

Taxonomic studies on Iberian *Cortinarius*: some *Telamonia* species with pelargonium smell and comments on *C. sertipes* f. *contrarius*

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Resumen: Se realiza un estudio crítico de algunas especies del género *Cortinarius* subgénero *Telamonia*, sección *Incrustati*, caracterizadas por su olor de hojas de *Pelargonium*. *Cortinarius flexipes*, *C. paleaceus* sensu auct. y *C. paleiferus* son consideradas como una misma especie. Se propone la nueva combinación *Cortinarius flexipes* var. *violilamellatus* (P. D. ORTON) A. ORTEGA, comb. & stat. nov. Igualmente, se incluye una breve descripción y comentarios sobre *C. sertipes* f. *contrarius* (J. GEESINK) A. ORTEGA & MAHIQUES.

Abstract: A taxonomic study of several species of *Cortinarius* subgenus *Telamonia* with pelargonium smell in the Iberian Peninsula is presented. *Cortinarius flexipes*, *C. paleaceus* sensu auct. and *C. paleiferus* are considered synonymous. The new combination *Cortinarius flexipes* var. *violilamellatus* (P. D. ORTON) A. ORTEGA, comb. & stat. nov. is proposed. Also, a brief description and comments of *C. sertipes* f. *contrarius* (J. GEESINK) A. ORTEGA & MAHIQUES is made.

Zusammenfassung: Eine taxonomische Studie einiger Arten von *Cortinarius* subg. *Telamonia* mit Pelargoniumgeruch aus Spanien wird vorgestellt. *C. flexipes*, *C. paleaceus* sensu auct. und *C. paleiferus* werden als synonym betrachtet. Die Neukombination *Cortinarius flexipes* var. *violilamellatus* (P. D. ORTON) A. ORTEGA, comb. & stat. nov., wird vorgeschlagen. Weiters wird eine kurze Beschreibung mit Kommentar von *C. sertipes* f. *contrarius* (J. GEESINK) A. ORTEGA & MAHIQUES gegeben.

Cortinarius flexipes (PERS.: FR.) FR. and some close taxa of sect. *Incrustati* with pelargonium smell are taxonomically considered one of the most controverted and difficult groups of the genus. KÜHNER (1961) related *C. sertipes* KÜHNER with *C. flexipes*, and considered it a simple form of *C. flexipes* differing basically in the colour of the lamellae; his interpretation was later discussed by GEESINK (1976), who proposed *C. contrarius* J. GEESINK to name *C. flexipes* f. *sertipes* (KÜHNER) KÜHNER. Recently, ORTEGA & MAHIQUES (1995) treated *C. contrarius* as a form of *C. sertipes* and ARNOLDS & al. (1995) merely as a synonym of *C. sertipes*; these points of view suggest that the colour

of the lamellae does not seem to be a relevant and constant feature to justify a separation of two independent species.

MOSER (1983) followed KÜHNER's concept, and recognized *C. paleaceus* as a different species growing in conifer forests, without violet lamellae and with spores $6.5\text{-}9 \times 4\text{-}6 \mu\text{m}$, and *C. paleifer* SVRČEK (= *C. paleiferus*) a species that grows in broad-leaved forests, with violet young lamellae and spores $7.5\text{-}10 \times 5\text{-}6 \mu\text{m}$. ARNOLD (1993) differentiated two species, e.g., *C. flexipes* (= *C. paleiferus*) with violet lamellae, spores $(7\text{-}8\text{-}9\text{-}10) \times 5\text{-}6 \mu\text{m}$ and habitat under conifers and *C. paleaceus* without violet lamellae, spores $8\text{-}9\text{-}10) \times 5\text{-}5.5\text{-}6) \mu\text{m}$ and habitat under broad-leaved trees; he himself has proposed *C. paleaceus* sensu MOSER as the new taxon *C. paleaceus* var. *pinetorum*. KEIZER & ARNOLDS (1994) have followed a similar treatment, and separate *C. paleaceus* and *C. paleiferus* exclusively by the colour of the lamellae, considering *Cortinarius flexipes* sensu KÜHNER a totally independent taxon. Finally, BRANDRUD & al. (1998) have recognized only one species *Cortinarius flexipes* (= *C. paleaceus* sensu auct., *C. paleiferus*), which would include those taxa with a pileus covered by an abundant whitish squamulose veil, a pelargonium smell, lamellae either violaceous or not and ellipsoid spores $7\text{-}9 \times 5\text{-}6 \mu\text{m}$, with a medium to low, warty ornamentation.

These controverted interpretations by the different specialists through time and material collected from the Iberian Peninsula belonging to this group, encouraged us to make a critical study of the different taxa recorded in the recent Spanish bibliography (CADIÑANOS AGUIRRE 1998, VILA & al. 1998, MAHIQUES 1999). We have also included *C. sertipes* f. *contrarius* in this contribution; this taxon does not have a pelargonium smell, and possibly does not belong to the *C. flexipes* group, but it was misunderstood in the past and included in the interpretation of this complex (see introduction and also key).

