

THE GENUS *STEPHANOSPORA* PAT., TWO NEW COMBINATIONS

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ABSTRACT. The genus *Stephanospora* Pat., two new combinations. As a result of the revision of herbarium material of the genera *Stephanospora* Pat., *Hydnangium* Wallr. ex Klotzsch and *Octaviania* Vittad., four species of *Stephanospora* has been identified, viz. *S. aurantiaca* (R. Heim et Malençon) J.M. Vidal *comb. nov.* (Europe), *S. caroticolor* (Berk.) Pat. (Europe), *S. chilensis* (E. Horak) J.M. Vidal *comb. nov.* (South America and Europe) and *S. flava* (Rodway) G.W. Beaton, Pegler et T.W.K. Young (Australia and South Africa). Two other species, *S. corneri* Pegler et T.W.K. Young and *S. penangensis* Corner et Hawker, are excluded from the genus *Stephanospora*. We afford the updated synonymy, a detailed description, O.M. pictures and a determination key for all the surveyed species. In the case of *S. aurantiaca* and *S. caroticolor*, after the study of recent collections and a sound bibliographic research, the data regarding their ecology, phenology and distribution in Europe has been completed and summarized. We afford also new data confirming the relationship between the genera *Stephanospora* Pat. and *Lindtneria* Pilát.

Key words: Stephanosporaceae, *Stephanospora*, *Lindtneria*, hypogeous fungi, taxonomy, chorology.

RESUMEN. El género *Stephanospora* Pat., dos nuevas combinaciones. Como resultado de la revisión del material de herbario de los géneros *Stephanospora* Pat., *Hydnangium* Wallr. ex Klotzsch y *Octaviania* Vittad., 4 especies de *Stephanospora* han sido identificadas: *S. aurantiaca* (R. Heim et Malençon) J.M. Vidal *comb. nov.* (Europa), *S. caroticolor* (Berk.) Pat. (Europa), *S. chilensis* (E. Horak) J.M. Vidal *comb. nov.* (Sudamérica y Europa) y *S. flava* (Rodway) G.W. Beaton, Pegler et T.W.K. Young (Australia y Sudáfrica). Otras dos especies, *S. corneri* Pegler et T.W.K. Young y *S. penangensis* Corner et Hawker, han sido excluidas del género *Stephanospora*. De todas las especies estudiadas se proporciona una sinonimia actualizada, una amplia descripción, fotografías al M.O., y una clave sistemática. Se ilustran *S. aurantiaca* y *S. caroticolor* y, a partir de recientes recolecciones y de una exhaustiva investigación bibliográfica, todos los datos referentes a su ecología, fenología y distribución en Europa han sido complementados y resumidos. También se aportan nuevos datos que confirman la relación entre los géneros *Stephanospora* Pat. y *Lindtneria* Pilát.

RESUM. El gènere *Stephanospora* Pat., dues noves combinacions. Com a resultat de la revisió del material d'herbari dels gèneres *Stephanospora* Pat., *Hydnangium* Wallr. ex Klotzsch i *Octaviania* Vittad., 4 espècies d'*Stephanospora* han estat identificades: *S. aurantiaca* (R. Heim et Malençon) J.M. Vidal *comb. nov.* (Europa), *S. caroticolor* (Berk.) Pat. (Europa), *S. chilensis* (E. Horak) J.M. Vidal *comb. nov.* (Sudamèrica i Europa) i *S. flava* (Rodway) G.W. Beaton, Pegler et T.W.K. Young (Australia i Sudàfrica). Dues altres espècies, *S. corneri* Pegler et T.W.K. Young i *S. penangensis* Corner et Hawker, han estat excloses del gènere *Stephanospora*. De totes les espècies estudiades s'en proporciona una sinonimia actualitzada, una amplia descripció, fotografies al M.O., i una clau sistemàtica. S'il·lustren *S. aurantiaca* i *S. caroticolor* i, a partir de recents recol·leccions i d'una exhaustiva recerca bibliogràfica, totes les dades referents a la seva ecologia, fenologia i distribució a Europa han estat complementades i resumides. També s'aporten noves dades que confirmen la relació entre els gèneres *Stephanospora* Pat. i *Lindtneria* Pilát.

INTRODUCTION

The genus *Stephanospora* was erected by PATOUILLEARD (1914) to accommodate *Hydnangium caroticolor* Berk. et Broome, separated from the genus *Hydnangium* Wallr. ex Klotzsch because of its peculiar spore ornamentation, of big pyramidal spines, with a prominent circular basal crown. Regarding its systematics, BATAILLE (1923) locates the genus *Stephanospora* in the family Hymenogastraceae Vittad., and the same position is taken by FISCHER (1933) and CUNNINGHAM

(1944), which synonymize it with *Octaviania* Vittad. Conversely, DODGE (1928), DODGE & ZELLER (1936), SOEHNER (1949), HAWKER (1954), KNAPP (1958) and SVRČEK (1958) find appropriate to include it in the family Hydnangiaceae C.W. Dodge. PEGLER & YOUNG (1979) prefer to locate it in the family Octavianiaceae Locquin ex Pegler et Young. OBERWINKLER & HORAK (1979), after realizing the similitude between the spores of the corticiaceous *Lindtneria trachyspora* (Bourd. et Galz.) Pilát and those of *Stephanospora caroticolor* (Berk.) Pat., decide to include it, along with *Lindtneria* Pilát, in a new family Stephanosporaceae Oberw. et E. Horak. Later JÜLICH (1981) retains in the family only the gasteroid genus *Stephanospora*, but erects a new family Lindtneriaceae Jülich to accommodate the resupinate genus *Lindtneria*. We will follow here the view of OBERWINKLER & HORAK (*op. cit.*), and will consider that both genera (*Lindtneria* and *Stephanospora*) are phylogenetic neighbours, as *Stephanospora* must be understood as a gasteroid adaptation of the genus *Lindtneria*. In consequence, they must both been included in the family Stephanosporaceae.

MATERIAL AND METHODS

The present work has been based upon the study of exsiccata material sent in loan by the following public herbaria K (Kew, UK), M (München, Germany), NY (New York, USA), PC (Paris, France), PRM (Praha, Czech Republic) and Z-ZT (Zürich, Switzerland), and fresh material collected by the author and collaborators, labeled JMV and kept in the herbarium BCN. The colours has been referred following the colour guide of KORNERUP & WANSCHER (1978), after the indication K&W. The measurements and the O.M. photographs has been made on material previously rehydrated with KOH or chloral hydrate. Measurements include neither ornamentation nor the hilar appendix.

RESULTS

As a result of a revision of herbarium material of number of collections of *Stephanospora* Pat., *Hydnangium* Wallr. ex Klotzsch and *Octaviania* Vittad., two new combinations in the genus *Stephanospora* are proposed, and two species of *Stephanospora* are rejected.

Stephanosporaceae Oberw. et E. Horak, *Pl. System. & Evol.* 131: 162 (1979).

