1985, *Bandala* 133; Jun. 12, 1992, *Bandala* 2072; Coapexpan, Jun. 8, 1985, *Bandala* 155; Jun. 5, 1988, *Bandala* 1338. San Andrés Tlalnehuayocan to Plan de Sedeño, near San Andrés Tlalnehuayocan, Jul. 20, 1989, *Montoya* 1339 (all in XAL). **NEPAL**, Nanghi, *Berkeley* (K, holotype of *Scleroderma nitidum*).

***Veligaster pseudostipitatum* (Petch) Guzmán & Tapia, comb. nov.** Fig. 12

≡ *Scleroderma pseudostipitatum* Petch, *Ann. Roy Bot. Gard. Perad. 7(1)*: 76, 1919. (Basionym)

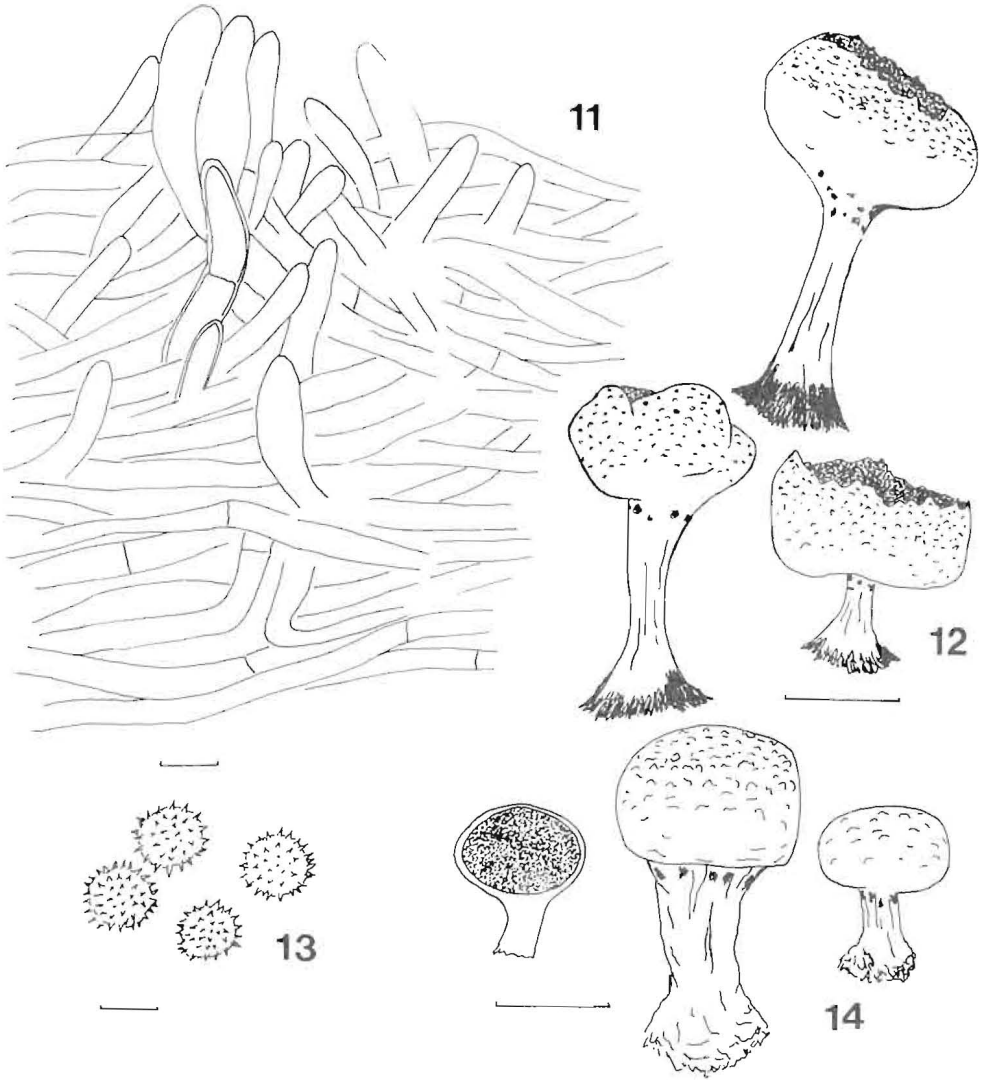
This well stipitate sclerodermataceous fungus, presents subgelatinous patches in the exoperidium on the base of the globose part of the basidiome and on the upper part of the stipe, and it is well placed in the genus *Veligaster*. It is close to *V.nitidum* because of the small scales of the exoperidium at the upper part of the globose part of the basidiome, even in the size and form of the basidiome, but its spores are larger : (8.5-) 10-13.5 (-15) µm diam. It is interesting to observe that Lloyd (1916-1919; 1924), who discussed all the stipitate forms of *Scleroderma*, as *S.nitidum*, *S.tenerum* and *S.columnare*, did not consider *S.pseudostipitatum*, moreover he studied the type included in his herbarium (Lloyd 37973, BPI). Lloyd considered all the stipitate forms of *Scleroderma*, as simply stalked forms of *S.verrucosum*.
Material examined : **SRI LANKA** (Ceylon), Hakgala, Sept., 1908, *Petch* 2958 (holotype BPI, *Lloyd* 37973, as *Scleroderma verrucosum*).

