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# The genus *Fuscopannaria* P. M. Jørg. (Pannariaceae, lichenized Ascomycota) in the Iberian Peninsula

Graciela Paz-Bermúdez, Regina Carballal & Eugenia López de Silanes

## Abstract

PAZ-BERMÚDEZ, G., R. CARBALLAL & E. LÓPEZ DE SILANES (2008). Synopsis of *Fuscopannaria* P. M. Jørg. (Pannariaceae, lichenized Ascomycota) in the Iberian Peninsula. *Candollea* 63: 269-280. In English, English and French abstracts.

Eight Iberian lichen species of the genus *Fuscopannaria* P. M. Jørg. are studied. Their taxonomic characters, distributions, and ecology are provided, as well as an identification key. This synopsis provides data contribution to the lichen catalogue of the Iberian Peninsula.

## Key-words

PANNARIACEAE – *Fuscopannaria* – Lichenized Ascomycota – Iberian Peninsula – Flora – Taxonomy

## Résumé

PAZ-BERMÚDEZ, G., R. CARBALLAL & E. LÓPEZ DE SILANES (2008). Synopsis de *Fuscopannaria* P. M. Jørg. (Pannariaceae, Ascomycètes lichénisés) dans la Péninsule Ibérique. *Candollea* 63: 269-280. En anglais, résumés anglais et français.

Huit espèces de lichens ibériques du genre *Fuscopannaria* P. M. Jørg. sont étudiées. Leurs caractéristiques taxonomiques, de répartition et écologiques sont données, ainsi qu'une clé d'identification. Ce synopsis est une contribution au catalogue des lichens de la Péninsule Ibérique.

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## Introduction

The lichen family *Pannariaceae* has been well studied in the worldwide during the last few years, and particularly for Europe (JØRGENSEN, 1978).

Later, Jørgensen's and others' research has mainly concerned the recognition of new genera and descriptions of newly discovered/species, and phylogenetic studies in different geographical areas which have shed light on our understanding of relationships within the family itself (JØRGENSEN & JAMES, 1990; CODOGNO & PUNTILLO, 1993; JØRGENSEN, 2000, 2003, 2005; EKMAN & JØRGENSEN, 2002).

JØRGENSEN (1994) separated *Fuscopannaria* P. M. Jørg. from *Pannaria* Delise for small-squamulose, mainly brownish species containing fatty acids and terpenoids. This genus is widespread in mainly cool-temperate areas of the Northern Hemisphere, and has two evolutionary centres: one in the northern Pacific and adjacent regions in America, and the other in Asia, mainly in Pacific North America and East Asia.

In this contribution we continue our review of the family *Pannariaceae* in Spain and Portugal (CARBALLAL & LÓPEZ DE SILANES, 2006; CARBALLAL & al., 2007) within the framework of the project «Flora Liquenológica Ibérica». In this we attempt to summarise the main features of the species as well as to provide new ecological and distributional data. The eight species of the genus *Fuscopannaria* P. M. Jørg., which are found in the Iberian Peninsula, are treated here and an identification key is provided.

## Material and Methods

We have studied more than 300 collections deposited in the following herbaria: BCC, GDA, LEB, LISU, MA, MACB, MAF, MGC, MUB, PO, SALAF, SANT, UPS, VAB as well as from the private collections of Drs J. Álvarez (herb. Álvarez), P. v.d. Boom (herb. Boom), J. Etayo (herb. Etayo), and Vigo-Lich (herb. Vigo-Lich). We have also collected and examined fresh material.

Macroscopic characters were studied using two stereomicroscopes: a Nikon with up to 80x magnification, and an Olympus SZX9, with magnification between 63-570 ×. For high-power microscopy we used an Olympus BH2 microscope. Slides were prepared from hand sections, which were first mounted in water to make all the measurements provided here. The asci were also observed in Lugol's iodine solution and, in some instances, following pre-treatment with 10% KOH.

## Results

*Fuscopannaria* P. M. Jørg. in J. Hattori Bot. Lab. 76: 198. 1994.

**Typus:** *Pannaria leucosticta* Tuck. (≡ *Fuscopannaria leucosticta* (Tuck.) P. M. Jørg.)

This genus, which was segregated from *Pannaria* P. M. Jørg. by JØRGENSEN (1994), is characterized by the squamulose to subcrustaceous thallus, which is mainly brownish (and to which the name of the genus refers), and usually contains fatty acids and terpenoids (which do not react with P). The apothecia are variously margined, with or without a thalline exciple, have anamyloid hymenium, and an amyloid apical structure in the asci.

The presence or absence of a thalline exciple explains why some species were formerly included in *Pannaria* or *Parmeliella* Müll. Arg. Species of *Pannaria* s.str. always have a well-developed thalline exciple, while no such exciple is present in *Parmeliella*. Furthermore, the different colour reaction with I of the hymenium, greenish blue turning reddish in *Fuscopannaria*, and persistent blue in *Pannaria* and *Parmeliella*, and also the different ways the asci open, facilitates the identification of specimens with apothecia.

Fourteen species are known in Europe, most of them either previously included in *Pannaria* or recently described (JØRGENSEN, 2005), eight of them having been found in the Iberian Peninsula. The distribution of the other four species is boreal, arctic or arctic-alpine which explains why do not appear to occur in the Iberian Peninsula. The nomenclature follows JØRGENSEN (2003).

1. *Fuscopannaria atlantica* P. M. Jørg. & P. James in Lichenologist 37: 221. 2005.

**Typus:** PORTUGAL. Azores: Sta. Maria, 1 km W of Arrebetantao, on earth bank by roadside, 14.IV.1977, James s.n. (holo-: BM).

*Thallus* 100-160 µm thick crustaceous, of dark grey to brownish coloured squamules, squamules 0.4-0.6 × 0.2 mm, repeatedly divided towards the apex, which gives them a greyish granular appearance. Upper *cortex* composed of 2-3 cell layers. *Photobiont* layer with large *Nostoc* clumps. *Apothecia* 0.4-0.8 mm diam, abundant, brown-orange, flat at first but becoming convex, with a granular thalline exciple evident when young. In some young apothecia, a narrow true exciple, which is lighter in colour than the disc, is apparent. *Epithelium* golden brown. *Hymenium* 80-100 µm tall, I+ blue in Lugol's iodine. *Subhymenium* 120-150 µm tall, colourless. *Paraphyses* unbranched, slightly swollen in the apex. *Exciple* paraplectenchymatous, 30-40 µm wide. *Asci* subcylindrical, 60-70 × 13-16 µm, 8-spored. *Ascospores*, colourless, ellipsoidal, without an epispore, 10.5-16(-17) × 4-7(-9) µm.

*Observations.* – This species may be mistaken for *Moelleropsis nebulosa* (Hoffm.) Coppins & P. M. Jørg. as a result of the high number of divisions in the squamules, which may be regarded as granules, especially in the middle of the thallus where it is hard to distinguish the squamules (see the key of the species). However, *F. atlantica* always has a well-defined cortex, and its grey never looks bluish.

