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MYCOTAXON

Volume LXXXIII, pp. 435-445 July-September 2002

STUDY OF SOME SPECIES OF THE GENUS CORTINARIUS, SECTION CAERULESCENTES (R. HENRY) EX MOËNNE-LOCCOZ & REUMAUX IN PENINSULAR SPAIN.

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ABSTRACT: A study of the complex *Cortinarius caesiostramineus* R. Henry *s. lato* has been made. As a result, we recognize four taxa: *C. caesiostramineus* var. *caesiostramineus*, *C. caesiostramineus* var. *amarescens* (M.M. Moser) A. Ortega & Mahiques ***comb. et stat. nov.***, *C. caesiostramineus* var. *cadinanos–aguirrae* Moënne-Locc. et A. Ortega, ***var. nova***, and *C. caesiostramineus* var. *gentianeus* (Bidaud) A. Ortega & Mahiques, ***comb. et stat. nov.*** The study has been complemented with *Cortinarius moënne-loccozii* Bidaud and its connections with related taxa such as *C. vaginatopus* Bidaud and *C. volvatus* A.H. Sm.

KEYWORDS: *Cortinarius* section *Caerulescentes*, taxonomy, corology.

INTRODUCTION: In this paper, we continue other contributions about Spanish taxa of genus *Cortinarius* (e.g. ORTEGA & ESTEVE-RAVENTÓS, 2002, ORTEGA & MAHIQUES, 1995). We draw taxonomic conclusions from the study of some species close to *Cortinarius caesiostramineus* R. Henry and *C. volvatus* A.H Smith. In this study we have analyzed several collections from France, Italy and Spain, more specifically from Spanish mediterranean areas. These mediterranean areas are very interesting, because of their high variability and diversity of fungi; for this reason we find frequent descriptions of new species (e.g. *Cortinarius assiduus* Mahiques et *al.*, *C. ayanamii* A. Ortega et *al.*, *C. erythrofuscus* Mahiques & A. Ortega, etc.).

MATERIAL AND METHODS: The field material comes from different areas of the North of Spain, and especially from the Mediterranean region (Andalusia and Valencian Communities); at the same time numerous typical samples from other European countries have been studied, and also some type-collections. The material comes from the following herbaria: Geneva (Switzerland): GK; Innsbruck (Austria): IB; Michigan (USA): MICH; Granada (Spain): GDA, GDAC; Sociedad Micológica de Aranzadi: ARAN-Cort.; private herbarium of R. Mahiques, (Quatretonda, Spain): M.E.S.; private herbarium of Dr. García Bona (Pamplona, Spain): M.N. and private herbarium of P. Moënne-Loccoz (Annecy, France): P.M.L.

Thirty spores of each collection have been measured, in order to calculate the maximum and minimal values, the mean range values and the average value (Xm), as well as the index (Q, Qm) = Quotient or quotient average of length (L) and width (w). When comparing between populations, the method of Simpson & Roy has been applied: Ic = Xm ± 1.96 σ/√30 (BIDAULT, 1968), in order to establish the differences between the sporal mean values (fig 1, 10). The study of the spores under the SEM included in this work (fig 2-9) has been carried out with a Zeiss microscope, DSM 950 model, following techniques applied by MORENO et *al.* (1995).

As basic literature we have used BIDAUD et *al.* (1993, 2000), BRANDRUD et *al.* (1990, 1992), BREITENBACH & KRÄNZLIN (2000) and MOSER (1960).

SPECIES STUDIED:

Cortinarius caesiostramineus R. Henry, Bull. Soc. Mycol. France 55 (1): 73 (1939) *s. lato*

BIDAUD et *al.* (2000) state that the taxonomic definition of this species has involved a serious difficulty over years because of its variability concerning the size of the spores and also its close affinities to other species, such as *Cortinarius amarescens* M.M. Moser and *Cortinarius gentianeus* Bidaud (= *C. amarescens* s. Kühner).

After having collected numerous samples of *Cortinarius gentianeus* from Andalusia (GDA) and the Valencian Community (MAHIQUES & GUTIERREZ, 2000, M.E.S. 2313), under *Quercus suber* and *Cistus laurifolius*, we decided to make a comparative study with other close taxa (e.g. *C. amarescens* s. *lato*, *C. caesiostramineus* s. *auct. hisp.*) collected and recorded in the Spanish bibliography (e.g. CADIÑANOS, 1996, MAHIQUES, 1999). This has allowed us to establish the possible limits and/or taxonomic relations among them and conclude that in this complex group of taxa we can recognize the following.

Cortinarius caesiostramineus var. ***amarescens*** (M.M. Moser) A. Ortega & Mahiques, ***comb. et stat. nov.***

Basion.: *Phlegmacium amarescens* M.M. Moser, *Die Gattung Phlegmacium*: 351 (1960).
= *Cortinarius caesiostramineus* R. Henry *sensu* Brandrud et *al.* (1990), Cadiñanos (1996),. Mahiques (1999), non *sensu* Bidaud et *al.* (2000) (= *C. caesiostramineus* var. *caesiostramineus*).