A NEW RECORD OF *VELIGASTER COLUMNARIS* : Figs. 13-14

This species was known onky from Sri Lanka and Java, after several collections by Berkeley, Petch, Patouillard, Copeland and Overeem (Guzmán, 1969). However, the senior author (GG), while revising his notes on *Veligaster*, found that the collection *Cave* 3697 in Lloyd Herbarium (Lloyd 41799) (BPI) from British India (SW Asia), agrees well with *V. columnaris*. This collection has a very well developed stipe, with subgelatinous patches, velvety exoperidium at the globose basidiomes, and spores (8-) 10-12 (-13.5) µm in diam., including the spines, which are 1.5-2 µm long. However, the basidiomes seem somewhat calcificated, because they are very hard and thick in every where.

GENERAL DISCUSSION :

Veligaster is characterized by its tropical or subtropical distribution and by the subgelatinous veil-like patches of the exoperidium both on the base of the globose part of the basidiome and on the upper part of the stipe (from where the name of the genus was taken : a gasteromycete with a veil) (Guzmán, 1969). This feature is completely absent in *Scleroderma* Pers.:Fr. and in other members of *Sclerodermataceae*. Thus, the position of Demoulin & Dring (1975), followed by Hawksworth & *al.* (1983) to consider *Veligaster* as conspecific



Figs.11-14.- 11-12 : *Veligaster nitidum* (Sampieri 12), 11 : exoperidium (scale at the top at the globose part, with the endoperidium below. 12 : *V. pseudostipitatum* (Holotype), three basidiomes. 13-14 : *V.columnaris* (Cave 3697), 13 : Spores. 14 : Basidiomes.
(scale bar 5 µm in 11 ; 20 mm in 12 ; 8 µm in 13 ; 20 mm in 14).

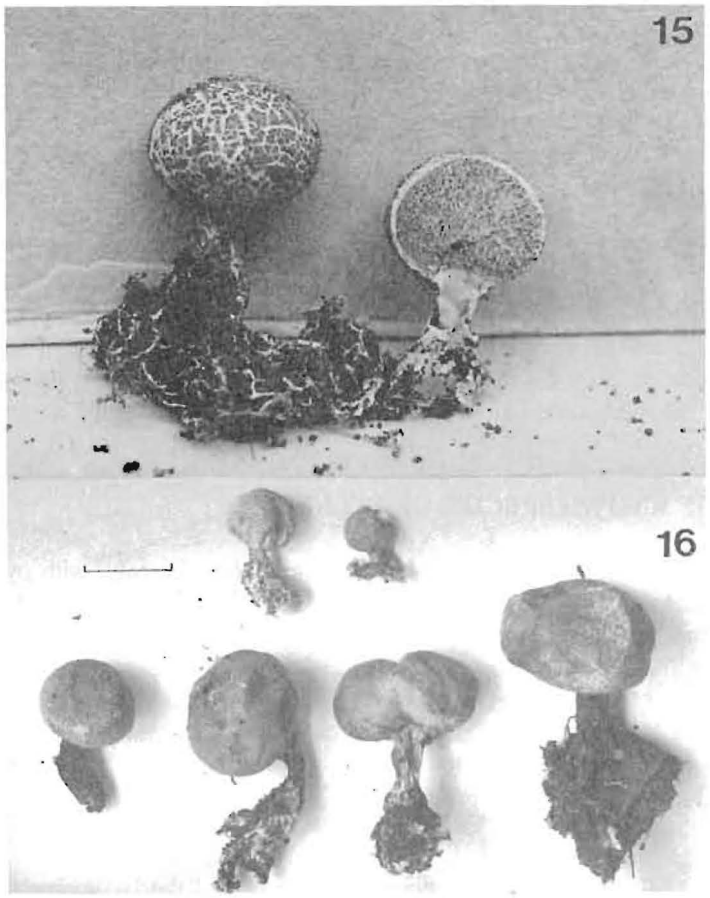
with *Scleroderma* is unacceptable. Certainly, in some specimens of *Veligaster*, as in very young and old basidiomes of *V.nitidum*, it is difficult to observe the subgelatinous patches, but in mature basidiomes this important feature is well defined. On the other hand, *V.nitidum* presents the same peridium scales and spores than those of *Scleroderma verrucosum* and *S. areolatum* Ehrenb. However, the mentioned peridium patches and the size of spores separate well these species. *S.verrucosum* has spores of (8)- 9-13 (-14) µm, and *S.areolatum* (10-) 11-16 (-18) µm in diam.