Materials and methods

The material studied belongs to collections deposited at GDA (Herbario de la Universidad de Granada) and some others sent on loan from the following official and private Herbaria: Herbarium of the Royal Botanic Garden, Edinburgh (E), private herbarium B. SENN-IRLET (BSI), Herbario de la Sociedad Micológica de Aranzadi (ARAN), Herbario de la Universidad de Alcalá de Henares (AH), and private herbarium JORDI VILA (JVG) in Barcelona.

The classic methodology to study macro- and microcharacters in *Cortinarius* has been followed. Thirty spore measurements were obtained from each collection, which enabled us to calculate the maximum and minimum values of length (L), width (W) and ratio of L/W. In order to establish the significance of the different mean values of L, W and L/W, the method of SIMPSON & ROE in BIDAULT (1968) has been applied; this method enabled us to calculate the interval of confidence of the mean values of L, W (Fig. 7) and Q: L/W (Fig. 8) ($I_c = X_m \pm 1.96 \sigma/\sqrt{30}$). The study of the spore ornamentation under the SEM was carried out in a Zeiss DSM 950 electronic microscope, following the method suggested by MORENO & al. (1995).

The contributions of ARNOLD (1993) and BRANDRUD & al. (1998), have been the basic bibliographic references used in this study.

Results

Cortinarius diasemospermus LAMOURE var. *leptospermus* H. LINDSTR., *Cortinarius* Fl. Phot. 4: 21, 1998
= *Cortinarius stenospermus* LAMOURE

= *Cortinarius paleaceus* FR. sensu auct.

= *Cortinarius tiliaceus* N. ARNOLD pro parte

Selected iconography: BRANDRUD & al. (1998: D27).

Material studied: Spain: Girona, Ripollés, Queralbs, Vall de Núria, among *Dryas octopetala* L. and *Salix retusa* L., 12. 8. 1997, leg. J. VILA (JVG 970812-35).

This collection was previously published and described by VILA & al. (1998), and it macroscopically agrees with the description of BRANDRUD & al. (1998: D27). According to our revision, the spores are 8.2-10.2(-10.5) x 4-4.8 μm [$X_m = 9 \times 4.3 \mu\text{m}$; Q (L/W) = (1.8-)1.9-2.3; $Q_m = 2.1$], subellipsoid, ellipsoid or subdacroid, with a low ornamentation constituted by anastomosed warts (Fig. 1). Universal veil constituted by hyphae 7-12 μm wide, hyaline, septate, with the terminal cells cylindrical to (sub-)claviform, 9-17 μm wide. Pileipellis a cutis of 4-16 μm wide hyphae, with dark brown encrusting pigment. Clamp-connections present. Hymenophoral trama showing a dark brown encrusting and intracellular pigment. Basidia 15-28 x 7-9 μm , 4-spored, hyaline or brown pigmented. Cystidia not observed.

Observations: We agree with BRANDRUD & al. (1998) to consider *Cortinarius stenospermus* and *C. diasemospermus* as conspecific, as the only relevant difference seems to be related to the size and shape of the spores; in the Spanish collection we have observed some overlapping in spore measurements given to both taxa, which would support a better treatment at varietal rank.

This taxon was previously recorded from the Catalanian Pyrenees by BON & BAL-LARÁ (1995).

***Cortinarius flexipes* (PERS.: FR.) FR.**, Epicr.: 300, 1838

= *Cortinarius paleiferus* SVRČEK

= *Cortinarius paleaceus* FR. sensu auct.

Selected iconography: BRANDRUD & al. (1998: D43).

Material studied: Spain: Barcelona, El Maresme, Arenys de Munt, 500 m s. m., in mixed forests of *Castanea sativa* MILL., *Populus spec.*, *Pinus sylvestris* L., *Quercus ilex* L. and *Q. suber* L., 14. 11. 1997, leg. B. SENN-IRLET (BSI 97/251). Burgos, Merindad de Sotoscueva, La Engaña, 815 m s. m., under *Quercus pyrenaica* WILLD. and *Betula celtiberica* ROTHM. & VASC., 20. 9. 1997, leg. O. ALONSO & J. A. CADIÑANOS (ARAN-Cort. 97/13) (CADIÑANOS AGUIRRE 1998). Jaén, Sierra de Cazorla, El Cantalar, in mixed forest of *Quercus ilex* subsp. *ballota* (DESF.) SAMP., *Pinus nigra* J. F. ARNOLD subsp. *salzmannii* (DUNAL) FRANCO and *P. pinaster* AITON, 22. 11. 1998, leg. J. D. REYES (GDA 44999); - - under *Quercus ilex* subsp. *ballota*, 15. 11. 1999, leg. J. D. REYES (GDA 45000). Vizcaya, Güeñes, Siebe de Aranguti, 100 m s. m., under *Quercus robur* L., 31. 10. 1991, leg. J. A. CADIÑANOS (ARAN-Cort. 91/18) (CADIÑANOS AGUIRRE 1998). Vizcaya, Valle de Carranza, La Calera del Prado, under *Quercus robur*, 13. 10. 1998, leg. F. ES-TEVE-RAVENTÓS (GDA 43222).