*Habitat and distribution.* – This recently described species by JØRGENSEN (2005) was originally reported only on consolidated soil material near the coast. The only Iberian specimen

was also collected near the sea, although it was growing on bark in an urban environment (Fig. 1). This species has been collected along the European Atlantic coast: from Norway and the Azores, in western Ireland, England, Wales, and Scotland, and in the Italian coast of Liguria; all of these localities have a marked oceanic influence.

*Specimens examined.* – **PORTUGAL. Estremadura:** Cascais, Parque Municipal, on the bark of *Pinus halepensis*, 17.VII.1946, Tavares 192972 (LISU, as *Parmeliella corallinoides* var. *incrassata* A. L. Sm.).

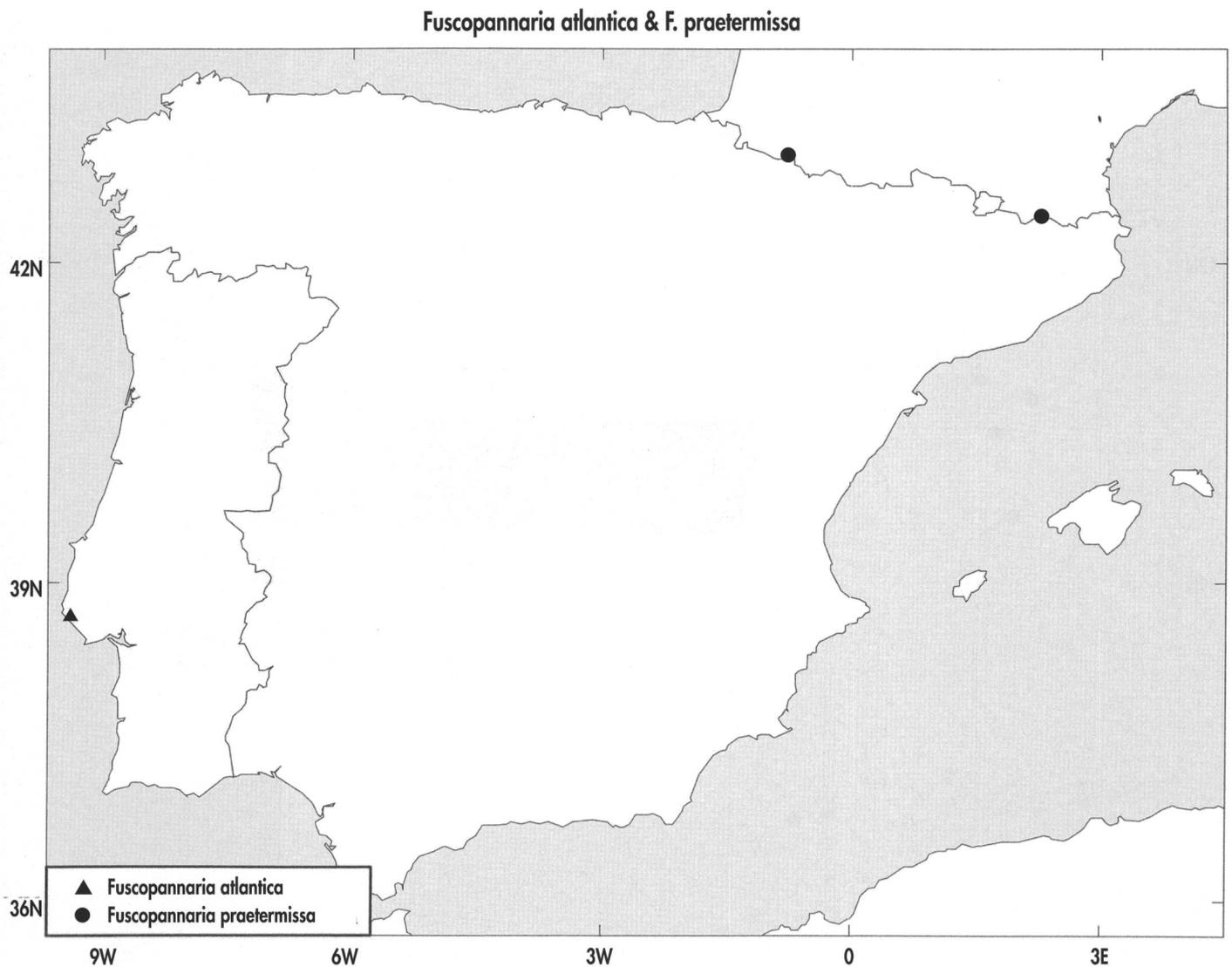


Fig. 1. – Distribution map of *Fuscopannaria atlantica* P. M. Jørg. & P. James and *F. praetermissa* (Nyl.) P. M. Jørg.

2. *Fuscopannaria ignobilis* (Anzi) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Pannaria ignobilis* Anzi in Comment. Soc. Crittog. Ital. 1: 138. 1862.

**Lectotypus** (designated by TAVARES, 1965): ITALY. **Monte Pisano**: [near Pisa], *s.coll.*, *s.n.* (TO).

*Thallus* 125-160  $\mu\text{m}$  thick, crustaceous, consisting of small squamules (0.25-)0.5-1(-1.5) mm wide, grey to brownish (rarely bluish), incised and sometimes verrucose, with a whitish margin, usually imbricate, rarely dispersed, and most clearly seen at the edges of the thallus. *Hypothallus* black-blue, usually well developed. Upper *cortex* paraplectenchymatous, 20-30  $\mu\text{m}$  thick. *Photobiont* layer (40-)60-90  $\mu\text{m}$  thick, consisting of *Nostoc* clumps. *Medulla* 25-40  $\mu\text{m}$  thick. *Apothecia* usually abundant,

sometimes confluent. *Thalline* exciple with a verrucose appearance and a whitish margin evident in younger specimens but disappearing in the oldest ones. *Disc* brown-orange to brown-red, soon becoming convex. *Epithecium* brown. *Hymenium* hyaline, 100-140(-180)  $\mu\text{m}$  tall, I+ blue-green turning to red. *Hypothecium* hyaline or slightly yellowish, 200-300  $\mu\text{m}$  tall. *Subhymenium* prosoplectenchymatous, with larger cells in the lower part. *Paraphyses* unbranched, slightly swollen at the apex. True *exciple* paraplectenchymatous, narrow, 20-40  $\mu\text{m}$  wide. *Asci* subcylindrical to clavate, 8-spored, 60-85  $\times$  18-20  $\mu\text{m}$ . *Ascospores* colourless, elliptical, usually with a large guttule, epispor present and attenuated to form a sharp apex (apiculus) at one or both apices, 11-18  $\times$  6-11  $\mu\text{m}$ , including the epispor 16-28(-40)  $\times$  7-11  $\mu\text{m}$ .