Ico. Sel.: BRANDRUD et *al.* (1990).

Studied material: SWITZERLAND: Kt. Bern, Lanenbach, Brienz, under *Picea/Fagus*, 16.10.1999, Leg. J. Gilgen (Det. M.M. Moser), IB 1999/0244. FRANCE: Pralognan, Fôret d'Isertan, under Nadelwald, 20.9.1971, leg. M.M. Moser, IB 71/166. ITALY: Trentino, Alpe Lucia bei Paneveggio, *Picea, Larix* zw. Moos und Nadelstreu, 10.9.1996, leg. M.M. Moser, IB 1996/0105. SPAIN: Castelló, Alt Palància, Pina del Montalgrao, Ombria de Sta. Bárbara, 1200m., under *Pinus pinaster* and *P. sylvestris*, 15.10.1999, leg. R. Mahiques, M.E.S. 3484 (MAHIQUES, 1999 sub *C.*

caesiostramineus). *Ibidem*, L'Alcalatén, Penyagolosa, Vistabella del Maestrat, Capçalera del Barranc de l'Esquilador, 1330m., under *P. sylvestris*, 16.10.1999, leg. A. Conca, M.E.S. 3457 (MAHIQUES, 1999, sub *C. caesiostramineus*).

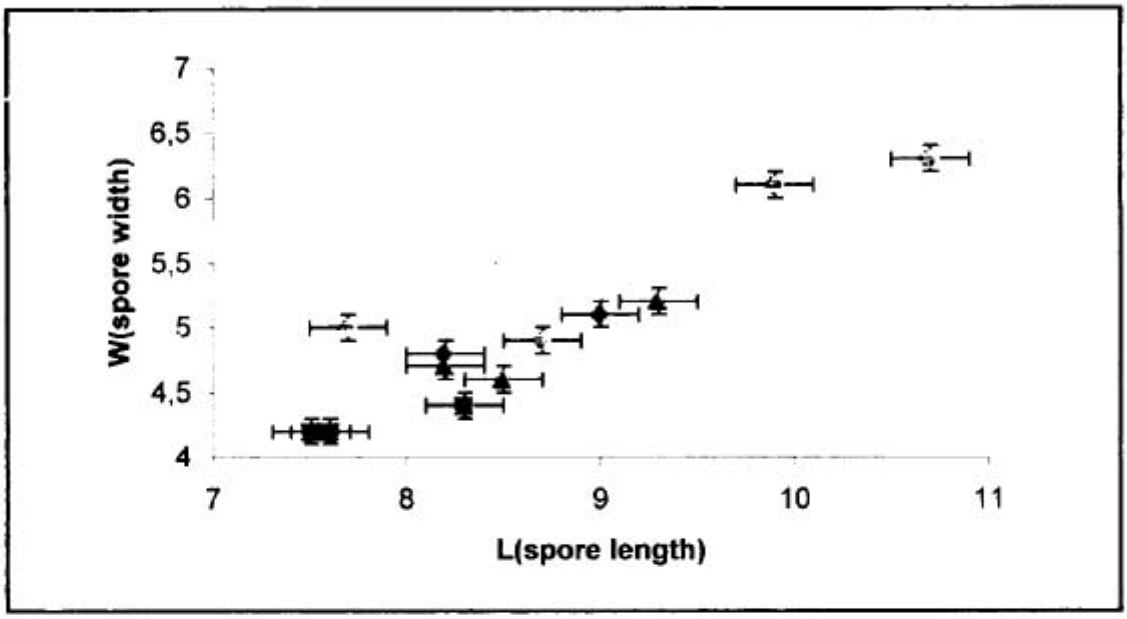

Figure 1. The intervale of confidence of the mean values of L, W: *Cortinarius caesiostramineus* var. *amarescens* Herb. IB (▲), Herb. M.E.S.(♦). C. *caesiostramineus* var. *cadinanos-aguirrae* (●). C. *caesiostramineus* var. *gentianeus* (■).

Description: The macroscopic description has been compiled from the data provided by CADIÑANOS (1996) and MAHIQUES (1999). Pileus 33-55 mm, convex, plano-convex or applanate, whitish, whitish cream, buff, with some bluish gray tones (MAHIQUES, 1999), which soon turns into pale ochre; cuticle viscid, without radial fibrils and with small white veil remains, of satiny-glazed aspect , more obvious in the disk. Lamellae crowded, emarginate, pale cream with very evanescent pink lilac shades, that turn into cream ochraceous and finally to tobacco brown. Stipe 40-61 x 8-14 (- 18) mm, white, with some lilac hues at the apex (CADIÑANOS, 1996), cylindrical, broadened in a marginately bulb (16-26 mm) hardly prominent. Context white, bitterish in the pileus and strongly bitter in the cap cuticle. Negative reaction with KOH and NH3.