Our study has revealed the following features: pileus reaching 45 mm in diam, conical to plane convex, more or less umbonate, grey-ochraceous to brown-ochraceous with the surface completely covered by woolly, greyish to whitish squamules; lamellae either purplish or violaceous in some collections (GDAC 45000, ARAN-Cort 97/13, BSI 97/251), or without these tints (GDA 44999, ARAN-Cort 91/18); stipe cylindrical, reaching 90 x 6 mm, with or without violet colours. Smell typically of *Pelargonium* leaves. Spores 7.2-10 x 4.1-6 μm , $X_m = 8.3 \times 5.1 \mu\text{m}$, Q (L/W) = 1.4-1.9, $Q_m = 1.64$,

ellipsoid, with a medium ornamentation formed by anastomosed warts (Fig. 2). Universal veil constituted by hyaline hyphae, rarely (GDA 45000) with brown-reddish fine encrusting pigment, septate, 8-15 μm wide, with terminal cells cylindrical to (sub-) claviform, 10-18(-20) μm wide. Epicutis made of 4-7 μm wide hyphae, showing dark reddish-brown encrusting pigment; hypocutis made of broader hyphae (12-18 μm wide), with encrusting pigment. Clamp-connections present. Hymenophoral trama formed by dark reddish-brown encrusted hyphae. Basidia 18-30 x 7-10 μm , 4-spored, hyaline or reddish-brown. Cystidia not frequent, 10-20 x 7-9 μm , clavate to pyriform.

Observations: Most of the studied collections were gathered in broad-leaved forests (*Quercus* spp., *Betula celtiberica*), and would fit within *Cortinarius paleaceus* FR. *sensu* N. ARNOLD; however, the purplish to violet colours of the lamellae and stipe would relate them closer to *C. flexipes sensu* N. ARNOLD (= *C. paleiferus*) which, nevertheless, should grow under conifers (ARNOLD 1993).

Concerning the spore size, most of the references consulted (MOSER 1983, MARCHAND 1983, BON 1992, ARNOLD 1993) suggest that collections showing violet lamellae would have bigger spores, but this fact contradicts what has been observed in the Spanish collections. For example, as can be seen in Fig. 7, collections showing violet to purplish lamellae (ARAN-Cort 97/13, BSI 97/251) have spores 7.1-9 x 4.1-6 μm [X_m = 8-8.1 x 5-5.1 μm ; Q (L/W) = 1.44-1.8; Q_m = 1.57-1.61], whereas those without these colours (GDA 43222, 44999, ARAN-Cort 91/18) show spores 7.5-10 x 4.3-5.2 μm [X_m = 8.3-9 x 4.9-5.2 μm ; Q (L/W) = 1.46-1.92; Q_m = 1.62-1.7 μm]. These data suggest that spore size is not correlated with the colour of the lamellae and that this character does not seem discriminative to separate *C. paleaceus* from *C. paleiferus*. We think more reasonable to conclude that only one species should be recognized, and that two forms or variants could be separated according to the colour of the lamellae; this treatment was already supported previously by BERTAUX (1966) and KEIZER & ARNOLDS (1994).

***Cortinarius flexipes* var. *flabellus* (FR.: FR.) H. LINDSTR. & MELOT**, *Cortinarius* Fl. Phot. 4: 21, 1998

Selected iconography: BRANDRUD & al. (1998: D34).