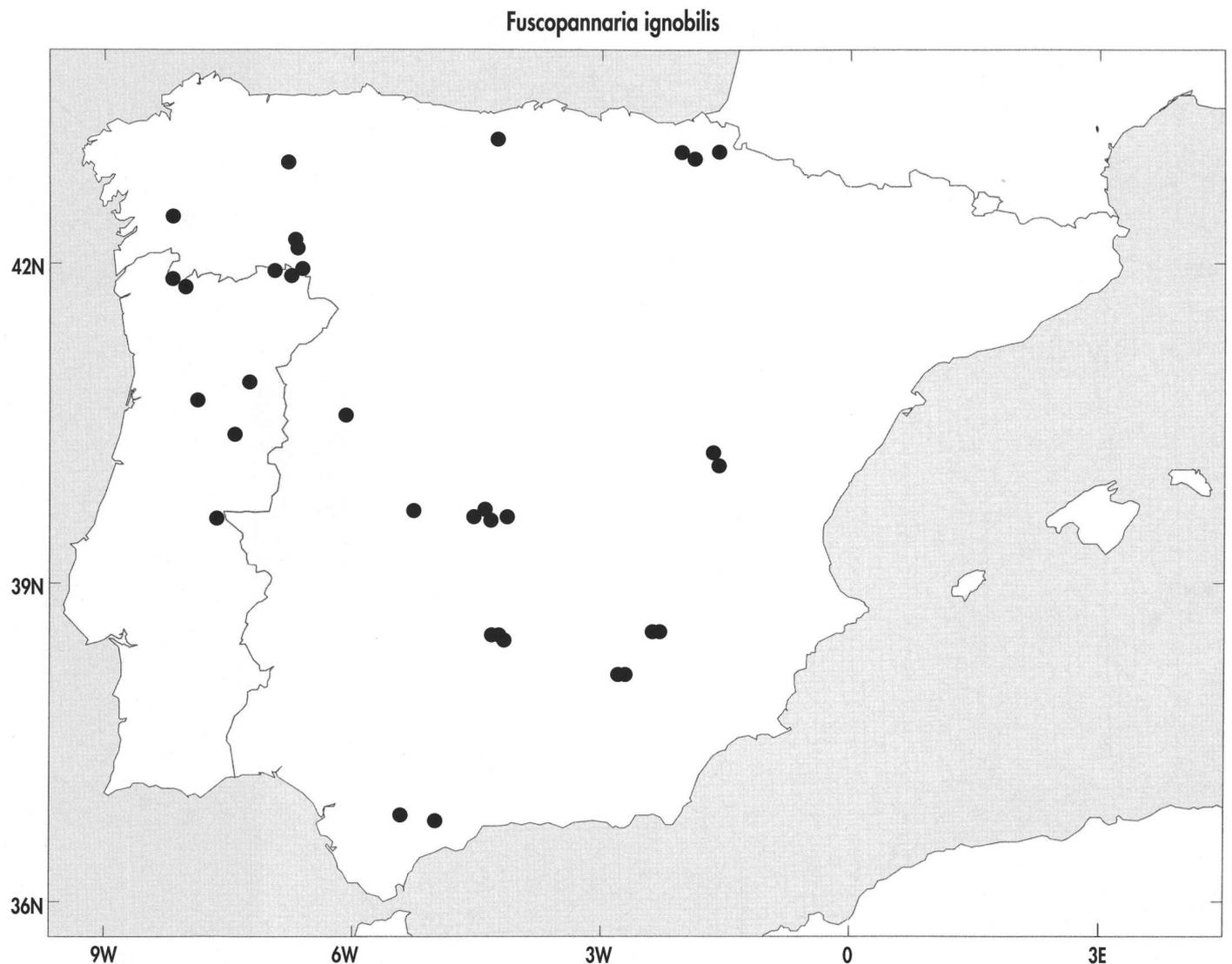


Fig. 2. – Distribution map of *Fuscopannaria ignobilis* (Anzi) P. M. Jørg.

**Observations.** – This species is readily distinguished by the strongly acuminate epispore, although in some cases it is necessary to make several sections to observe this feature clearly. There is another species known in Europe with an acuminate epispore, *F. leucosticta*, which has a brown thallus and apothecia with white tomentose edges; it is only known from Italy and the former Yugoslavia and apparently extinct (SÉRUSIAUX, 1989; JØRGENSEN, 2005).

**Habitat and distribution.** – A widespread epiphytic species, usually found on deciduous trees in the Iberian Peninsula, such as *Quercus robur* L., *Q. pyrenaica* Willd., and *Fraxinus angustifolia* Vahl. Although it has also been reported on evergreen trees such as *Quercus rotundifolia* Lam., *Q. ilex* L. and *Abies pinsapo* Boiss. It is frequently observed on old *Castanea sativa* trees in Portugal. It may be found in both closed-canopy forests and open areas, and is always collected far from the coast and often at high altitudes, occurring from 500 m (Navarra) to 1430 m (Ciudad Real) (Fig. 2). It seems to require a high moisture environment. This taxon has a Mediterranean-Atlantic distribution, it is distributed from NW Africa into Europe, where it is known from Greece to Portugal, and also present near the coast in Norway and inland in Scotland.

**Selected specimens examined.** – **PORTUGAL. Alto Alentejo:** Serra de Portalegre, Quinta da Saude, sobre o ritidoma de *Castanea*, 10.V.1948, *Tavares 192961* (LISU). **Beira Alta:** Serra da Estrela: Sra. do Desterro (Cova da Moura), ad cortices *Castaneae sativae*, 790 m, 20.IX.1951, (n° 184 Lichenes Lusitaniae selecti exsiccati), *Tavares 5195L* (PO). **Minho:** Serra do Gerez, próximo da Albergaria, sobre *Quercus robur*, 730 m, 2.VII.1948, *Tavares 192965* (LISU). **Trás-os Montes e Alto Douro:** Parque Natural de Montesinho, Serra da Coroa, N of Vinhais, main road to north, mature *Castanea* trees in orchard, 41°51.6'N 7°01.8'W, 800 m, 28.VII.1999, *Boom 23452* (herb. Boom).