Refering to the ecology, *Veligaster* appears to be a mycorrhizal genus mainly associated with tropical or subtropical species of *Quercus*, as Guzmán observed with the specimens of *V.nitidum* and *V.mexicanus* in Mexico. In the localities from S and SW of Asia, *Quercus* is a common tree. It is interesting to observe that *V.mexicanus* and *V.nitidum* live together at the same locality of the State of Chiapas, in Mexico, but of the 64 Mexican studied specimens of *V.nitidum*, 62 are from subtropical (mesophitic) forests at 1300-1400 m alt. in the State of Veracruz, and the others 2 from a tropical evergreen forest in the State of Chiapas, at 850 m alt. Concerning phenology, the majority of the Mexican collections, grow between June-August, mainly in July. However, some collections are from September, a few from May, October and November, and only one from January and other from December. These observations agree with those, recently discussed by Chacón & Guzmán (1995), on other fungi in Mexico, mainly in the mesophitic (subtropical) forests, that have in Xalapa an annual rainfall of 1490 mm.

KEY TO THE KNOWN SPECIES OF *VELIGASTER* :

1a. Exoperidium at the globose part of the basidiome densily scaly, with pyramidal scales, deciduous at maturity. Species known only from Central Africa.....***V. leptopodium***[2]
1b. Exoperidium at the globose part of the basidiome velvety, smooth or scaly by craking, with flat scales.....2
2a. Exoperidium at the upper part of the globose part of the basidiome velvety or smooth.....3
2b. Exoperidium scaly by craking, with flat scales.....5
3a. Spores (7-) 8-10 (-11) µm in diam. Exoperidium at the globose part of basidiome smooth to somewhat velvety. Species known only from Mexico.....***V. mexicanum***
3b. Spores bigger than above. Exoperidium at the globose part of the basidiome, velvety.....4
4a. Spores (8-) 10-12 (-13.4) µm in diam. Globose part of the basidiome up to 35 mm in diam. Species known only from S and SW of Asia.....***V. columnaris***
4b. Spores (10-) 12-15 (-18) µm in diam. Globose part of the basidiome up to 60 mm in diam. Species known only from Singapore.....***V. singaporensis***
5a. Spores (7.5-) 9-11 (-12) µm in diam. Pantropical species.....***V. nitidum***
5b. Spores (8.5-) 10-13.5 (-15) µm diam. Species known only from Sri Lanka.....
.....***V. pseudostipitatum***

[2] *V. leptopodium* (Har. & Pat.)Guzmán 1969 (≡ *Scleroderma leptopodium* Har. & Pat., *Bull. Soc. Mycol. Fr. 24*: 14, 1908 ; *Bull. Mus. Hist. Nat. Paris 15*: 84, 1909). Both Guzmán's (1969) and Demoulin & Dring's (1975) reports, only considered the 1909 reference of Hariot & Patouillard.



Figs. 15-16.- *Veligaster nitidum*, basidiomes (15, above : Guzmán 10330, 16, below : Herrera (scale bar 20 mm).

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