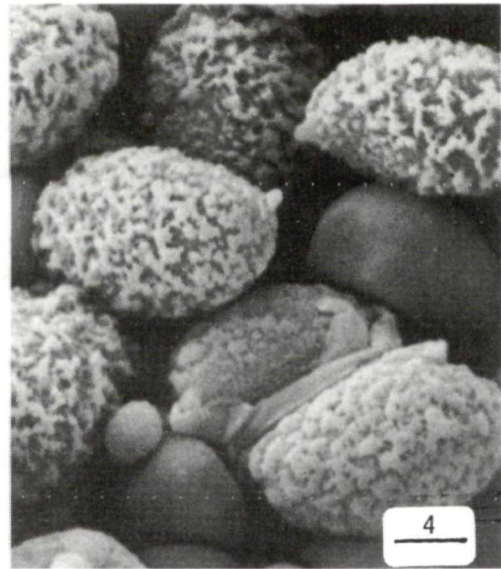
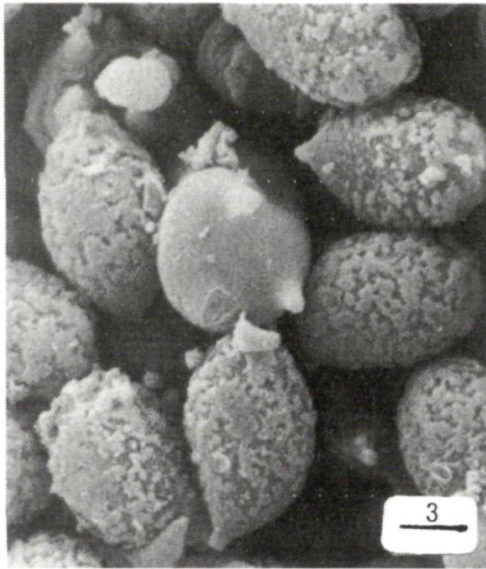
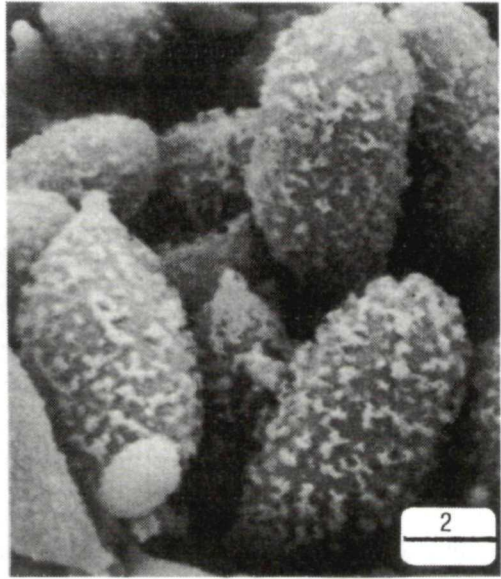
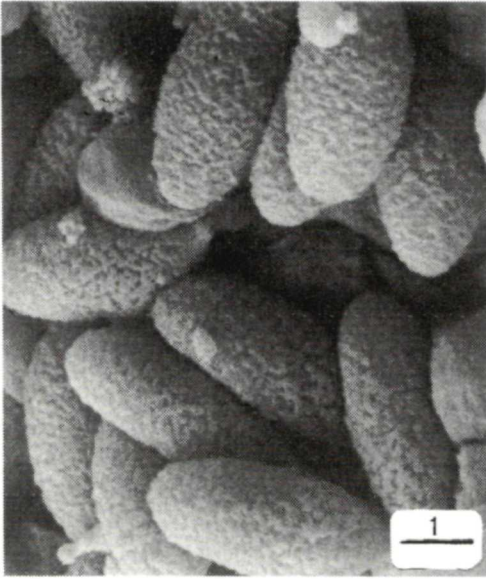
Material studied: Spain: Girona, Areu, Font Roja, 1440 m s. m., among *Sphagnum* under *Betula alba* L., 1. 9. 1998, leg. L. SANTAMARÍA (JVG 980901-6).

The collection shows a pileus covered at the margin by abundant rests of whitish fibrillose veil, and spores 7.2-9 x 5-5.8 μm , X_m = 8 x 5.3 μm , Q (L/W) = (1.3-)1.4-1.65, Q_m = 1.51, ellipsoid to subamygdaliform, with a low to medium ornamentation of anastomosed warts (Fig. 3).

Observations: Apart from the habitat, since BRANDRUD & al. (1998) indicate it under conifers, this collection fits well with var. *flabellus*, owing to the presence of a marginal whitish veil and spores broader than in var. *flexipes* (Fig. 8).

***Cortinarius flexipes* var. *montanus* ad int.**

Material studied: Spain: Girona, Ripollés, Setcases, Uldeter, Turonet, 2350 m s. m., in snowbed with *Salix herbacea* L., 14. 8. 1997, leg. J. VILA (JVG 970814-13).



Figs. 1-4. Spores. – Fig. 1. *Cortinarius diasemospermus* var. *leptospermus* (JVG 970812-3). – Fig. 2. *Cortinarius flexipes* (BSI 97/251). – Fig. 3. *Cortinarius flexipes* var. *flabellus* (JVG 980901-6). – Fig. 4. *Cortinarius flexipes* var. *montanus* (JVG 970814-13). – Bars: 2.5 μ m.

This collection was previously studied and published by VILA & al. (1998) as *C. diasemospermus*. According to our revision, it macroscopically shows a pileus 5-15 mm, campanulate-conical to convex, clearly umbonate, reddish-brown, blackish at the disc, hygrophanous, the margin covered by whitish woolly-fibrillose rests of veil; lamellae moderately crowded, with violaceous hues when young; stipe 10-20 x 2-3 mm, somewhat paler than pileus, darkening towards the base; smell of *Pelargonium* leaves; spores 7.8-10 x 5-6 μm , [Xm = 8.7 x 5.5 μm , Q (L/W) = 1.3-1.8, Qm = 1.57], ellipsoid, subovoid to subamygdaliform, with moderately high to medium ornamentation constituted by anastomosed warts (Fig. 4).