**SPAIN. Albacete:** Riopar, Sierra del Calar del Mundo, Lago de las Truchas, sobre *Quercus faginea*, 26.V.1984, *Egea & Moreno 241* (MUB). **Cáceres:** Villar del Pedroso, Garganta del Mesta, sobre *Quercus pyrenaica*, 30SUJ0285, 600 m, 4.I.1995, *Aragón & Martínez 6927* (MA). **Cádiz:** Benamaoma, pinsapar, sobre *Abies pinsapo* en umbría, 30STF87, 1100 m, 2.IV.1997, *Fernández & Sarrión 14881* (MA). **Cantabria:** Comunidad de Campoó de Cabuérniga, río Saja, Monte de la Canal del Inf, 30TUN9372, 850 m, 1.IV.1994, en tronco muerto de haya, *Aragón, Martínez & Rojas 5142* (MA). **Ciudad Real:** Fuencaiente, Robledo de las hoyas, 30SUH8056, 1060 m, sobre *Quercus pyrenaica*, corteza de cara norte, 5.II.1997, *Burgaz, Martínez & Sarrión 85595* (MACB). **Cuenca:** Campillos-Sierra, Serranía de Cuenca, Valdeliebres, 1320 m, 30TXK1337, sobre *Quercus rotundifolia*, 3.V.1998, *Aragón & Martínez 10310* (MA). **Guipúzcoa:** Ataún, Puerto de Lizarrusti, 530 m, sobre *Quercus robur*, 29.I.1984, *Aguirre 3607* (MAF). **Jaen:** Santiago-Pontones, Sierra de Cazorla, entre El Valle y Bujaraiza, cerca de la Fuente de la Pascuala, 30SWH1512, 750 m, sobre *Quercus faginea*, 29.I.1988, *Rico 5866* (MAF). **León:** Velilla, sobre encina, 1400 m, 8.VII.1991, *López de Silanes 10575* (SANT). **Málaga:** Ronda, Sierra de las Nieves, subida al puerto de los Pilones, 30SUF1862, 1350 m, sobre *Abies pinsapo*, 18.III.1995, *Aragón & Martínez 6970* (MA). **Navarra:** Corredor de la Barranca, Bacaicoa, sobre *Quercus robur*, 500 m, 26.VI.1993, *Etayo 6236* (MA). **Ourense:** Manzaneda, entre Requeixo e Prada, sobre *Quercus pyrenaica*, 17.IV.2003, *Carballal 10576* (SANT). **Salamanca:**

Miranda del Castañar, sobre *Arbutus unedo*, 26.VI. 1990, *Marcos 2201* (SALAF). **Toledo:** Hontanar, Montes de Toledo, arroyo del Gatillo, 30SUJ7384, 1100 m, melojar, sobre *Quercus rotundifolia*, 10.VI.1995, *Aragón, Herrero & Martínez 7253* (MA). **Zamora:** Galende, Parque Natural Lago de Sanabria, valle del río Tera, 29TPG 8568, 1230 m, sobre *Quercus pyrenaica*, 7.IX.1996, *Aragón, Castillo & Herrero 8851* (MA).

3. ***Fuscopannaria leucophaea*** (Vahl) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Lichen leucophaeus* Vahl, Fl. Dan. 6: 8. 1787.

**Neotypus** (designated by JØRGENSEN, 1978): **NORWAY. Hordaland:** Granvin, 1903, *Havaas s.n.* (BG).

**Thallus**, 100-116 µm thick, crustaceous, consisting of small flat squamules light to dark brown or almost black, with incised edges, 0.3-1.5(-2) mm wide, imbricate, forming a continuous crust, or with raised margins, sometimes discrete squamules are apparent at the edges of the thallus. *Prothallus* black-blue, but not always conspicuous. Upper *cortex* paraplectenchymatous, 30-36(-40) µm tall. *Photobiont* layer 56-64 µm thick, of large *Nostoc* clumps. *Medulla* 10 µm thick. *Apothecia* numerous, sometimes confluent, 0.2-1.8 mm diam, brown-orange to dark brown or almost black, plane at first but becoming convex with age. *Thalline* exciple usually absent, but if present sometimes only developed on one side of the apothecium. True *exciple* thin, paraplectenchymatous, 80 µm thick. *Epithecium* brown. *Hymenium* hyaline, 100-140 µm tall, I+ blue-green turning red. *Hypothecium* paraplectenchymatous, yellowish, 120-140 µm tall. *Paraphyses* unbranched, slightly swollen at the apex. *Asci* sub-cylindrical to clavate, 8-spored, (36-)44-60 × (9.5-)12-16 µm. *Ascospores* colourless, elliptical, usually with a large guttule, without a conspicuous epispore, 12-17.5(-20) × 5-6(-8) µm.

**Observations.** – A variable species with respect to the degree of imbrication and the colour of the squamules, as well as the colour of the apothecia. This may be due to the habitat as in wet and dark situations the squamules are scattered and light brown, and the apothecia are pale brown, while in exposed habitats the squamules are imbricate and dark brown and the apothecia also dark.

**Habitat and distribution.** – This is the only species of the family found in the Iberian Peninsula which is exclusively saxicolous, occurring on acidic, or rarely slightly carbonated, rocks (Fig. 3). It has been reported in the Mediterranean region between 137 m and 2400 m (supramediterranean to cryromediterranean belts) and in the western part of the Peninsula at 600 m, the lower limit given by JØRGENSEN (1978) for its occurrence in mid- and southern Europe.

**Specimens examined.** – **PORTUGAL. Douro Litoral:** Pinhão, VI.1880, 29TPF26, *Newton 5332L* (PO). **Minho:** Sobre o granito vertical a ca. de 600 m, Serra do Gerez, entre as Caldas e a Pedra Bela, 29TNG61, 23.III.1948, *Tavares 195136* (LISU).

**SPAIN. Barcelona:** Carretera Sant Celoni a Sant Marçal km 23 Montseny DG 5426, granitos degradados, verticales y orientados al E, 31TDG52, 1370 m, 18.X.1975, *Hladun 2280* (BCC). **Girona:** Ripollés, Vall de Nuria, Sota el Pui de l'Aluga, DG39, 2400 m, sobre calcoesquistos descalcificados, 31TDG39, 27.IV.1983, *Hladun 4266* (BCC). **La Rioja:** Subida al Pico S. Lorenzo, desde la estación de esquí de Valdezcaray, 30TWM0278, 1500 m, rocas musgosas, 7.IX.2004, *López de Silanes 10577* (SANT).

4. *Fuscopannaria mediterranea* (Tav.) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Pannaria mediterranea* Tav. in Portugaliae Acta Biol., Sér. B, Sist. 8: 5. 1965.

**Typus: PORTUGAL. Alto Alentejo:** entre Castelo de Vide e Marvão, sobre o ritidoma de *Q. faginea*, 2.IV.1959, *Tavares 6546A* (holo-: LISU!).