Spores (Fig. 2, 3) of 7.5-10.5 x 4-6 µm, mean values 8.2-9.3 x 4.6-5.2 µm (Xm = 8.7 x 4.9 µm). Q: L/w = 1.6-2, mean values 1.74-1.85, (Qm = 1.79), yellowish, almond-shaped to lemon-shaped, with sub-smooth to low ornamentation, formed by isolated or hardly interconnected warts.

Observations: Some authors (e.g. BRANDRUD et *al*., 1990; CADIÑANOS, 1996;

MAHIQUES, 1999) consider *C. caesiostramineus* and *C. amarescens* conspecific, however for other mycologists (e.g. BIDAUD et *al.*, 2000) they represent different species according to the following characteristics:

(1) Distinct bluish or violet colour in the pileus of *C. caesiostramineus*.

(2) Context yellow with KOH and green with NO3Ag of *C. caesiostramineus*.

(3) Specific habitat under *Picea abies* of *C. caesiostramineus*.

However, if we analyze closely these characters, we can accept that their taxonomic value is not significant, since (1) the presence or absence of violet-bluish colours on the basidiocarp is not a character very stable in section *Caerulescentes* (MELOT, 1990); (2) the reaction of the flesh with KOH and NO3Ag has only been observed by BIDAUD et *al.* (2000), and is not described in the original description of HENRY (1939); (3) some typical collections of *C. amarescens* (e.g. IB 1999/0244) have also been gathered in mixed woods of *Picea* and *Fagus*. For these reasons, we do not agree with the separation of *C. amarescens* and *C. caesiostramineus* at specific range; we better consider -as also indicated by BIDAUD et *al.* (*op. cit*: 68) and BRANDRUD et *al.* (1992: 13)- a differentiation of two varieties: *Cortinarius caesiostramineus* var. *caesiostramineus* (= *C. caesiostramineus* s. Bidaud et *al.*, 2000) and *Cortinarius caesiostramineus* var. *amarescens* (= *C. caesiostramineus* s. Brandrud et *al.*, 1990).

Cortinarius caesiostramineus var. ***cadinanos-aguirrae*** Moënne-Locc. & A. Ortega, ***var. nov.***

Etymology: Dedicated to J.A. Cadiñanos Aguirre for his study focused on *Cortinarius* in the Basque Country.
= *Cortinarius amarescens* M.M. Moser, *sensu.* Bidaud et *al.* (1993) *pro parte*, Cadiñanos (1996) *pro parte*, Marchand (1982) *pro parte*.

Studied material: FRANCE: Bois de Beyne, Ile de France, under broadleaved trees, oct.1979, P.M.L. 2769 (*paratypus*). SPAIN: Burgos, Barrasa de Mena, under *Quercus faginea*, 20.11.1999, leg. J.A. Cadiñanos. GDA 44814 (*holotypus*).

Basidiomata Cortinarius caesiostramineus var. *amarescens similis. Sporae* 9-11.2 x 5.5-7 µm. *Hispania, Burgos, Barrasa de Mena, in Querci faginea silva, leg. J.A. Cadiñanos, holotypus in herbario GDA 44814.*

Observations: The distinctive characters of this taxon, which is macroscopically quite similar to *C. amarescens* (BIDAUD et *al.*, 1993: 135) are: (1) its habitat in broad-leaved forests) and, (2) its spores (Fig. 4) lemon-shaped – almond-shaped (Q :L/w = 1.5-1.9, Qm = 1.67) of (8.8 -) 9-11 (- 11.2) x 5.5-6.8 (-7) µm (mean values 9.9-10.7 x 6.1-6.3 µm, Xm= 10.3 x 6.2 µm), whereas in *C. caesiostramineus* var. *amarescens* the spores, though morphologically similar (Fig. 3), are smaller (Fig. 1), measuring: 7.5-10.5 x 4-6 µm (mean values 8.2-9.3 x 4.6-5.2 µm, Xm= 8.7 x 4.9 µm).