Syn.- *Lindtneriaceae* Jülich, *Biblioth. Mycol.* 85: 377 (1981).

Basidioma gymnocarpic or angiocarpic; if gymnocarpic, resupinate, loosely adnate, pellicular to membranaceous; hymenial surface odontoid or poroid, whitish to ochraceous or orange; if angiocarpic, globular to irregular, sessile; peridium orange to ochraceous, fragile, evanescent; gleba orange, with minute chambers, irregular or labyrinthiform, empty to full; stipe and columella absent.

Spores heterotropic or orthotropic, hyaline, yellowish or orange, globose to ellipsoid, somewhat thick-walled, ornamented with spines or short crests, and often with a peri-appendicular closed corona around a short hilar appendix; contents homogeneous or guttulate; spore walls inamyloid but cyanophilous. Basidia hyaline, cylindrical, clavate or suburniform, thin-walled, with or without a basal clamp, 2-4-spored. Cystidia absent or present. Hyphal-system monomitic. Hyphae hyaline, cylindrical to broadly inflated; clamp-connexions present or absent; hyphae of the subiculum next to substratum and of the mycelial strands often brown pigmented and rough. Peridiopellis a poorly differentiated epicutis of narrow, woven hyphae. Habitat & distribution.- Epigeous on plant debris or saprophytic on wood (*Lindtneria*), or hypogeous and ectomycorrhizal with trees (*Stephanospora*). Type genera.- *Stephanospora* Pat. Bibl. sel.- JÜLICH (1981: 171; 1984: 533), PEGLER *et al.* (1993: 150).

KEY TO GENERA

1 **a)** Basidioma gymnocarpic, resupinate; hymenophore merulioid to poroid; spores heterotropic:

Lindtneria Pilát (not treated)

1 **b)** Basidioma angiocarpic, globular; hymenophore loculate; spores orthotropic:

Stephanospora Pat.

***Stephanospora* Pat., Bull. Soc. Mycol. Fr. 30: 349 (1914).**

Basidioma angiocarpic, 1-3 cm diam, globose to irregular, sessile. Peridium arachnoid, fragile, evanescent, ochraceous to red-orange. Gleba loculate, orange to vinaceous, chambers minute, irregular or labyrinthiform, empty to full. Stipe and columella absent. Mycelial strands present.

Basidiospores statismosporic, orthotropic, globose, subglobose or ellipsoidal, yellowish to orange, somewhat thick-walled; eusporium ornamented with spines or short crests, with a peri-appendicular closed corona; hilar appendix short, cylindrical, with an hilar pore, often retaining a collapsed sterigmal appendage; contents homogeneous or guttulate; spore walls non-amyloid, non-dextrinoid, but cyanophilous. Basidia hyaline, cylindrical to clavate, thin-walled, without a basal clamp, (1)-2-4-spored. Cystidia absent. Hyphal-system monomitic. Hyphae of peridium and hymenial trama hyaline, cylindrical to broadly inflated, without clamp-connexions. Hyphae of the mycelial strands with some clamps, hyaline and smooth, thick, some of them brownish and rough. Peridiopellis a poorly differentiated epicutis of narrow, thin, interwoven hyphae. Habitat & distribution.- Hypogeous or semihypogeous, ectomycorrhizal, associated with trees, in temperate regions of Eurasia, Australasia and South America. Phylogenetical relationship: *Lindtneria* Pilát (see OBERWINKLER & HORAK, 1979). Type species.- *Stephanospora caroticolor* (Berk.) Pat. (= *Hydnangium caroticolor* Berk.). Bibl. sel.- PEGLER & YOUNG (1979: 382-383), JÜLICH (1984: 533), BEATON *et al.* (1985: 595-597), MOSER & JÜLICH (1985-2002: VII *Stephanospora*), CASTELLANO *et al.* (1989: 94-95).

KEY TO SPECIES

- 1 a) Spore-base with a prominent circular corona of 5-9 µm width and 1,5-2,5 µm of projection; spores ovoid, 10-13,5-(15) x 7,5-10 µm. In temperate regions of Europe:
S. caroticolor
- b) Spore-base without a prominent circular corona, not more than 3,5-5 µm wide and 1-1,5 µm of projection
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- 2 a) Spores ovoid, 9-12,5 x 7,5-9 µm, spinose. Found in Chile and Germany:
S. chilensis
- b) Spores globose to subglobose, spinose, crestate or subreticulate **3**
- 3 a) Spores crestate to subreticulate, 9-11,5-(12,5) x 8,5-10,5-(12) µm. Found in Australia and South Africa:
S. flava
- b) Spores spinose to subreticulate, 10-14-(15,5) x (7,5)-10-13 µm. In temperate regions of Europe:
S. aurantiaca

***Stephanospora caroticolor* (Berk.) Pat., Bull. Soc. Mycol. Fr. 30: 349 (1914) (ut "*carotaecolor*") (Fig. 1)**

Basionym.- *Hydnangium caroticolor* Berk., *Ann. Mag. Nat. Hist.*, Ser. I, 13: 351 (1844).

Syn.- *Octaviania caroticolor* (Berk.) Corda, *Icon. Fung.* 6: 36 (1854).

Excl.- *Stephanospora caroticolor* sensu Codina & Font Quer, *Cavanillesia* 3: 169 (1931); Hawker, *Phil. Trans. Roy. Soc. London*, Ser. B, Biol. Sci., 650(237): 519, figs. 26a-g (1954) (= *Stephanospora aurantiaca*).

ICON. AND BIBL. SEL.- BERKELEY (1844: 351, ut *H. carotaecolor*); TULASNE & TULASNE (1851: 75, pl. 21/4, ut *H. carotaecolor*); CORDA (1854: 36, tab. VII/65, ut *O. carotaecolor*); BERKELEY (1860: 293, pl. 20/1, ut *H. carotaecolor*); QUÉLET (1873: 375, ut *H. carotaecolor*); WINTER (1883: 877-878, fig. p. 871, ut *H. carotaecolor*); QUÉLET (1886: 247, ut *H. carotaecolor*); DE TONI (1888: 176-177, ut *H. caroticolor*); MASSEE (1889: 36, pl. 1/6, ut *H. carotaecolor*); HESSE (1891: 83, ut *H. carotaecolor*); BATAILLE (1910: 149, ut *H. carotaecolor*; 1923: 179, ut *S. carotaecolor*); PATOUILLARD (1910: 203-204, fig. 3, ut *H. carotaecolor*; 1914: 349, ut *S. carotaecolor*); LLOYD (1922: 1141, figs. 2162-2163, ut *O. carotaecolor*); REA (1922: 28-29, ut *H. carotaecolor*); MATTIROLO (1935: 28, ut *H. carotaecolor*); DODGE & ZELLER (1936: 597-598); KNAPP (1941: 178, tab. I, fig. 35, ut *H. carotaecolor*); COSTANTIN & DUFOUR (1967: 201, pl. 57, fig. 1768, ut *H. carotaecolor*); SOEHNER (1949: 12-13, figs. 18-25); KNAPP (1958: 156-157, tab. X/15); SVRČEK (1958: 202-203, fig. 40/1); SZEMERE (1965: 267-268, ut *S. carotaecolor*); HAWKER (1975: pl. 31/1-2, spores, ut *S. carotaecolor*); OBERWINKLER & HORAK (1979: 160-161,