*Thallus*, 160-230  $\mu\text{m}$  thick, crustaceous, 2-6  $\times$  1-3 cm, of thick rounded 1-3 mm wide squamules convex, with either entire or slightly lobate edges, rarely deeply divided, olive-brown, with a thin whitish tomentose edge which is not always conspicuous as the margins become revolute and covered with bluish soresia *Soredia* granular-woolly, tending to invade the whole squamule, giving a greyish blue tone to the thallus, or at least its central part. *Hypothallus* black, but visible in only some specimens. Upper *cortex* paraplectenchymatous 30-40  $\mu\text{m}$  thick. *Photobiont* layer 120-140  $\mu\text{m}$  thick, with dense clumps of *Nostoc*. *Medulla*  $\pm$  100  $\mu\text{m}$  thick, poorly delimited

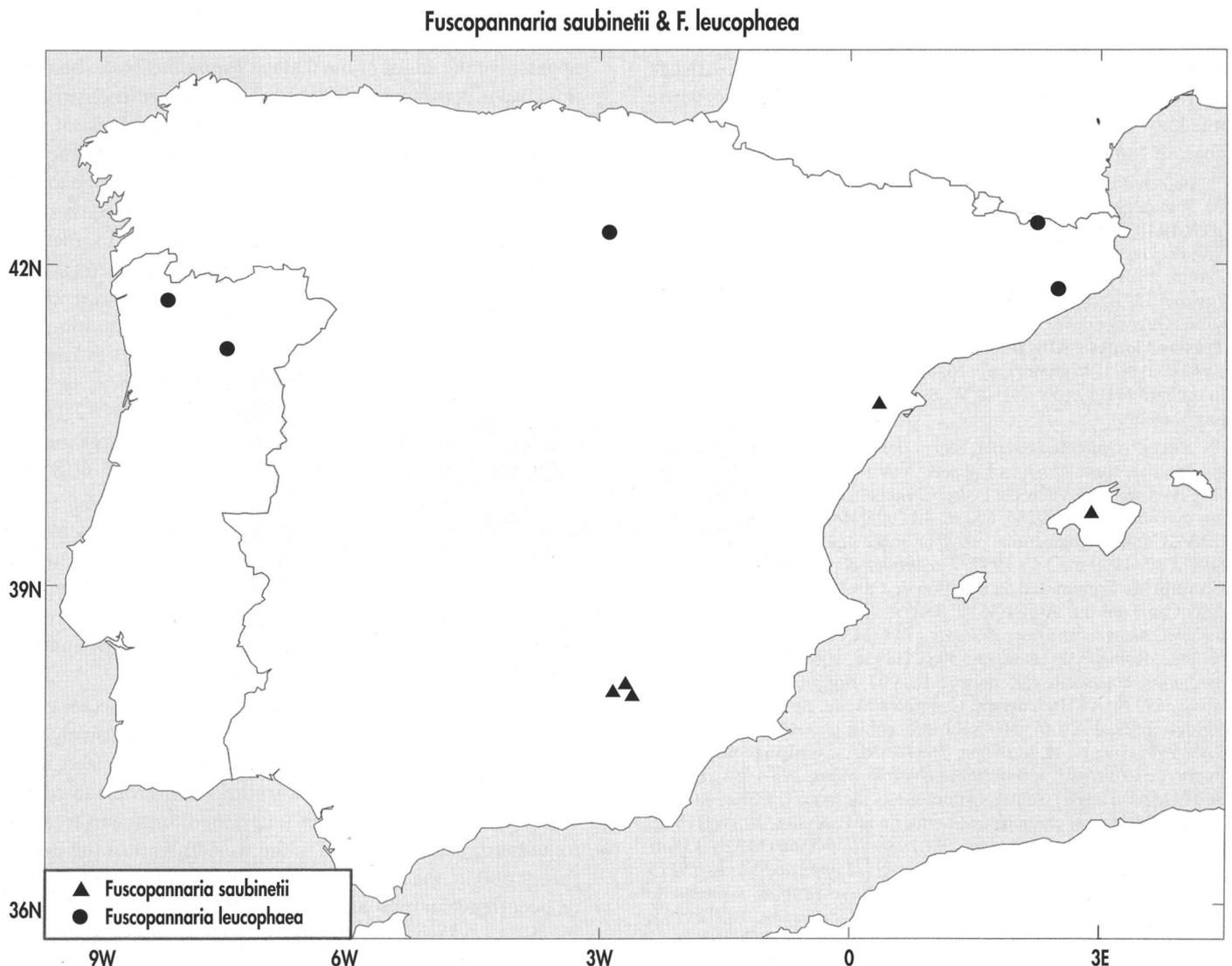


Fig. 3. – Distribution map of *Fuscopannaria leucophaea* (Vahl) P. M. Jørg. and *F. saubinetii* (Mont.) P. M. Jørg.

below. *Apothecia* rare 0.5–1.5 mm diam, disc dull reddish brown disc. *Thalline* exciple granular, whitish, rarely sorediate, poorly developed or absent in some cases. True *exciple* conspicuous, paler than the disc, usually whitish, paraplectenchymatous, 40–70 µm wide. *Hymenium* 100–120 µm tall, with a yellowish brown epithecium. *Paraphyses* unbranched, slightly swollen at the apex. *Asci* subcylindrical to clavate, 8-spored, 80–100 × 12–18 µm. *Ascospores* colourless, elliptical, with rounded apices and a smooth epispore, 16–24 × 8–10 µm with epispore, and 10–16 × 7–9 µm without it.

*Observations.* – The olive-brown colour of the squamules, together with the abundant soredia which usually coalesce into a bluish crust in the middle of the thallus, enable the identification of this species. Some greyish brown specimens may be mistaken for *Parmeliella parvula* P. M. Jørg., which is very rare in the Iberian Peninsula, but rounded and neatly convex squamules of *F. mediterranea* enable them to be separated. The material studied had sometimes been originally identified as *Pannaria conoplea* (Acher) Bory, but the presence of marginal lobules and the P+ orange reaction of the later avoid confusions.

*Habitat and distribution.* – This species is corticolous, and may be found on many kinds of broadleaved tree, whether cultivated (*Olea europaea* L., *Populus* L., *Platanus* L., *Aesculus hippocastanum* L., etc.) or wild (*Betula* L., *Arbutus unedo* L., *Fraxinus* L.), but in most cases it is found on the species of *Quercus* L. It is very rare on conifers, and can also live on mosses, rocks, or earthy cliffs. This is the most common species of the genus in the Iberian Peninsula (Fig. 4), and about 200 specimens have been studied, and of which 13 have apothecia. *Fuscopannaria mediterranea* is a member of the *Lobarion pulmonariae* Ochsner community in the western coasts of Europe (JØRGENSEN, 1978), although it may also be found in this alliance in more continental areas (BURGAZ & al., 1994). Indeed, it appears in 70% of the collections made from this alliance in Portugal (JONES, 1999), which possibly represents its most common habitat, although it is not exclusive to *Lobarion* in the Peninsula. The species is present in regions with an oceanic or Mediterranean climate in Europe, Africa, and North and South America. More exceptionally it is found in colder areas such as Fennoscandia or Tierra de Fuego (Argentina). Although present through the whole peninsular territory, it is, however, quite unusual in the Mediterranean coast.