Observations: This material comes closer to *Cortinarius flexipes* sensu lato than to *C. diasemospermus* by virtue of the shape and size of the spores (Fig. 8). However, the pileus only shows the fibrillose scales of veil at the margin and the spores are clearly more ellipsoid (Qm = 1.57) with higher warts. These features would relate it to *C. flexipes* var. *flabellus*, which has larger basidiomata and shorter spores 7-8.5 x 5-6 μm (BRANDRUD & al. 1998). *Cortinarius paleiferus* var. *brachispermus* LAMOURE differs by the more broadly ellipsoid spores (LAMOURE 1987, 1991). According to BON (pers. comm.), our collection could represent a new alpine variety of *C. flexipes*, though new collections are necessary to check the variability of this character and justify its recognition.

***Cortinarius flexipes* var. *violilamellatus* (P. D. ORTON) A. ORTEGA, comb. & stat. nov.**

Basionym: *Cortinarius violilamellatus* P. D. ORTON, Not. Roy. Bot. Gard. Edinburgh 41: 571, 1984

Selected iconography: BRANDRUD & al. (1998: D39).

Material studied: Portugal: Viseu, Boa Aldeida, under *Pinus pinaster*, 7. 11. 1996, leg. F. ESTEVE-RAVENTÓS (GDA 43060, duplo in AH). Tondela, Silvares, Carvalhal da Mulher, among mosses under *Pinus pinaster*, 5. 11. 1996, leg. F. ESTEVE-RAVENTÓS (GDA 43061, duplo in AH).

Spain: Segovia, parque natural de las Hoces del rio Duraton, under *Pinus pinaster* and *Pinus nigra*, 10. 11. 1993, leg. F. ESTEVE-RAVENTÓS (AH 21363).

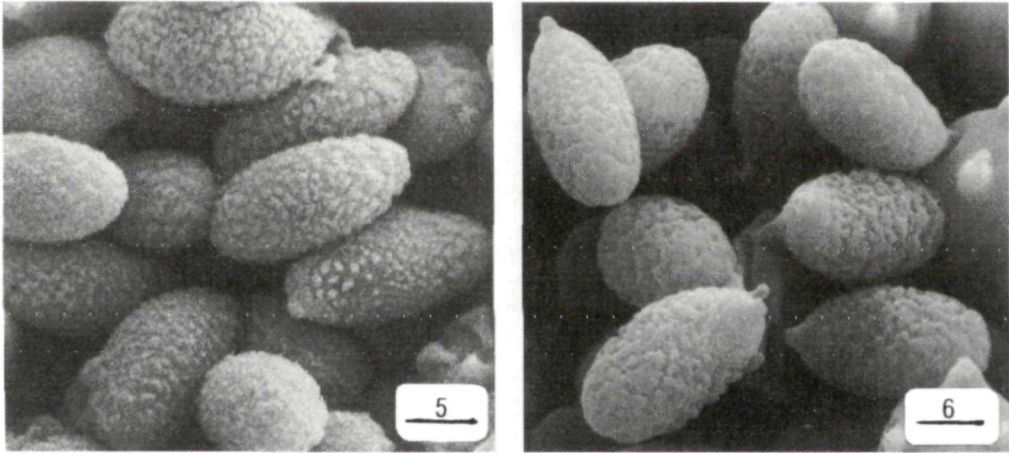
England: Surrey, Witley, in pinetis, 3. 11. 1958, leg. P. D. ORTON n° 131922 (E, Holotype).

Pileus 15-40 mm, conical-campanulate to convex, umbonate, chestnut-brown to brown-ochraceous, hygrophanous, not striate, surface entirely covered by abundant rests of whitish veil, forming bundles of fibrils or squamules; stipe 18-60 x 2-5.5 mm, cylindrical, concolorous to pileus, sometimes with violaceous reflections at the apex, surface covered by abundant fibrillose rests of veil, sometimes forming a more or less complete annular zone. Flesh concolorous, in some specimens with violaceous tints at the stipe apex. Smell strong of *Pelargonium* leaves. Spores 7.2-10(-11) x 3.8-5(-5.5) μm [Xm = 8.5-9.4 x 4.4-4.8 μm ; Q (L/W) = (1.67-)-2.1(-2.2); Qm = 1.94-1.96], narrowly ellipsoid to subamygdaliform or subcylindrical (Fig. 7), with a low to medium ornamentation formed by isolated or scarcely anastomosed warts (Fig. 5).