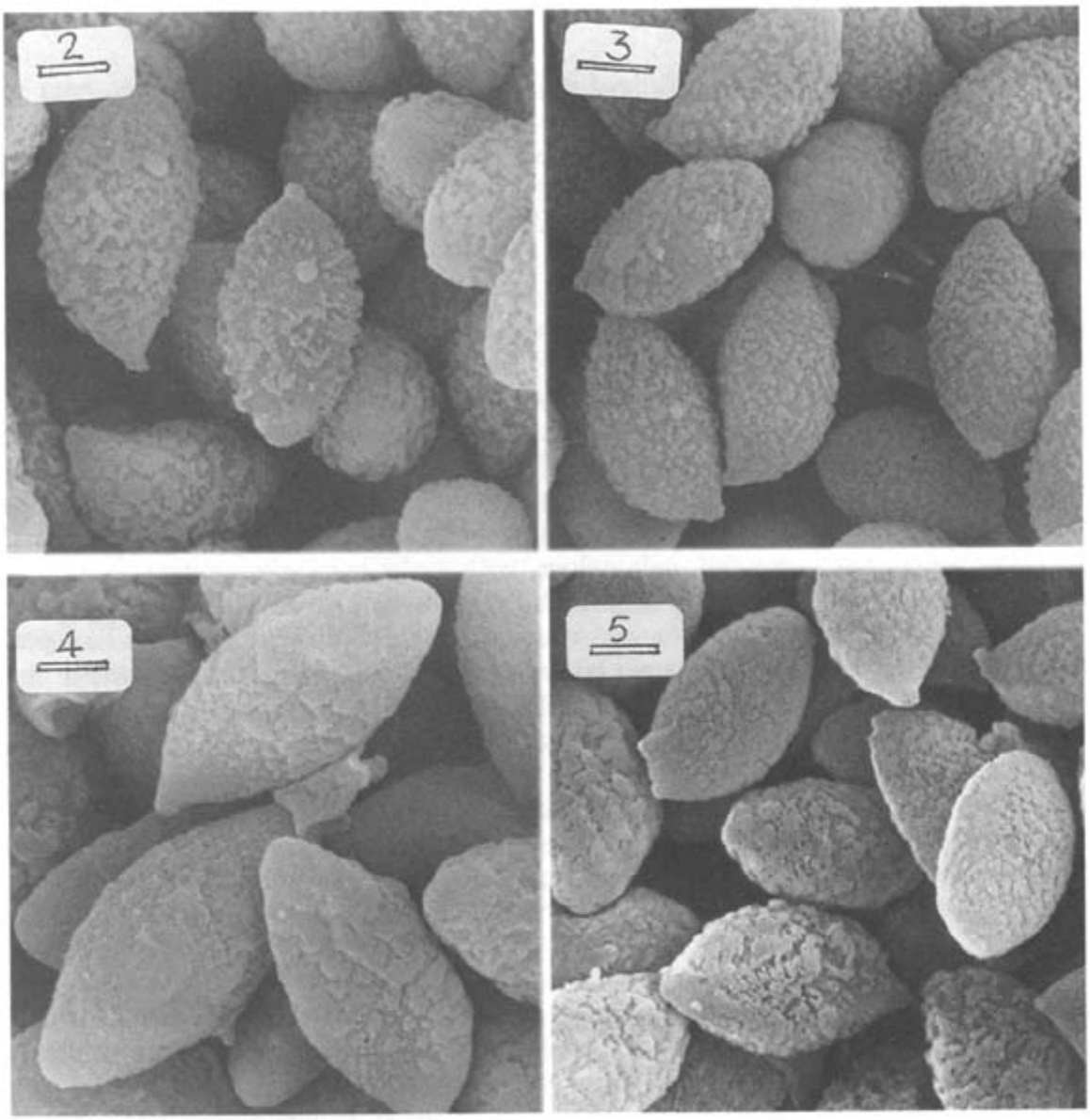

Figure 2: *Cortinarius caesiostramineus* var. *amarescens* (M.E.S. 3484). Fig. 3: *C. caesiostramineus* var. *amarescens* (IB 1996/ 0105). Fig. 4: *C. caesiostramineus* var. *cadinanos-aguirrae* (holotypus). Fig. 5: C. *caesiostramineus* var. *gentianeus* (GDA 44813). (Bar: 2µm).

Cortinarius caesiostramineus R. Henry. var. ***caesiostramineus***, Bull. Soc. Mycol. France 55 (1): 73 (1939)

= *Cortinarius caesiostramineus* R. Henry, *sensu* Bidaud et *al.* (2000), non Brandrud et *al.* (1990).

Desc. et Icon. Sel. : BIDAUD et *al.* (2000).

Cortinarius caesiostramineus var. ***gentianeus*** (Bidaud) A. Ortega & Mahiques, ***comb. et stat. nov.***

Basion.: *Cortinarius gentianeus* Bidaud in Bidaud et *al.*, Atlas des Cortinaires, pars V: 150 (1993)
= *Cortinarius amarescens* M.M. Moser, *sensu* Kühner

Icon. Sel.: BIDAUD et *al.* (1993), CONSIGLIO (1995), MAHIQUES & GUTIERREZ (2000).

Studied material: SPAIN: Castelló, Artana, under *Quercus suber*, 17.11.1997, leg. A. Burguete, M.E.S. 2313 (MAHIQUES & GUTIÉRREZ, 2000). Jaén, Santa Elena, Miranda del Rey, under *Quercus suber* and *Cistus ladanifer*, 27.11.1999, leg. J.D. Reyes, GDA 44813.