*Selected specimens examined.* – **PORTUGAL. Algarve:** Vale de Sarva, entre Alferce e Monchique, sobre o ritidoma de *Arbutus*, II.1952, Mendes 192977 (LISU). **Alto Alentejo:** Inter Castelo de Vide et Marvão, ad corticem *Querci pyrenaicae*, 500 m, 2.IV.1959, (n° 207 Lichenes Lusitaniae selecti exsiccati), Tavares 195122 (LISU). **Baixo Alentejo:** Via rápida mesmo em frente a Santiago. Estrada nova a mais ou menos 3km do cruzamento para a estrada velha Oliveiras, sobre *Olea europaea*, NC 2209, 21.III.1998, Sim-Sim, Carvalho & Garcia 185048 (LISU). **Beira Alta:** Serra da Estrela,

Caldas de Manteigas, na carvalheira, sobre *Quercus*, 22.VIII.1944, Tavares 195132 (LISU). **Beira Litoral:** Monte Real, Olival de Viez, sobre *Quercus musgoso*, IV.1942, Oeiras 195124 (LISU). **Minho:** Serra de Gerez, próx. de Caldas, à entrada da estrada Florestal para a Pedra Bela, sobre *Frullania* nos troncos das árvores, 29.VII.1944, Tavares 195135 (LISU). **Estremadura:** Serra dos Candeeiros, S of Leiria, SE of Porto de Mós, Zambujal de Alcaria, near crossing to Alvalados, on *Olea*, Boom 17207 (herb. Boom). **Trás-os Montes e Alto Douro:** NW of Bragança, 800 m, along Rio Tuela shaded and sheltered valley, on *Fraxinus*, Boom 19292 (herb. Boom).

**SPAIN. Albacete:** Vianos, S<sup>a</sup> de Alcaraz, Cerro Pelado, 30SWH 4771, 1330 m, sobre *Quercus ilex*, 28.XII.1996, Aragón & Martínez 9489 (MA). **Burgos:** Huidobro, sobre *Quercus pyrenaica*, 7.VI.1978, Burgaz 30341 (MACB). **Cáceres:** Hoyos, estribaciones de la S<sup>a</sup> de Santa Olalla, 29TPE9348, 550 m, en *Olea*, 5.IV.1996, Aragón, Herrero & Martínez, 7647 (MA). **Cádiz:** Jerez de la Frontera, Mojón de Vibora, 30STF7955, 610 m, sobre *Quercus suber*, 17.IV.1994, Etayo, Casares & al. 5746 (MA). **Ciudad Real:** Fuencaliente, 30SUH8653, 660 m, olivar semiabandonado, sobre *Olea*, 1.VII.1996, Sarrion 85608 (MACB). **Cuenca:** Las Majadas, S<sup>a</sup> de las Majadas, Dehesa, 30TWK8157, 1300 m, sobre *Q. faginea* ssp. *broteroi*, 6.XII.1993, Aragón & Martínez 50277 (MACB). **Jaén:** Santiago-Pontones, S<sup>a</sup> del Segura, río Aguamulas, 30SWH1711, 800 m, sobre *Q. rotundifolia*, 21.III.1995, Aragón & Martínez 7685 (MA). **La Rioja:** Canales de la Sierra, Ermita de la Soledad, sobre *Q. pyrenaica*, 19.IX.1990, Burgaz & Fuertes 42548 (MACB). **León:** Puerto del Pando, 30TUN45, 1600 m, sobre *Fagus sylvatica*, 7.IX.1990, Ubeda & Terrón 1860 (LEB). **Lugo:** S<sup>a</sup> de Ancares, Vilanova, 29TPH6342, 550 m, sobre *Betula pendula*, X.1994, Álvarez 1803 (herb. Álvarez). **Madrid:** Montejo de la sierra, en hayedo, sobre *Quercus pyrenaica*, 30TVL5851, 1.IV.2002, Amo & Burgaz 88627 (MACB). **Málaga:** Ronda, S<sup>a</sup> de las Nieves, 2km antes del cortijo “Los Quejigales”, 1050 m, sobre *Q. rotundifolia*, 16.IV.1994, Etayo, Casares & al. 5577 (MA). **Navarra:** Abárzuza, pista del monasterio de Iranzazu, 800 m, sobre *Q. rotundifolia*, 12.X.1993, Etayo 4413 (MA). **Ourense:** Manzaneda, Raigada, en talud con musgos, 24.III.2002, Carballal 10007 (SANT). **Pontevedra:** Caldelas de Tui, 29TNG3656, 15 m, sobre *Populus nigra*, 8.III.2000, Garcia & Bernárdez 1401 (herb. Vigo-Lich.). **Salamanca:** Peña de Francia, sobre *Q. pyrenaica*, 19.III.1981, Marcos 431 (SALAF). **Segovia:** Riofrío de Riaza, valle del riaza, 30TUL6465, 1400 m, sobre *Q. pyrenaica*, 6.III.1994, Aragón & Martínez 4973 (MA). **Tarragona:** Vall de Castellfollit, sobre musgos, 11-09-1980, López de Silanes 2335 (SANT). **Teruel:** Bronchales, Sierra del Tremedal, cerca de la Maja de las Cabras, 30TXK2183, 1630 m, 3.V.1998, sobre *Q. pyrenaica*, melojar con pino silvestre, Aragón & Martínez 10341 (MA). **Toledo:** Los Navalucillos, Montes de Toledo, Las Becerras, 30SUJ5779, 1000 m, sobre *Q. faginea*, 26.II.1995, Aragón & Martínez 7007 (MA). **Zamora:** Cobreiros, Sotillo de Sanabria, arroyo Truchas, 29TPG8662, 1230 m, sobre *Q. pyrenaica*, 2.V.1997, Aragón & Martínez 9029 (MA).

5. *Fuscopannaria olivacea* (P. M. Jørg.) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Pannaria olivacea* P. M. Jørg. in Opera Bot. 45: 49. 1978.

**Typus:** GREECE. Peloponnes: on the Kronos-hill near Hain-hill of Olympia, 1959, C. Poelt & J. Poelt (holo-: M).

*Thallus*, 110-190  $\mu\text{m}$  thick, crustaceous, composed of small squamules 1-1.5 mm wide, olive-brown, their edge and lower surface covered by a white felt which may extend over a bluish-black hypothallus either slightly or deeply narrowly incised, slightly imbricate, with undulating edges, more or less ascendant, so that they recall isidia. Upper *cortex* paraplectenchymatous 30-40  $\mu\text{m}$  tall. *Photobiont* layer 80-120  $\mu\text{m}$  tall, with large *Nostoc* clumps. *Medulla* 50  $\mu\text{m}$  thick. *Apothecia* 0.5-1.2 mm diam, disc reddish brown disc and becoming convex only in the oldest. *Thalline* exciple more or less crenulate, persistent, sometimes with a white felt. *Epithecium* brown. *Hymenium* hyaline, 80-140  $\mu\text{m}$  tall, I+ green-blue turning red. *Hypothecium* paraplectenchymatous, 120-140  $\mu\text{m}$  tall, either hyaline or yellowish. *Paraphyses* unbranched, slightly swollen

at the apex. True *exciple* paraplectenchymatous, 40  $\mu\text{m}$  wide. *Asci* subcylindrical to clavate, 8-spored, 52-60  $\times$  10-14  $\mu\text{m}$ . *Ascospores* colourless, elliptical, usually with a large guttule, apices rounded, epispore not acuminate, 13-17  $\times$  7-10  $\mu\text{m}$ , including the epispore 17-22.5  $\times$  9.5-12  $\mu\text{m}$ .