figs. 3-4); PEGLER & YOUNG (1979: 382-383, figs. 113-116, spores); DEMOULIN & MARRIOTT (1981: 56); BEATON *et al.* (1985: 596, fig. 33M-N, spores); BREITENBACH & KRÄNZLIN (1986: pl. 491); CASTELLANO *et al.* (1989: 94, spore, ut *S. carotaecolor*); ELLIS & ELLIS (1990: 249, fig. 539); AUGUADRI *et al.* (1991: 294); PEGLER *et al.* (1993: 150-152, fig. 26A-C, pls. 8E, 24H-J); MOSER & JÜLICH (1985-2002: VII *Stephanospora* 1); MONTECCHI & LAZZARI (1993: 294); MEDARDI (1996: 15-16, fig. 2 right); VIDAL (1997: 55-56, fig. 10e); FERNÁNDEZ-VICENTE *et al.* (1998: 12); KRIEGLSTEINER (2000: 189-190); MONTECCHI & SARASINI (2000: 623-625); CALONGE *et al.* (2002: 57, figs. 5-6, spores).

Basidioma 1-5 cm, globose or tuberiform, soft-fleshy, with some minute basal and peridial mycelial strands. Columella and sterile base absent. Peridium arachnoid, very thin and fragile, floccose to glabrescent, at the beginning white, then butter yellow (K&W 4A5) to reddish yellow (K&W 4A7), soon evanescent and revealing the underlying gleba. Gleba reddish yellow (K&W 4A6), melon yellow (K&W 5A6) to deep orange (K&W 6A8), labyrinthoid, with numerous, minute, irregular, 0.5-1 mm, full chambers, internally filled by a tomentum of white hyphae. Tramal plates orange, 100-200 μ m thick. Spore mass in the locules deep yellow to orange. Odour unappreciable or fruity and unpleasant.

Spores ovoid, 10-13.5-(15) x 7.5-10 μ m, orthotropic, yellowish under O.M., non-dextrinoid, cyanophilous, ornamented by compressed spines, 2.5-5 x 0.5-1 μ m; spore-base with a distinctive corona formed by a perfect fusion of basal spines, 5-9 μ m wide and 1.5-2.5 μ m of projection; hilar appendix short, cylindric, usually retaining collapsed rests of sterigma. Basidia pyriform, ventricose or clavate, 25-40 x 14-16 μ m, with numerous oil drops, 1-4-spored, with short sterigmata. Cystidia absent. Hymenial trama formed by a disordered tissue of interwoven septate hyphae, 3-6 μ m in diam., mixed with numerous inflated hyphae, polygonal to rounded, up to 25 μ m in diam. Peridiopellis a disrupted epicutis of thin-walled hyphae, 3-6 μ m in diam. Mycelial strands of substratum dark brown, up to 60 μ m in diam., composed by clamped and very septate, brown to yellow hyphae, 2-8 μ m in diam., with frequent branching, and with encrusted walls, 0.5-2 μ m thick. Mycelial strands of peridium orange, formed by large, orange hyphae, 4-20 μ m in diam., with walls 2-2.5 μ m thick, lacking clamped and brown hyphae.

HABITAT AND DISTRIBUTION.- Solitary or gregarious, semihypogeous under litter, or emerging in the bare soil, in woods of deciduous trees (*Fagus*, *Quercus*) or conifers (*Abies*, *Larix*, *Pinus*, *Taxus*), on clayey, calcareous soil, but also on siliceous soil, in summer-autumn. Rare, but widely distributed in Europe, in temperate regions from the Submediterranean to Eurosiberian zone.

COLLECTIONS EXAMINED.- FRANCE: Fôret des Fanges (Aude), under *Fagus sylvatica* mixed with *Abies alba*, 30-9-1992, leg. M. Candusso (JMV920930-1).- GERMANY: Bayern, near Berchtesgaden, 850 m, under *Acer*, 13-8-1949, leg. and det. E. Soehner #2254 (M); *Ibid.*, Berchtesgaden, near Eitenberg, 10-8-1925, leg. and det. E. Soehner #1044 (M); *Ibid.*, near Lauchdorf, 12-10-1945, leg. and det. E. Soehner #2128 (M); *Ibid.*, near Helchenried, 9-8-1920, 14-8-1920, 8-10-1921, leg. and det. E. Soehner #237, 239, 560 (M); Baden-Württemberg, Karlsruhe, 15-9-1950, leg. Schwöbel, ex Dr. Haas, E. Soehner #2276 (M).- SPAIN: Girona, Hostalets d'en Bas (Garrotxa), 1.000 m, under *Quercus pubescens* mixed with *Corylus avellana* and *Buxus sempervirens*, 18-9-1999, leg. J. Olivets (JMV990918-2); *Ibid.*, Montagut (Garrotxa), 700 m, under *Quercus pubescens* mixed with *Acer* sp., *Corylus avellana* and *Buxus sempervirens*, 12-10-1995, leg. J.M. Vidal (JMV951012-2); *Ibid.*, la Vall de Bianya (Garrotxa), 900 m, under *Quercus pubescens* mixed with *Corylus avellana* and *Buxus sempervirens*, 18-8-1997, 30-8-1997, leg. J.M. Vidal (JMV970818-6, 970830-4).- SWITZERLAND: Zwingen, Kt. BE, 9-1948, leg. and det. A. Knapp #170 (Z-ZT); Bouillet Gemeinde Bex, 6-9-1976, leg. M. Ruchet, det. C. Schwärzel #47 (Z-ZT).- UK: England, Avon, Bristol, 11-1842, leg. H.O. Stephens (K{M}-69326, Berkeley Herb., lectotypus of *Hydnangium caroticolor*); *Ibid.*, ex Berkeley, rev. Corda as *Octaviania caroticolor* (PRM 719210, Corda Herb., probably an isolectotypus of *Hydnangium caroticolor*); *Ibid.*, Leigh Woods, 25-10-1953, leg. Lock, det. L.E. Hawker H941 (K{M}-69342, Hawker Herb.); *Ibid.*, Cleeve Cliff, under *Pinus* sp. and *Taxus* sp., 25-9-1953, leg. L.E. Hawker H836 (K{M}-69341, Hawker Herb.).