Description: Pileus 4-8 cm width, hemispheric to flat -convex, whitish cream, with pink hues in some specimen, then ochraceous, cuticle viscous and peeling off, bitter. Lamellae emarginate, crowded, pale colour, with violet hues when young, becoming cream or buff. Stipe 5-7 x 1.8-2.2 cm cylindrical, with marginated bulb 3.5-4 cm, broad coated with abundant membranous volviform remains, at first whitish with the apex lilac-bluish, then ochraceous. Context bitter, whitish, slightly bluish at the apex of the stipe, yellowish cream in the bulb. Spores (Fig. 5) 6.5-9 (- 10) x (3.5 -) 4-5 µm, mean values 7.6-8.3 x 4.4 µm (Xm = 7.9 x 4.4 µm), Q: L/w = (1.5 -) 1.55-2.2, mean values 1.72-1.89 (Qm = 1.8), yellowish, ellipsoid to subellipsoid or subalmond-shaped, with soft ornamentation, mainly constituted by isolated warts.

Distribution: It does not seem to be a common species in Spain. In Europe it is known from France (BIDAUD et *al.*, 1993) and Italy (CONSIGLIO, 1995).

Observations: This taxon shows close affinities to *Cortinarius caesiostramineus* var. *amarescens*, which seems to grow almost exclusively in coniferous forests, for that reason *Cortinarius gentianeus* Bidaud could represent an analogous taxon in broad-leaved forests. *C. caesiostramineus* var. *amarescens* shows a more slender stipe (up to 1'5 cm thick) and the spores are amygdaliform or, more frequently, sublemon-shaped (Fig. 3), and bigger (Fig. 1) (mean values 8.2 –9.3 x 4.6-5.2 µm); *C. caesisotramineus* var. *gentianeus* shows a broader stipe (up to 2.2 cm) and the spores are ellipsoid to subalmond-shaped or subellipsoid (Fig. 5) and smaller (Fig. 1) (mean values 7.5-8.3 x 4.2-4.4 µm). Consequently, we believe that it is reasonable to treat *C. caesiostramineus* var. *amarescens* and *Cortinarius caesiostramineus* var. *gentianeus* as two different varieties which grow in coniferous and broadleaved trees respectively. Also some overlapping in spore values of both taxa are observed. The spore size is the only character used by BIDAUD et *al.* (1993) to separate both at specific level, but this has been revealed to be untenable. In addition, there is a strong variability in spore size of *Cortinarius amarescens* s. *lato* as some authors have previously indicated (e.g. MARCHAND, 1982: 223).

Cortinarius moenne-loccozii Bidaud in Bidaud et *al.*, Atlas des Cortinaires, pars V: 151 (1993)

= *Cortinarius volvatus* A.H. Smith *sensu* Lazzari & Bellu (1985), Cetto (1993)
= *Cortinarius vaginatopus* Bidaud et *al.* (1993) ?

Icon. Sel.: BIDAUD et *al.* (1993), BREITENBACH & KRÄNZLIN (2000), CETTO (1993), CONSIGLIO (1996).

Studied material: SPAIN: Granada, Arroyo de Fardes, Natural Park of the Sierra de Huétor, under *Quercus faginea* and Q. *ilex* subsp. *ballota*, 10.10.1996, leg. A. Capilla, GDAC 42717. Barcelona, Serra de l'Arca, Seva (Osona), mixed forest of *Quercus ilex* and *Pinus* sp., 2.11.1991, leg. Gutiérrez. (GUTIÉRREZ & MAHIQUES, 1999). *Ibidem*, Cantomigrós, oak wood (Quercus pubescens?), in eutrophic soil or a little acid, 18.10.1999. Leg. J.A. Cadiñanos, ARAN-Cort. Navarra: Elzaburu, in oak wood, between fallen leaves, 31.10.1987, leg. García Bona, M.N. 3134. (GARCÍA BONA, 1994 as *Cortinarius volvatus* A.H. Smith). Alava, puerto de Altube, beech wood eutrophic or a little acid, 12.10.1994, Leg. J.A. Cadiñanos, ARAN-Cort. *Ibidem*, Ondátegui, Zigoitia, under *Quercus faginea* and *Quercus robur*, in neutral or calcicolous soil, 12.10.1994, Leg J.A.Cadiñanos, ARANZ-Cort. FRANCE: Face west of the Desit-du-Chat a Meyzieu-Tronet (Savoie), near a acid wood with grass layer (heathland) with *Quercus* sp., *Acer* sp., *Betula* sp. et *Populus tremula*, 20.10.1991, leg. A. Bidaud, GK 416908 (*holotypus*).