*Observations.* – The only species known in the Iberian Peninsula with white felt tissue on the lower surface. This feature, together with the epispore having a rounded apex, distinguishes it from the other species in the region.

*Habitat and distribution.* – *Fuscopannaria olivacea* was collected in a variety of localities in the Mediterranean region of the Iberian Peninsula (Fig. 5). It commonly appears on evergreen trees, namely *Juniperus oxycedrus* L. and *Quercus suber* L., at

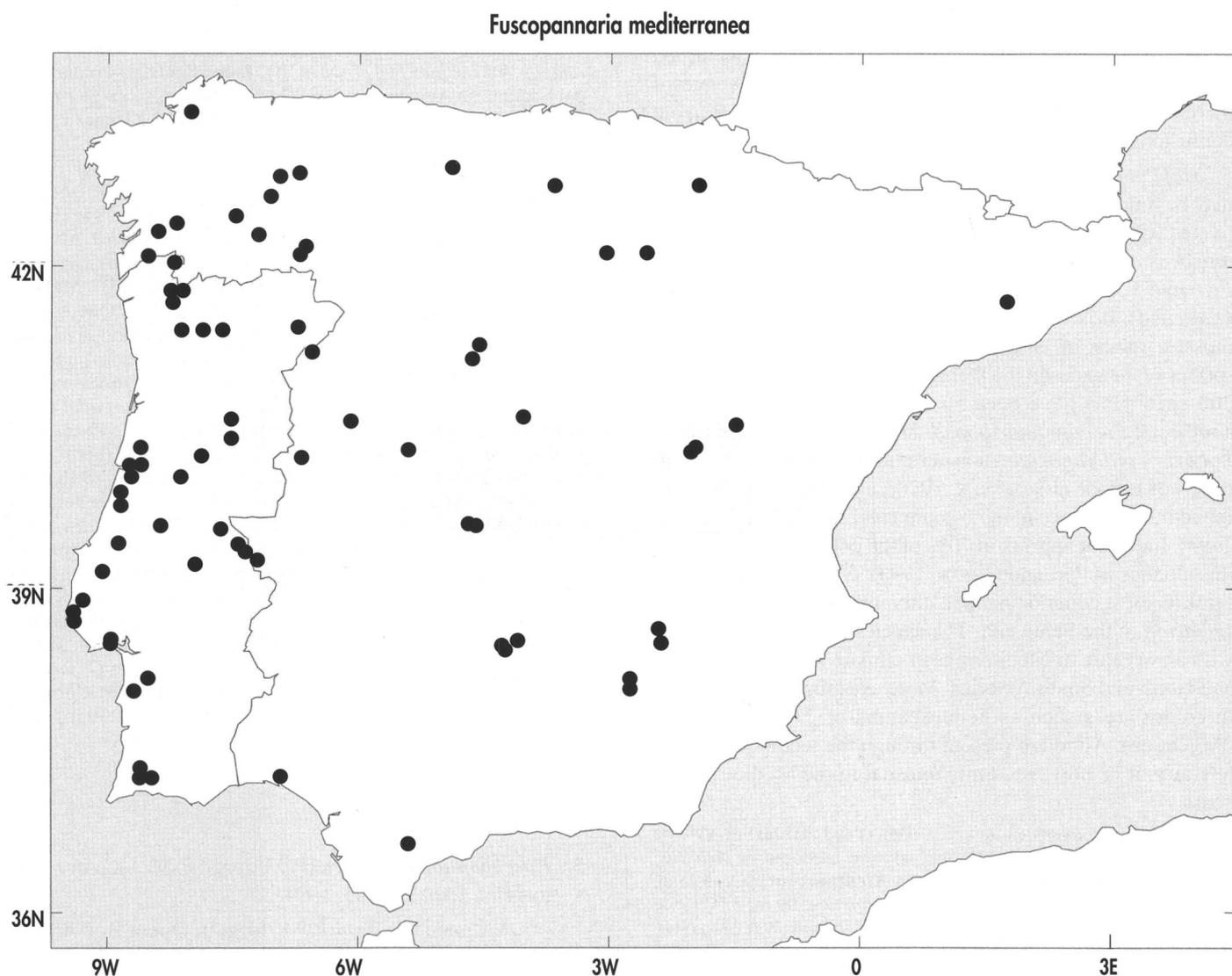


Fig. 4. – Distribution map of *Fuscopannaria mediterranea* (Tav.) P. M. Jørg.

300–1200 m, i.e. from the meso- to supramediterranean belts. Its distribution is characteristically Mediterranean; it is known from several countries of both sides of the Mediterranean Sea.

*Specimens examined.* – **PORTUGAL. Algarve:** N of Albufeira, 1 km N of Alte, near spring, E slope along path, orchard with *Ceratonia*, *Olea*, *Prunus dulcis* and calcareous outcrops, sobre *Prunus dulcis*, 400 m, 37°14.5'N 8°10.8'W, *Boom* 14939 (herb. Boom).

**SPAIN. Baleares:** Mallorca, Lluc, sobre pino, 31SDE8642906393, 7.IV.1964, *Lambinon* 56 (BCC). **Cádiz:** Jerez de la Frontera, Loma de la Mesa, 30STF6347, 360 m, sobre *Quercus suber*, 19.X.1992, *Fos* 4457 (VAB). **Ciudad Real:** Fuencaliente, Peña Escrita, 30SUH8853, 870 m, sobre *Juniperus oxycedrus*, 4.VII.1996, *Sarrion* 86698 (MACB); Solana del Pino, garganta de Valhondo, 30SVH0250, 850 m, sobre *Juniperus oxycedrus*, 12.III.1995, *Sarrion* 85634 (MACB). **Granada:** Parque Natural del Alcornocal, carretera entre Alcalá de los Gazules y Puerto Galis, 500 m, sobre *Quercus suber*, 30STF6433, 13.III.1992, *Casares & González Tejero* 875 (GDA). **Jaen:** La Iruela, Sierra de Segura, río Borosa, cerrada de Elías, 30SWH1405, 1000 m, sobre *Juniperus oxycedrus*, 14.V.1995, *Aragón & Martínez* 5873 (MAF). **Toledo:** Los Navalucillos, Montes de Toledo, Las Becerras, arroyo del Chorro, 30SUJ5879, 950 m, sobre *Juniperus oxycedrus*, 11.II.1995, *Aragón, Herrero & Martínez* 7152 (MA). **Zamora:** Río de Laguna de Cárdenas, 29TPG8468, 1200 m, sobre *Quercus pyrenaica*, 11.VII.1997, *Álvarez & Terrón* 2399 (herb. Álvarez).