Stephanospora caroticolor is easy to recognize by its spores ornamented with very big and scattered spines and with a prominent basal crown. The spores illustrated by CORDA (1854) are devoid of the typical basal crown and seem to us scarcely representative of those of *S. caroticolor*. Neither the spores illustrated by HAWKER (1954) are representative of *S. caroticolor*. Probably they have been drawn after the collection H536, that we have found to belong to *S. aurantiaca*. As proved by OBERWINKLER & HORAK (1979), the spores of *S. caroticolor* show a surprising similitude with that of the corticiaceous *Lindneria trachyspora* (Bourd. et Galz.) Pilát, indicating a probable

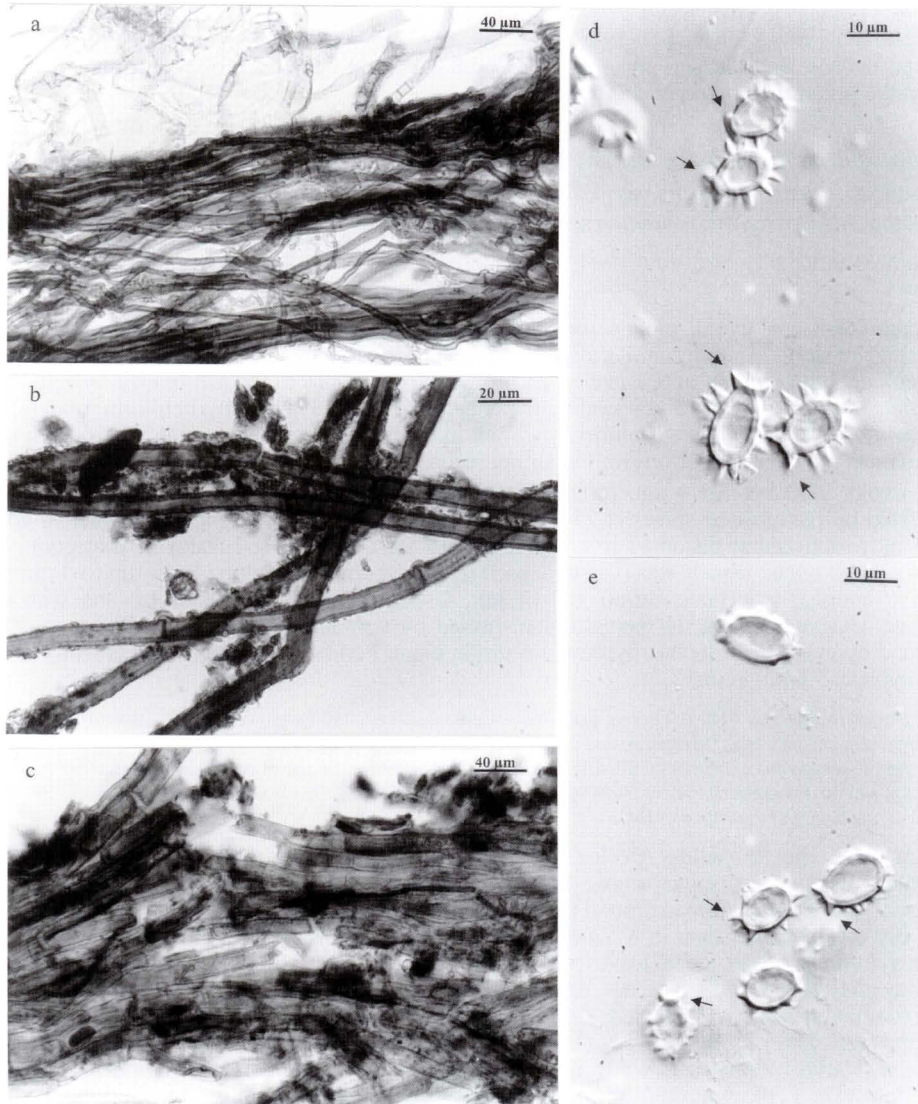


Fig. 1.- *Stephanospora caroticolor*.- a-b. Mycelial strand of the substratum and detail of the hyphae (JMV970830-4). c. Hyphae of the mycelial strands of the peridium (JMV970830-4). d. Spores (JMV970830-4). e. Spores of *H. caroticolor* (K, lectotypus). The arrows indicate the peri-annular corona.

phylogenetic relationship with it. We share this view, and we add a further evidence: the similitude between the hyphae of the mycelial strands of *S. caroticolor* and the basal hyphae of the subiculum and the mycelial strands of *L. trachyspora*, that in this case are brown, rugose and fibuliferous, 10 µm or more. *Lindtneria trachyspora* is known from Europe, Canada, USA and Costa Rica (GILBERTSON & RYVARDEN, 1986). The presence of thin mycelial strands, the fibuliferous and encrusted hyphae, and the peri-appendicular sporal crown, are evidences that account for the link between the genera *Lindtneria* and *Stephanospora*.

Stephanospora chilensis (E. Horak) J.M. Vidal, *comb. nov.* (Fig. 2a-d)

Basionym.- *Octavianina chilensis* E. Horak, *Sydowia* 17: 311 (1964).

Misappl.- *Hydnangium aurantium* sensu Soehner, *Zeitschr. f. Pilzk.*, N.F., 20(3-4): 112 (1941).

ICON. AND BIBL. SEL.- SOEHNER (1941: 112-113, ut *H. aurantium*); HORAK (1964: 311-312, fig. 3, ut *O. chilensis*).

Basidioma 0,5-2 cm, ovoid, globose or applanate, soft-fleshy; basal mycelial strands not found. Columella and sterile base absent. Peridium arachnoid, very thin and fragile, floccose to glabrescent, with a colour similar to that of *S. caroticolor*, brownish-ochraceous to reddish-orange, orange-brown in dry state, soon evanescent and revealing the underlying gleba. Gleba labyrinthiform, orange, with numerous and irregular minute chambers, 1-2 mm in diam. Tramal plates orange, 80-160 µm thick. Spore mass in the locules light yellow. Odour not recorded.

Spores ovoid, 9-12,5 x 7,5-9 µm, orthotropic, yellow under O.M., non-dextrinoid, cyanophilous, ornamented by compressed spines, 1,25-2,5 µm high; spore-base with a slightly distinctive corona formed by partial lateral fusion of basal spines, 3,5-5 µm wide and 1-1,5 µm of projection; hilar appendix very minute, usually retaining collapsed rests of the sterigmal appendage, up to 4 µm long. Basidia cylindrical to clavate, 30-60 x 8-14 µm, 4-spored, with large oil drops, and with short sterigmata. Cystidia lacking. Hymenial trama formed by very inflated, globose cells, up to 40 µm broad, and by cylindrical, septate hyphae, 3-6 µm in diam. Peridiopellis a disrupted epicutis of thin-walled hyphae, 3-6 µm in diam.

COLLECTIONS EXAMINED.- CHILE: Osorno, Fucatrihue, Pacific rainforest, 110 m, growing under leaves of *Aextoxicon*, *Gevuina*, *Lomatia* and other Myrtaceae and Lauraceae, 28-4-1963, leg. E. Horak Y96-64/91 (Z-ZT-Horak Herb., holotypus of *Octavianina chilensis*).- GERMANY: Bayern, Berchtesgaden, Ettenberg near Schellenberg, 1.000 m, 4-8-1925, leg. and det. E. Soehner #1040 as *Hydnangium aurantium* (M); *Ibid.*, 1.200 m, 5-8-1925, leg. and det. E. Soehner #1042 as *Stephanospora caroticolor* (M).