Studied material for comparison: *Cortinarius vaginatopus* Bidaud & al.: FRANCE: Neufchef (Moselle), beech-forest in thermophilous clay calcareous soil, 27.8.1989, leg. G. Trichies, GK 416912 (*holotypus*). *Cortinarius volvatus* A.H. Smith: USA: California, Crescent City, under spruce, 18.11.1937, leg. A.H. Smith, MICH (A.H. Smith) 8857 (*holotypus*). *Ibidem*, 5.11.1937, MICH (A.H. Smith) 8457, *Ibidem*, under *Picea*, 5.11.1937, MICH (A.H. Smith) 8457, IB 1937/28, *Ibidem*, under spruce, 3.11.1937, MICH (A.H. Smith) 8359, Fort Dick, under spruce, 11.10.1937, MICH (A.H. Smith) 8599, Mendocino Co., Russian Gulch State PK., under Tsuga, Pseudotsuga and Sequoia, 30.11.1991, leg. M.M. Moser, IB 91/613.

Description: The macroscopic description has been taken from fresh material or from data provided by other authors (e.g. GARCÍA BONA, 1994, GUTIÉRREZ & MAHIQUES, 1999, etc.), which we have been studying. The spore size is referred to Spanish material and also to type material.

Pileus 4-9.5 (-11) cm diam., dark blue, grey bluish, violet-lilaceous, grey violet, turning into pale grey lilac or lilac pink, fading at the end loosing the bluish hue, violet or lilac; hemispherical convex, then flat-convex, with the edge strongly recurved when young; surface viscid, with radial innate fibrils, more or less evident, but always more distinct to the periphery; universal veil distinct, white or yellowish ochraceous forming membranous remnants, "sometimes so copious that reminds of an *Amanita* (GARCÍA BONA, 1994)". Stipe 4-9 (-11) x 0.7-2.3 cm cylindric, with bulb conspicuously marginated (x 1.5-4 cm), concolorous or paler than the pileus, although, quickly turning yellowish ochraceous from the bulb, distinct basal volva that wraps all the bulb or even

exceeds it, white, yellowing or browning with age. Lamellae adnate or emarginate, crowded, at first concolorous with pileus or lilac, immediately turning cream ochraceous or ochraceous.

Spore (fig. 7, 8) 8.2-10.5 (-11) x (4.5-) 5-6.2 µm, mean values 9.1-10.2 x 5.3-5.7 µm (Xm = 9.7 x 5.5 µm), almond-shaped, sublemon-shaped o lemon-shaped, with moderate or coarse ornamentation, formed by more o less anastomosing warts.