Observations: The habit and the smell of *Pelargonium* poses this taxon close to *Cortinarius flexipes* sensu lato, differing apparently by the habitat, which is exclusively under *Pinus* (ORTON 1984, BRANDRUD & al. 1998) and by the more elongate spores (Qm: 1.95 vs. Qm: 1.6-1.7, Fig. 8). However, according to KEIZER & ARNOLDS (1994), *C. violilamellatus* may also grow under *Fagus* or *Quercus*. The abundant material col-

lected from Portugal enabled us to observe some overlapping in the spore size recorded for both taxa. This observation, together with the wider ecological range given to *C. violilamellatus* by both Dutch authors would support that the recognition of both taxa at specific level is not sustainable. A treatment at varietal rank for *C. violilamellatus*, in the way that BRANDRUD & al. (1988) have supported for other related taxa, e.g., *C. diasemospermus* or *C. diasemospermus* var. *leptospermus*, is more justifiable.

The spore size observed in the Spanish material (AH 21363): [8.5-10(-11) x (4.2-) 4.5-5.2(-5.5) μm , $X_m = 9.4 \times 4.8 \mu\text{m}$] and in BRANDRUD & al. (1998) for *C. violilamellatus* (8-11 x 4-5.5 μm), does not correspond with the measurements observed neither in the holotype nor in the Portuguese material (7.2-9.5 x 3.8-4.7 μm), which shows that *C. violilamellatus* is more related to *C. flexipes* than to *C. diasemospermus* var. *leptospermus*.



Figs. 5-6. Spores. – Fig. 5. *Cortinarius flexipes* var. *violilamellatus* (GDA 43060). – Fig. 6. *Cortinarius sertipes* f. *contrarius* (GDA 43057). – Bars: 2.5 μm .

Cortinarius sertipes f. *contrarius* (J. GEESINK) A. ORTEGA & MAHIQUES, Cryptog., Mycol. 16: 267, 1995

Selected iconography: LANGE (1935: pl. 103 as *C. decipiens*).

Material studied: Spain: Granada, Sierra Nevada, Lanteira, 1300 m s. m., under *Salix atrocinerea* BROT., 13. 11. 1999, leg. A. CAPILLA & al. (GDA 43057).

Pileus 12-25 mm, conical-campanulate to convex, umbonate, chestnut-greyish to chestnut-ochraceous, hygrophanous, not striate, with whitish fibrillose rests of veil at the margin; lamellae ochraceous; stipe 30-52 x 2-4 mm, concolorous with pileus, with violaceous to lilac tints at the apex. Smell not particular. Spores 7.5-8.5 x (4.1-)4.5-5(-5.5)

μm [$X_m = 8.3\text{--}4.8 \mu\text{m}$; $Q(L/W) = 1.5\text{--}1.9$; $Q_m = 1.73$], ellipsoid with rounded to subacute apex, with a medium ornamentation constituted by anastomosed warts (Fig. 6).

Observations: The habit, small size of the spores and habitat reminded us at first of *Cortinarius diasemospermus*, but this has a typical *Pelargonium* smell and more abundant rests of veil on the pileus. This collection from Sierra Nevada shows smaller spores than other collections from Andalusia ($8.5\text{--}10.5 \times 5\text{--}5.8 \mu\text{m}$, $X_m = 9.2 \times 5.4 \mu\text{m}$) recorded previously (ORTEGA & MAHIQUES 1995) and those indicated by GEESINK (1976), though they perfectly fit the measurements of KEIZER & ARNOLDS (1984) for *C. flexipes* sensu KÜHNER.

Key to the studied taxa

- | | | |
|----|--|--|
| 1 | Smell of pelargonium leaves | 2 |
| 1' | Smell different | |
| | | <i>Cortinarius sertipes</i> f. <i>contrarius</i> |
| 2 | Veil whitish, abundant on pileus surface; spores with $Q_m < 2$ | 3 |
| 2' | Veil scanty, limited to pileus margin; spores with $Q_m > 2$, in alpine areas | |
| | | <i>Cortinarius diasemospermus</i> var. <i>leptospermus</i> |
| 3 | Veil more abundant at the pileus margin; $Q_m < 1.6$ | 4 |
| 3' | Veil abundant throughout the pileus surface; $Q_m > 1.6$ | 5 |
| 4 | Pileus generally > 1.5 cm diam.; not alpine | |
| | | <i>Cortinarius flexipes</i> var. <i>flavellus</i> |
| 4' | Pileus < 1.5 cm diam.; under <i>Salix herbacea</i> in alpine habitat | |
| | | <i>Cortinarius flexipes</i> var. <i>montanus</i> |
| 5 | $Q_m = 1.6\text{--}1.7$ | |
| | | <i>Cortinarius flexipes</i> var. <i>flexipes</i> |
| 5' | $Q_m = 1.95$ | |
| | | <i>Cortinarius flexipes</i> var. <i>violilamellatus</i> |

Conclusions

On the basis of numerous Iberian collections of *Cortinarius* taxa with pelargonium smell, belonging to the *C. flexipes*-*C. paleaceus*-*C. paleiferus* complex, we have been able to support that there are no correlations between the habitat (broad-leaved trees vs. conifers), colour of the lamellae (with or without violet tints) and size of the spores; these features have been considered diagnostic by some authors (e.g., ARNOLD 1993, KEIZER & ARNOLDS 1994) to separate some taxa at specific level. Our observations fully back up the opinion of BRANDRUD & al. (1998) of considering only one species, i.e. *C. flexipes* = *C. paleaceus* = *C. paleiferus*, with the recognition of some infra-specific taxa.