It differs from the remaining species of the genus *Stephanospora* by its little ovoid spores, ornamented with robust spines, more densely distributed but of smaller size than those of *S. caroticolor*, and partially joined around the hilar appendix, forming a well defined peri-appendicular crown, but much smaller than in *S. caroticolor*. This species was found by HORAK (1964) in the Chilean rainforest, under dead leaves of diverse broadleaf trees of the families Aextoxicaceae, Proteaceae, Myrtaceae and Lauraceae, and because of its inamyloid spores, with stout spines and the lack of fibuliferous hyphae, he included it in the genus *Octavianina* Kuntze. The specimens collected in Europe (Germany) by SOEHNER (1941) and formerly published under the name *Hydnangium aurantium* (Harkn.) Zeller et C.W. Dodge, and later under *S. caroticolor* (SOEHNER, 1949), are very similar. The ecological data given are very scarce, but the herbarium material includes some remains of the substratum, containing carbonates and fragments of broadleaf trees leaves. In this European collection, the peri-appendicular crown shows a smaller development than in the Chilean material, but the remaining characters are not different.

Stephanospora flava (Rodway) G.W. Beaton, Pegler et T.W.K. Young, *Kew Bull.* 40(3): 595 (1985) (Fig. 2e)

Basionym.- *Gymnomyces flavus* Rodway, *Paps. & Proc. Roy. Soc. Tasmania* 1917: 110 (1918).

Syn.- *Gymnomyces flavus* f. *tetraspora* Rodway, *Paps. & Proc. Roy. Soc. Tasmania* 1923: 161 (1924).- *Octaviania flava* (Rodway) G.H. Cunn., *Trans. Roy. Soc. New Zealand* 67: 408 (1938).- *Octavianina flava* (Rodway) Singer et A.H. Sm., *Mem. Torrey Bot. Club* 21: 9 (1960) (*comb. superfl.*, orthographic variant of *Octaviania*).

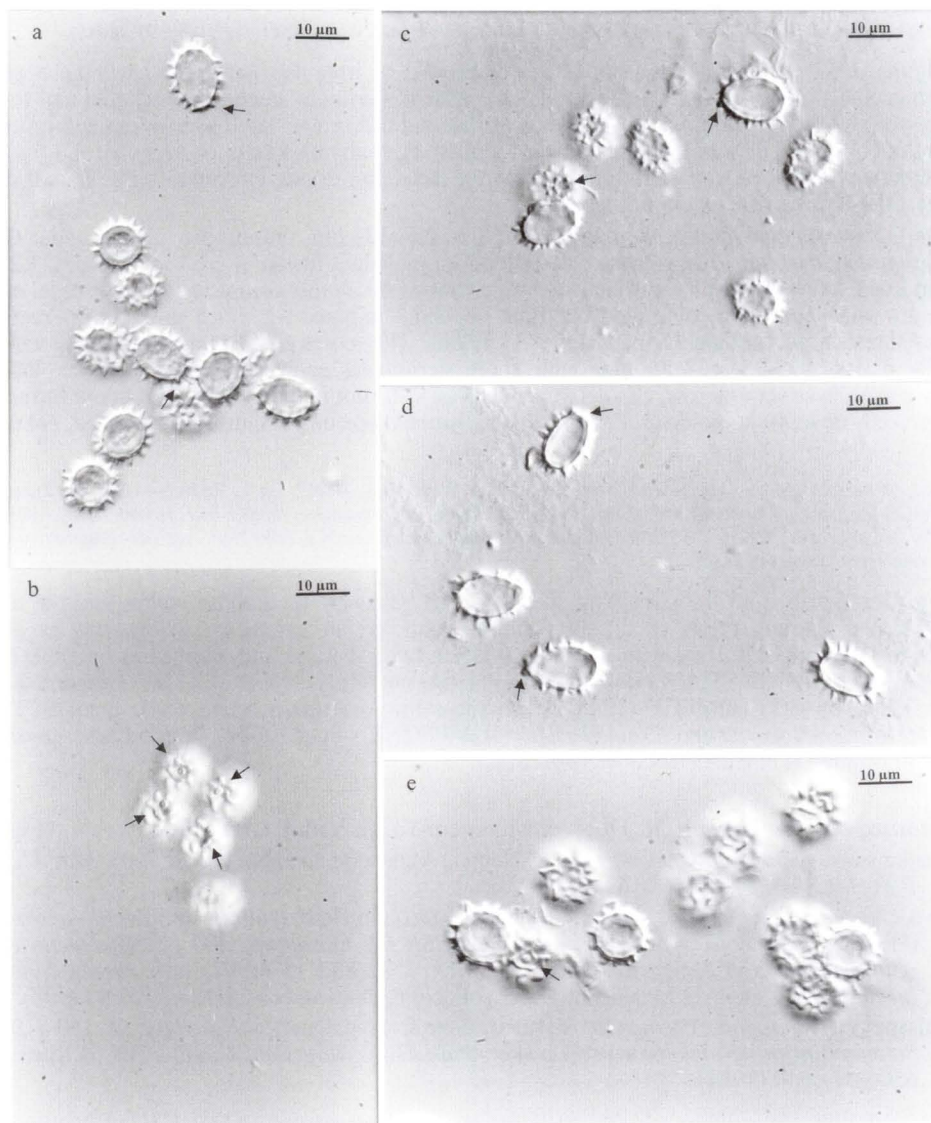


Fig. 2.- *Stephanospora chilensis*.- Spores: **a-b.** *O. chilensis* (Z-ZT, holotypus). **c-d.** *H. aurantium* (M. Soehner 1040). *Stephanospora flava*.- Spores: **e.** *G. flavus* (NY, isolectotypus). The arrows indicate the peri-appendicular corona.

ICON. AND BIBL. SEL.- RODWAY (1918: 110, ut *G. flavus*; 1924: 161, ut *G. flavus* & f. *tetraspora*); CUNNINGHAM (1944: 57, pl. 33/21, ut *O. flava*); CRIBB (1958: 248, ut *O. flava*); SINGER & SMITH (1960: 9-10, fig.14, ut *O. flava*); BEATON *et al.* (1985: 595-597, figs. 32, 33A-L); CASTELLANO *et al.* (1989: 94, spores).

Basidioma 0,5-2 cm, subglobose, applanate, ellipsoidal or irregular, soft-fleshy, without apparent basal mycelial strands. Columella and sterile base absent. Peridium arachnoid, very thin and fragile, canary yellow when fresh, drying ochraceous or pale reddish brown, soon evanescent and revealing the underlying gleba. Gleba labyrinthoid, with numerous, minute, globose or irregular, 0,3-0,4 mm, full chambers, ochraceous or slightly paler than the peridium, drying cinnamon buff. Tramal plates orange, 50-140 μm thick. Odour not recorded.