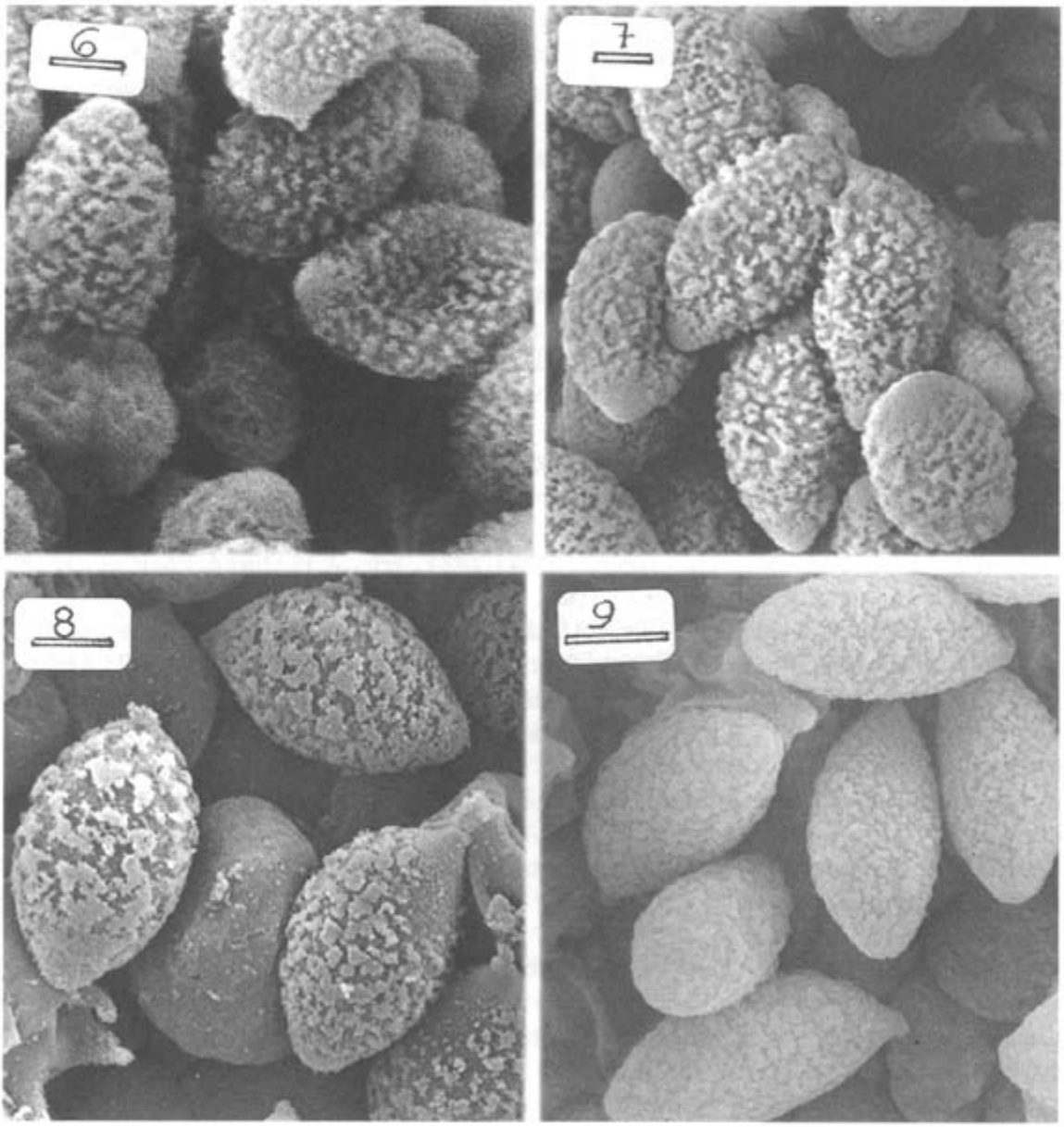

Figure 6: *Cortinarius volvatus* (holotype). Fig. 7: *C. moenne-loccozii* (holotype). Fig. 8: *C. moenne-loccozii* (GDAC 42717). Fig. 9: *C. vaginatopus* (holotype). (Bar: 2 µm).

Distribution: It is a frequent taxon in Spain and its presence is known from the Basque Country (CADIÑANOS, 1998), Navarra (GARCÍA BONA, 1994, as *C. volvatus*), Catalonia (GUTIÉRREZ & MAHIQUES, 1999) and now in Andalusia, as well as in other European Countries like France (BIDAUD et *al*., 1993), Italy (CONSIGLIO, 1996, CETTO, 1993 as *C. volvatus* and LAZZARI & BELLÙ, 1985 as *C. volvatus*) and Switzerland (BREITENBACH & KRÄNZLIN, 2000 and FRELECHOUX, 1995).

Discussion: In spite of the intense study on *Cortinarius moënne-loccozii* Bidaud carried out by FRELECHOUX (1995), where the distinction from other close species like *Cortinarius volvatus* A.H. Smith or *Cortinarius vaginatopus* Bidaud et *al*. is discussed, we think that the separation between this three taxa, especially in the case of *C. vaginatopus*, is really difficult, if we take into account the great variability in colour (especially of the pileus) of many species of *Phlegmacium*. This problem becomes obvious in the section *Caerulescentes*, as MELOT (1990) has pointed out (depending of the degree of development on basidiomata, bioclimatic peculiarities, etc). We believe that the character should not be overemphasized in separating different species. Likewise other macroscopical (e.g. presence of radial fibrils on the pileus surface, degree of development, colour of remnants of universal veil on pileal surface, colour of context, etc.) and even microscopical characters (e.g. basidia size), explained by FRELECHOUX (1995) and BIDAUD et *al*. (1993), seem too variable, as we have obseved in the Spanish collections belonging to the complex.

The only feature which we consider of taxonomic value referres to morphology and spore size. We have carried out the study of the sporal peculiarities of *C. moënne-loccozii* (Fig. 7, 8), *C. vaginatopus* (Fig. 9) and *C. volvatus* (Fig. 6), that has allowed us to conclude the following:

(1) *Cortinarius moënne-loccozii* shows almond-shaped to lemon-shaped spores, with moderate or coarse warts, 9.1-10.5 x 5.3-5.8 µm; Q : L/w = 1.67-1.86 (mean values). *Cortinarius vaginatopus* has almond-shaped to lemon-shaped spores, with moderate ornamentation, 9-9.3 x 4.9-5 µm; Q : L/w = 1.84-1.86 (mean values). In *Cortinarius volvatus* the spores are almond-shaped to lemon-shaped with smooth to moderate ornamentation, 7.8-8.6 x 4.7-5.4 µm; Q: L/w = 1.55-1.75 (mean values). As it can be noted, there are not clear differences in sporal size (Fig. 10), not even in sporal shape. Some Spanish collections of *Cortinarius moënne-loccozi* (e.g. GDAC, ARANZ-Cort., etc.) show spores significantly smaller than observed by BIDAUD et *al*. (1993) and FRELECHOUX (1995), close to the sporal size of *Cortinarius vaginatopus* and even of *Cortinarius volvatus*.