In the same way we conclude, after the study of the type and several Iberian collections of *C. violilamellatus*, that this is a taxon closely related to *C. flexipes*, and we subordinate it to the latter at a varietal rank.

We wish to express our gratitude to Dr M. BON (St. Valéry-sur-Somme, France) for the revision and comments of the material labelled as *Cortinarius flexipes* var. *montanus* ad int.; also to the Director and Curator of E for the loan of the holotype of *Cortinarius violilamellatus*; to Dr B. SENN-IRLET (Bern, Switzerland), Mr J. A. CADIÑANOS AGUIRRE (Bilbao) and Mr J. VILA (Barcelona) for the loan of material of their private herbaria. Drs J. D. BUENO and A. GONZÁLEZ are thanked for their collaboration in the study of the spores under the SEM; finally, to the C.I.C.Y.T. (Ministerio de Educación y Cultura, Spain) for granting the Research Project PB98-1316 in which this contribution is included.

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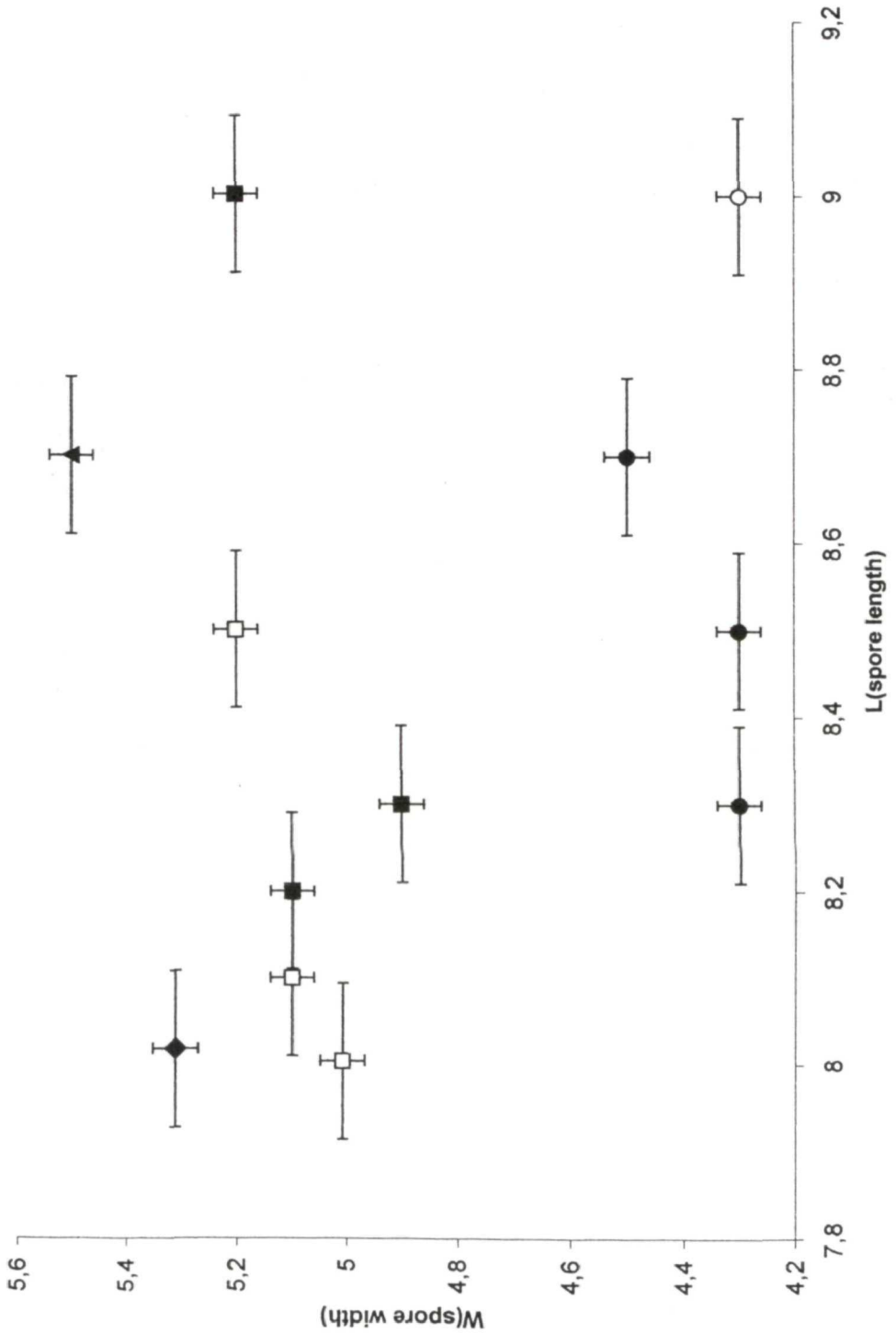


Figure 7

Fig. 7. The intervals of confidence of the mean values of L, W. □: *C. flexipes* (with violet to purplish lamellae); ■: *C. flexipes* (without violet to purplish lamellae); ●: *C. violilamellatus*; ○: *C. diasemospermus* var. *leptospermus*; ▲: *C. flexipes* var. *montanus*; ◆: *C. flexipes* var. *flabellus*.