Spores globose to subglobose, 9-11,5-(12,5) x 8,5-10,5-(12) μm , orthotropic, yellow under O.M., non-dextrinoid, cyanophilous, crestate or subreticulate by lateral fusion of crests and spines, 1,2-2,5-(3) μm high, spore-base with a distinctive corona formed by almost complete fusion of basal crests, 3,5-6 μm wide and 1 μm of projection; hilar appendix minute, 1-2 x 1,5 μm , usually retaining collapsed rests of the sterigmatal appendage, 1-3 μm long. The spores are often agglutinated in tetrads. Basidia clavate, 25-35 x 7-15 μm , with short sterigmata, soon collapsing. Cystidia lacking. Subhymenial layer very narrow, of interwoven hyphae 7-10 μm in diam. Hymenial trama formed by globose cells up to 40 μm in diam. Peridiopellis a disrupted epicutis of thin-walled hyphae, 2-4 μm in diam.

COLLECTIONS EXAMINED.- AUSTRALIA: Tasmania, Hobart, Wedge Bay, 4-1917, *leg.* L. Rodway #1276, *rev.* Zeller & Dodge as *Arcangeliella tasmanica* (NY-Zeller Herb., isoelectotypus of *Gymnomycetes flavus*); *Ibid.*, Hobart, *leg.* L. Rodway #1279, *ex* Lloyd Mus. #090, *rev.* Zeller & Dodge as *Arcangeliella tasmanica* (NY-Zeller Herb., probably original material of *Gymnomycetes flavus* f. *tetraspora*).

Easy to distinguish from the remaining species of the genus by its globose spores and the robust spines joined forming crests or a subreticulum, frequently in tetrads (f. *tetraspora*), as in the collection Rodway 1279. Found in Australia (Queensland, Victoria and Tasmania) by RODWAY (1918, 1924), CUNNINGHAM (1944), CRIBB (1958) and BEATON *et al.* (1985). Recorded from South Africa by BOTTOMLEY (1948). In southeastern Australia it seems to be associated with *Eucalyptus cyphellocarpa* and *E. muelleriana* (JUMPPONEN *et al.*, 2004). A good description and spores illustration is in BEATON *et al.* (*op. cit.*).

***Stephanospora aurantiaca* (R. Heim et Malençon) J.M. Vidal, *comb. nov.* (Fig. 3)**

Basionym.- *Hydnangium aurantiacum* R. Heim et Malençon, in Heim *et col.*, *Treb. Mus. Ci. Nat. Barcelona*, Sér. Bot., 15(3): 69 (1934).

Syn.- *Hydnangium font-queri* Heim et Malençon, *ined.*, in Herb. (MPU).- *Octaviania aurantiaca* (Heim et Malençon) Svrček, in Pilát, *Flora ČSR BI, Gasterom.*: 191 (1958).- *Octavianina olida* Malençon et Astier, in Astier, *Doc. Mycol.* 22(88): 18 (1993) (*syn. nov.*).- *Martellia aurantiaca* (R. Heim et Malençon) Astier et Pacioni, *Doc. Mycol.* 28(109-110): 9 (1998).

Misappl.- *Hydnangium caroticolor* sensu Codina & Font Quer, *Cavanillesia* 3: 169 (1931).- *Stephanospora caroticolor* sensu Hawker, *Phil. Trans. Roy. Soc. London*, Ser. B, Biol. Sci., 650(237): 519 (1954).

ICON. AND BIBL. SEL.- HEIM *et col.* (1934: 69-74, figs. 16-17, ut *H. aurantiacum*); DODGE & ZELLER (1936: 586-587, ut *H. aurantiacum*); HAWKER (1954: 519, fig. 26a-g, ut *S. carotaecolor*); VIDAL (1991: 157-158, fig. 7a-e, ut *H. aurantiacum*); VIDAL & PASCUAL (1991: pl. 468, ut *H. aurantiacum*); ASTIER (1993: 17-20, figs. 1-2, pl. 3, ut *O. olida*); SARASINI & DE VITO (1998: 198-199, 324, spore, ut *H. aurantiacum*); MENDAZA (1999: 441, ut *H. aurantiacum*); MONTECCHI & SARASINI (2000: 330-332, ut *H. aurantiacum*); TEJEDOR & MAHIQUES (2002: 275-277, fot. p. 204, ut *H. aurantiacum*).

Basidioma 0,5-3 cm, globose to subglobose, sometimes flattened, irregular or tuberiform, soft-fleshy, with some minute peridial and basal mycelial strands. Columella and sterile base absent. Peridium arachnoid, floccose, very thin and fragile, soon evanescent and revealing the underlying gleba, initially white to yellowish white (K&W 4A2), becoming deep orange (K&W 5A7), mixed with roots of mycorrhizal plant, and with some mycelial strands. Gleba initially pastel yellow (K&W 3A4), deep orange (K&W 5A8), finally persian orange (K&W 6A7) to mandarin orange (K&W 6B8), labyrinthoid, with numerous, minute, irregular, elongated, 300-900 μm , full chambers, lacking