(2) The present level of knowledge about the variability of *Cortinarius vaginatopus* Bidaud et *al*. (= C. *volvatus* s. Moser, 1960 Marchand. 1982) is very poor, because up to now it has been only published data about type material and some other doubtful collection studied by FRELECHOUX (1995); in our opinion, it is not advisable to separate -at specific level- this taxon from *Cortinarius moënne-loccozi*, as there is a clear overlapping in the sporal values of both species (MOSER, 1960, MARCHAND, 1982). This situation is the same in the case of *C. vaginatopus* and *C. volvatus s. Smith*, as far a we know, the sporal measure of the last species are 7-9 (-9.5) x 4.5-5.5 (-5.8) µm; Q: L/w = 1.4-1.9, overlapping therefore with the sporal value of *C. vaginatopus*, for

that reason the separation between these taxa does not seem clear.

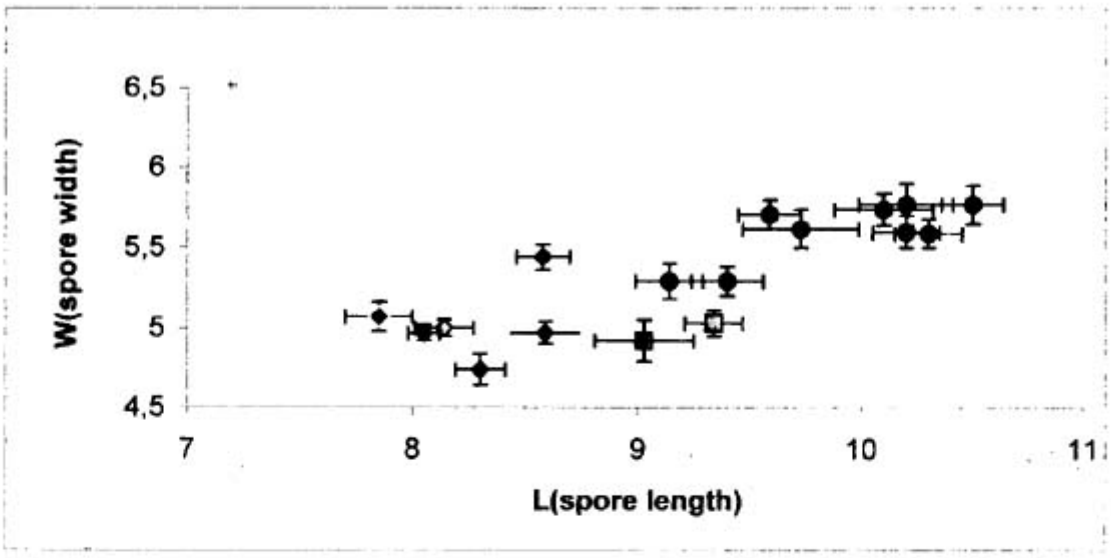

Figure 10: The intervales of confidence of the mean values of L, W: *Cortinarius moenne-loccozzi* (●). *C. vaginatopus* (■). *C. volvatus* (♦).

(3) As a consequence of what has been exposed in paragraphs one and two, we believe that is the separation of the two species is acceptable:

Cortinarius volvatus A.H. Smith : it grows in coniferous forests, has a paler pileus (blue or grayish violet), smaller spores (mean values 7.8-9 x 4.7-5.4 µm), less markedly lemon-shaped (sublemon-shaped to lemon-shaped) and with lower ornamentation.

Cortinarius moënne-loccozii Bidaud (= *Cortinarius vaginatopus* Bidaud et *al.*?): it grows under broad-leaved trees, has a deeper pileus colour with larger spores (value means 9.1-10.5 x 5-5.8 µm), markedly lemon-shaped and coarser ornamentation.

As for *Cortinarius vaginatopus* Bidaud et *al.*, we believe that it would be appropiate to study new collections in order to establish clear differences with *C. moënne-loccozii.*

ACKNOWLEDGMENT:

We would like to express our gratitude to the keepers of herbaria of Michigan (MICH), Innsbruk (IB), Geneva (GK), Granada (GDA), of the Aranzadi Mycological Society (ARAN/Cort.) and to the Dr. Gª Bona (M.N.) by the material loan of *Cortinarius moënne-loccozii*, *C. vaginatopus* and *C. volvatus*. To the Ministry of Education and Culture (D.G.I.C.Y.T.) for the financial support of this study (PB98-1316). To the Dr. J.D. Bueno & A. González (Granada University) for their collaboration in the SEM study of the spores. To C. Pastor and Dr. F. Esteve-Raventós (Univ. Alcalá de Henares, Spain) for the linguistic review of the English text. Also to Dr. M.M. Moser (Innsbruck, Austria) for revision and expert criticism on the manuscript.

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