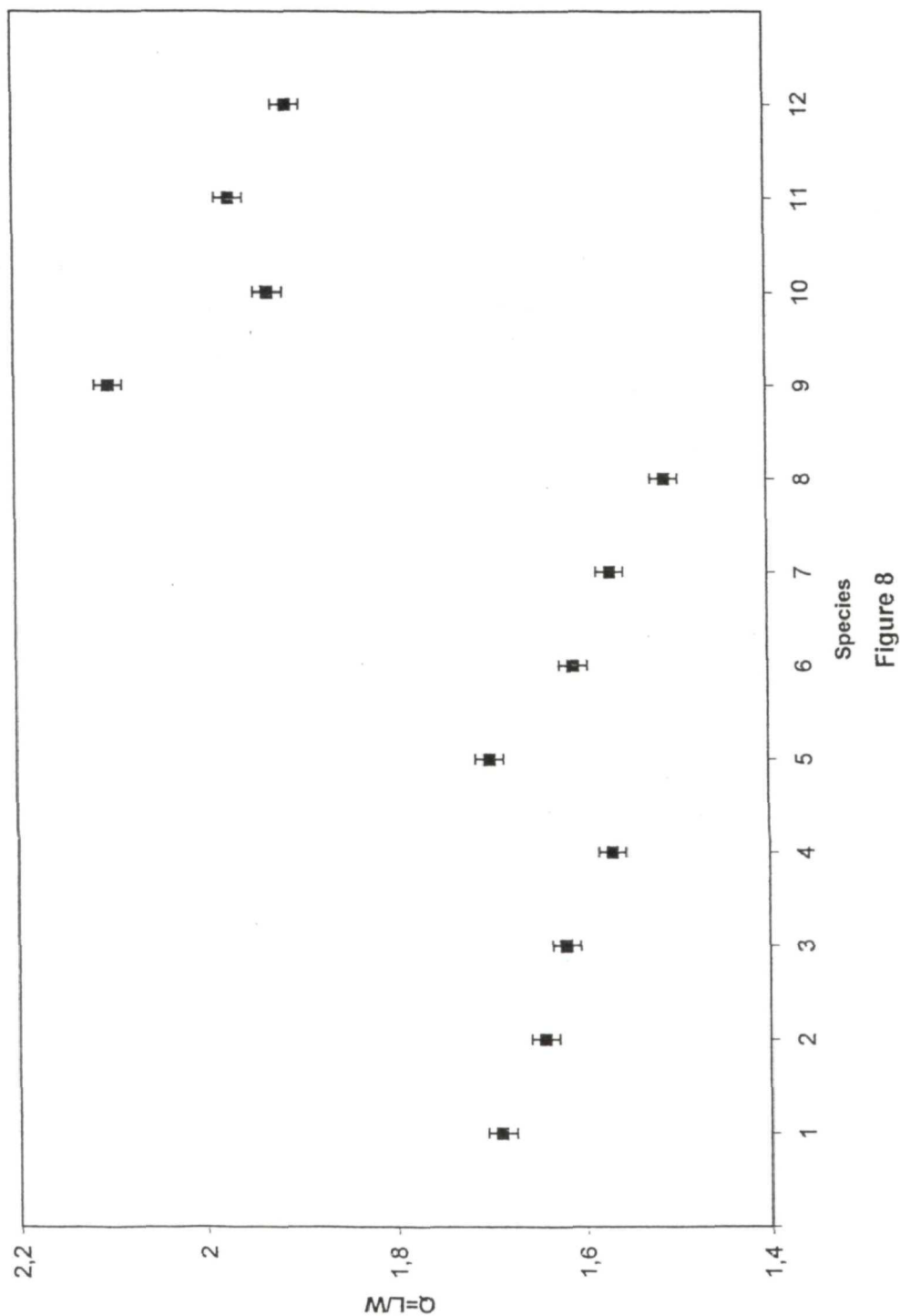


Fig. 8. The intervals of confidence of mean values of $Q = L/W$. *C. flexipes* (n. 1-6); *C. flexipes* var. *montanus* (n. 7); *C. flexipes* var. *flabellus* (n. 8); *C. diasemospermus* var. *leptospermus* (n. 9); *C. flexipes* var. *violilamellatus* (n. 10-12).

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