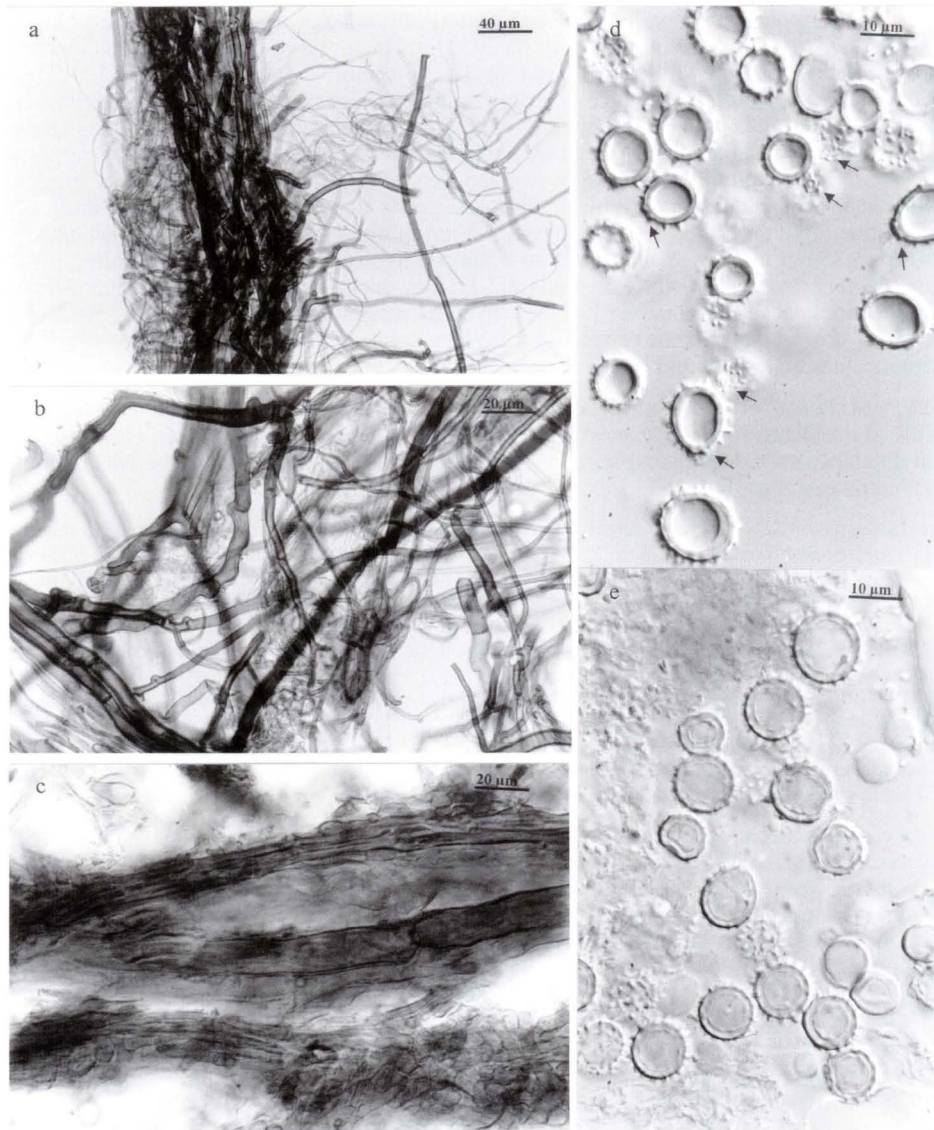


Fig. 3.- *Stephanospora aurantiaca*. a-b. Mycelial strand of the substratum and detail of the hyphae (JMV991212-3). c. Hyphae of the mycelial strands of the peridium (JMV20011206-1). d. Spores (JMV991212-3). e. Spores of *H. aurantiacum* (PC, holotypus). The arrows indicate the peri-appendicular corona.

any radial arrangement, internally filled by a tomentum of white hyphae. Tramal plates not gelatinized, yellow to orange, 125-200 µm thick. Spore mass in the locules cream to pale orange. Odour intense, alcoholic, fruity, pleasant.

Spores globose to subglobose, 10-14-(15,5) x (7,5)-10-13 µm, orthotropic, hyaline to yellow under O.M., non-dextrinoid, cyanophilous, when young ornamented by a subreticulum, later with compressed and interconnected spines, up to 2-(3) µm high; spore-base with an incomplete and slightly distinctive corona formed by basal fusion of spines, 4-5 µm wide and 1,5-(2) µm of projection; hilar appendix very minute, usually retaining sterigmatal rests of 2-6 x 1,5-2 µm. Basidia subclavate, 35-60 x 9-12 µm, (2)-3-4-spored, with large, orange oil drops, and with long sterigmata. Cystidia lacking. Hymenial trama formed by a thin central layer of septate hyphae 4-8 µm in diam., and an external large and disordinate layer, that connects with the hymenium, formed by irregular and broad hyphae, with frequent enlargements up to 30 µm in diam. Peridiopellis a thin and disrupted epicutis formed by thin-walled septate hyphae, 3-5 µm in diam. Mycelial strands of substratum dark brown, up to 75 µm in diam., with septate and clamped hyphae, with frequent branching, 1,5-10 µm in diam., hyaline to dark brown, with walls 0,2-1,5 µm thick, some of them with incrustations. In some collections lacks the clamped hyphae. Mycelial strands of peridium orange, 50-250 µm in diam., formed by septate, hyaline or yellowish hyphae, 3-15 µm in diam., with thick walls, 0,5-1 µm, but without clamped hyphae and brown hyphae.

HABITAT AND DISTRIBUTION.- Solitary or gregarious, semihypogeous under litter, or emerging from bare soil, in deciduous forests (*Quercus*) or under conifers (*Cupressus*, *Pinus*), on clayey, calcareous soil, in autumn-winter. Meridional species, distributed in warm regions from the Mediterranean to Submediterranean zone. Rare.

COLLECTIONS EXAMINED.- SPAIN: Barcelona, Monistrol de Montserrat (Bages), 700 m, under *Quercus ilex* mixed with *Corylus avellana* and *Buxus sempervirens*, 25-10-1932, leg. G. Malençon and R. Heim (PC, holotypus of *Hydnangium aurantiacum*; MPU-Malençon Herb., isotypus, as *Hydnangium font-queri*); *Ibid.*, Muntanyola (Osona), 770 m, under *Quercus pubescens* mixed with *Pinus sylvestris*, 25-12-1999, leg. J.M. Vidal (JMV991225); *Ibid.*, Oristà (Osona), 500 m, under *Quercus pubescens* mixed with *Pinus sylvestris*, 17-10-1992, 12-12-1999, leg. M. Tabarés (JMV921017, 991211); Girona, Sant Aniol de Finestres (Garrotxa), pla de Sant Roc, el Llopart, 400 m, under mosses and *Quercus ilex*, on calcareous soil, leg. J.M. Vidal & A. Torrent (JMV20011206-1); *Ibid.*, Madremanya (Gironès), 160 m, under *Quercus ilex*, 24-11-1987, 15-12-1989, leg. J.M. Vidal (JMV871124-1, 891215-8); *Ibid.*, Monells (Baix Empordà), 100 m, under *Quercus ilex* and *Q. pubescens*, 18-1-1991, leg. J.M. Vidal (JMV910118-3); *Ibid.*, Torroella de Montgri (Baix Empordà), 80 m, near *Quercus coccifera*, 13-11-1990, 23-12-1990, leg. J.M. Vidal (JMV901113-75, 901223-11).- UK: England, Sussex, Seaford, Friston Forest, under *Cupressus macrocarpa*, 8-10-1951, leg. P.C.K. Austwick #584, det. L.E. Hawker H536 as *Stephanospora caroticolor* (K{M} 69340, Hawker Herb.).

This species has been collected by CODINA & FONT-I-QUER (1931) in Catalonia (Spain), Tarragona, Corbera, 5-10-1924, in a sclerophyllous wood, under *Pinus halepensis*. They identified it as *Hydnangium caroticolor* Berk. et Br., because of its orange colour, despite of the lack of robust spines and peri-appendicular crown, characteristic of the true *Stephanospora caroticolor*. Some years later, Georges Malençon and Roger Heim (HEIM *et col.*, 1934) collect in Catalonia, in a sclerophyllous wood of *Quercus ilex*, a fungus with the same characters of that described by CODINA & FONT-I-QUER (*op. cit.*). Realizing the lack of a well developed peri-appendicular crown, they include it as a new species of *Hydnangium*: *H. aurantiacum* Heim et Malençon. In the herbarium of G. Malençon, kept in Montpellier (MPU, France), there is a small part of this collection, labeled *Hydnangium font-queri* Heim et Malençon (CALONGE, 1990), but ever published under this binomium. We consider this material an isotype of *H. aurantiacum*.

As stated before, the genus *Stephanospora* is characterized by its gasteroid development and its spores ornamented by compressed spines, that joins laterally around the hilar appendix, forming a peri-appendicular crown. But the spines grows slowly, and their differentiation is completed before the formation of the peri-appendicular crown. In *Hydnangium aurantiacum* this fusion progress very slowly (VIDAL, 1991) and the resulting peri-appendicular crown is very small and incomplete, sometimes hard to be observed, but characteristic of the genus *Stephanospora*. This leads us to the inclusion of *Hydnangium aurantiacum* in the genus *Stephanospora*, changing the mind expressed some years ago (VIDAL, *op. cit.*). *Octavianina olida* Malençon et Astier is fully concordant with the description of *S. aurantiaca* and, in consequence, must be considered a synonym.

It seems of interest to mention the presence of thin mycelial strands at the basis of the basidioma of *S. aurantiaca*, already described by HEIM *et col.* (*op. cit.*), and also observed by ourselves in *S.*

caroticolor. The mycelial threads in contact with the substrate are dark-coloured and contain two different types of hyphae. The external hyphae are brown, fibuliferous and with incrustations, and the internal hyphae are equal to the threads addressed to the peridium, without clamp connections, yellow and with a thick wall. This hyphae are of the same type found in the base of the subiculum and in the mycelial threads of some species of *Lindtneria*. We have also observed that *S. aurantiaca*, as *S. caroticolor* does, stain in yellow the paper in long lasting contact with the dry material, a fact also mentioned by BATAILLE (1910) regarding *S. caroticolor*.

Along with *Lindtneria trachyspora*, other species of *Lindtneria* share some characters with the genus *Stephanospora*, namely those highlighted by OBERWINKLER & HORAK (1979) between *S. caroticolor* and *L. trachyspora*. *Lindtneria flava* Parmasto and *L. rugospora* (W.B. Cooke) M. Larsen show a set of characters in common with *Stephanospora*: orange colour, porate hymenium, subiculum and mycelial strands containing fibuliferous hyphae, peri-appendicular crown and absence of cystidia. *Lindtneria flava* shows two types of hyphae in the basal layer of the subiculum and in the mycelial strands: the first type are hyaline, 4-7 µm in diam., and the second are brown, 6-8 µm in diam., with thick walls, finally rugose, with incrustations, resembling those in *S. aurantiaca*; the spores are broadly elliptical, 7,5-9,5 x 5-6 µm, with spines up to 1,5 µm high, but the peri-appendicular crown has not been described, probably because of being too difficult to be observed. It is known from Europe (Bielorussia) (PARMASTO, 1968), North America (USA, New York State) (GILBERTSON & RYVARDEN, *op. cit.*), and East Africa (Kenia and Tanzania) (HJORTSTAM, 1987). *Lindtneria rugospora* lacks of brown hyphae in the subiculum and mycelial strands; the hyphae, 3-4,5 µm in diam., are hyaline, with thin walls, plenty of clamp connections and with frequent swellings, up to 8 µm in diam.; the spores are globose or subglobose, cyanophilous, 5,6-6,5 x 4-5 µm, with spines up to 0,5 µm, forming a subreticulum and a peri-appendicular crown by joining of the crests, as in *S. flava*; it has been found only from North America, USA (LARSEN, 1986). Other species with similar characters are *L. lowei* M. Larsen (USA), *L. thujatsugina* M. Larsen (USA) and *L. pterospora* Reid (Ghana), all with a double sporal crown. In any case, we leave for future research with the aid of molecular techniques the gathering of more sound evidences to ground the phylogenetic relationships among the different species of *Stephanospora* and *Lindtneria*.

EXCLUDED SPECIES

Stephanospora corneri Pegler et T.W.K. Young, *Trans. Br. Mycol. Soc.* 72(3): 383 (1979).

=*Hydnangium virescens* Corner et Hawker, *Trans. Br. Mycol. Soc.* 36: 125 (1953). (*nom. illeg.*)

COLLECTIONS EXAMINED.- MALAYSIA: Singapore, Reservoir Jungle, 11-12-1930, E.J.H. Corner #730 (K, holotypus of *Hydnangium virescens*).

This species was described by CORNER & HAWKER (1953) from Australasia, formerly in the genus *Hydnangium*, because of the spores with strong spines, and later in the genus *Stephanospora* by PEGLER & YOUNG (1979), after realizing the strong similitude between the spores of *Stephanospora penangensis* Corner et Hawker. But the ensemble of characters of this species: peridium thick, initially white, turning to green in contact with the air, gleba elastic, chocolate brown, with veins and trama gelatinous, and spores inamiloid, dark brown, devoid of peri-appendicular crown, indicate clearly the correct position of this species in the genus *Octaviania* Vittad., as a synonym of *O. malaiensis* (Corner et Hawker) Pegler et Young (published by PEGLER & YOUNG, *op. cit.*, as "*Octavianina*", an orthographic variant of *Octaviania*).

COLLECTION EXAMINED OF *Octaviania malaiensis*.- MALAYSIA, Kelanton, Sengei Ketil, 6-1931, E.J.H. Corner #743 (K, holotypus of *Elasmomyces malaiensis*).

Stephanospora penangensis Corner et Hawker, *Trans. Br. Mycol. Soc.* 36: 130 (1953).

COLLECTION EXAMINED.- MALAYSIA: Singapore, Penang Hill, 29-5-1941, E.J.H. Corner #747 (K, holotypus).

Also described by CORNER & HAWKER (1953) from Australasia, shows a microscopy identical to *Stephanospora corneri* Pegler et T.W.K. Young. In consequence, it must be enclosed in the genus *Octaviania* Vittad., as a further synonym of *O. malaiensis* (Corner et Hawker) Pegler et Young.

Stephanospora redolens (G. Cunn.) E. Horak, in Oberwinkler & Horak, *Plant System. & Evol.* 131: 163 (1979). (*comb. illeg.*)

=*Octaviania redolens* G. Cunn., *New Zealand J. Sci. Technol.* 23: 172B (1942).

=*Gymnomyces redolens* (G. Cunn.) Pfister, *Occ. Paps. Farlow Herb. Crypt. Bot.* 9: 43 (1976).

=*Martellia redolens* (G. Cunn.) G.W. Beaton, Pegler et T.W.K. Young, *Kew Bull.* 39(4): 682 (1984).

TYPE.- NEW ZEALAND: Auckland, Mt. Te Aroha, 5-1940, G.H. Cunningham #10141 (K, holotypus).

According to PFISTER (1976) and LEBEL & CASTELLANO (2002), on the ground of the presence of a sporal ornamentation deeply amyloid, and the presence of leptocystidia and of sphaerocytes in the hymenial trama, this species must be located in the genus *Gymnomyces* Masee et Rodway, in the family Russulaceae Lotsy.

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Stephanospora caroticolor, phot. J.M. Vidal (JMV970830-4)



Stephanospora aurantiaca, phot. J.M. Vidal (JMV20011206-1)