6. *Fuscopannaria praetermissa* (Nyl.) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Pannaria praetermissa*, Nyl. in Not. Sällsk. Fauna Flora Fenn. Förh. 4: 97. 1858.

**Lectotypus** (designated by JØRGENSEN, 1978): **FINLAND:** Karelia ladogensis (Karelskaya ASSR), Kirjavalaks (Kirjavalahiti), 1856, *Chydenius s.n.* (H).

*Thallus*, 200–300 µm thick, crustaceous, composed of greyish to dark brown squamules, strongly imbricate, 2–3 mm wide, thick and round, with the edges sometimes ascending, surface matt, with a whitish edge; revolute lobes with cylindrical thick protuberancies recalling isidia, their appearance and number variable; the apex of the lobes and also the protuberances break off revealing the photobiont layer. *Hypothallus* not visible. Upper *cortex* paraplectenchymatous, 40–50 µm thick. *Photobiont* layer very thick, with *Nostoc* clumps, 50–80 µm tall. *Medulla* ± 100 µm thick, composed of thick and intricately woven hyphae which turn into dark rhizohyphae below. *Apothecia* not seen in the material studied.

*Observations.* – This species shows great variability in colour and morphology. The absence of soredia and isidia, and also frequently apothecia, hinders its identification. Various authors have warned about the danger of mistaking this species for *Massalongia carnosa* (Dicks.) Körb. However, the latter species may be identified by the thin subfoliaceous thallus, with enlarged reddish brown lobes or squamules, which have a shiny upper cortex and lack a whitish edge. The ecology of the two species is also significantly different; *M. carnosa*

grows on acidic substrates (soils and rocks) whereas *F. praetermissa* is found on calcareous substrata. This mistake has been found in the material examined, for example in specimen *Sant* 7612 (Monte Pedroso, Santiago de Compostela (A Coruña)), with a small sterile specimen. This was the only record for Galicia (ÁLVAREZ & al., 2001; LLIMONA & HLADUN, 2001) and now has to be deleted as an error.

*Habitat and distribution.* – This species is known in the Iberian Peninsula from two localities in the Navarre Pyrenees: Larra and El Común where it occurs on beech stumps (ETAYO, 1989) (Fig. 1). In addition, JØRGENSEN (1978) cites it from the Catalanian Pyrenees (Nuria, Girona), and indicates its possible presence in other elevated zones in the Spanish territory. It is a muscicolous or terricolous species, living on calcareous soils in arctic-alpine regions. It is widespread in cold areas of the Northern Hemisphere, and in Europe it is commonest in Fennoscandia and Iceland; further south, it has been reported only in mountain ranges from the Balkans to the Pyrenees. Its reported presence in the Southern Hemisphere (Kenya and Chile) requires confirmation.

*Specimens examined.* – **SPAIN. Navarra:** Larra, XN7857, 1500–1750 m, en base de tocón de *Fagus*, 17.VIII.1987, *Etayo* 3312 (herb. Etayo).

7. *Fuscopannaria sampaiana* (Tav.) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205 (1994).

≡ *Pannaria sampaiana* Tav. in Portugaliae Acta Biol., Sér. B, Sist : 76. 1950.

**Typus:** **PORTUGAL. Minho:** Serra do Gerez, entre S. Bento da Porta Aberta e Freitas, sobre o ritidoma de *Castanea* (600 m), 9.VII. 1948, *Tavares* 192990 (holo-: LISU!).

*Thallus* 200–250 µm thick, crustaceous, composed of squamules 1–3 × 1–2 mm, firmly attached to the substratum, light brown, rounded and somewhat scattered in the middle, which gives the thallus a cracked-areolate appearance, enlarged in the perimeter, where the lobes become confluent and have pale margins. *Hypothallus* bluish-black, well-developed at the edges of the thallus. Central part covered with *soralia*, beige at the base and greyish (never bluish) at the apex, mostly granular although some of them resembling isidia. Upper *cortex* paraplectenchymatous, 35–40 µm thick. *Photobiont* layer (80–120 µm) consisting of large *Nostoc* clumps. *Medulla* 50–75 µm thick. *Apothecia* not seen in the material studied.

*Observations.* – The greyish colour of the soredia may lead to this species being mistaken for *F. mediterranea*. However, the last species has bluish *soralia*, smaller and olive-green squamules. The colour of the thallus of *F. sampaiana* is quite similar to that of *Parmeliella testacea* P. M. Jørg., but that species has bluish *soralia*.

**Habitat and distribution.** – This species is corticolous, and mostly collected from preserved deciduous forests (sweet chestnut and oak). More sporadically, it has been collected in Portugal on *Olea europaea* and *Arbutus unedo* L. According to JØRGENSEN (1978), its distribution is markedly mediterranean-atlantic, and the species is known in Europe and North Africa. It is common along the Atlantic façade of the Iberian Peninsula and Navarra (ETAYO, 1989), which confirms it as oceanic in the Iberian Peninsula (Fig. 5).

**Specimens examined.** – **PORTUGAL. Alto Alentejo:** PNSSM, Reguengo, Quinta do Leão, *Castanea sativa*, 670 m, PD5139, 9.xi.1994, *Carvalho 185095* (LISU); PNSSM, Quinta de Campos, *Quercus pyrenaica*, 658 m, PD3852, 22.XII.1994, *Carvalho 185096* (LISU);

Serra de Portalegre, Quinta da Saude, sobre o ritidoma de *Castanea*, 10.V.1948, *Tavares 195166* (LISU). **Beira Litoral:** Próximo de Lorvão, sobre o ritidoma de *Olea*, 5.I.1950, *Tavares 195172* (LISU); Serra de Lousã, a oriente da Quinta da Alfocheira, sobre a ritidoma musgoso de *Castanea sativa*, 10.VIII.1943, *Tavares 195168* (LISU); Buçaco, Cruz Alta, sobre *Arbutus unedo*, 19.VI.1944, *Tavares 195167* (LISU). **Beira Alta:** Folgoso (Gouveia), sobre o ritidoma de *Castanea sativa*, 13.IX.1965, *Tavares 195170* (LISU); Serra do Caramulo, Paredes do Guardão, sobre *Quercus*, VIII.1942, *Tavares 195171* (LISU). **Minho:** Serra do Gerês, Leonte, sobre o ritidoma de *Quercus*, 1000 m, *Tavares 195173* (LISU); Parque Nacional do Gerês, on *Quercus*, 1000 m, 6.VIII.1987, *Boom 6414* (herb. Boom). **Trás-os-Montes e Alto Douro:** NW of Villa Real, Parc Natural de Alvão, 1 km S of Lamas de Olo, small grassland near stream, subs *Quercus*, 7°47.5'W, 41°21.1'N, 1000 m, 18.VII.1999, *Boom 23062* (herb. Boom).

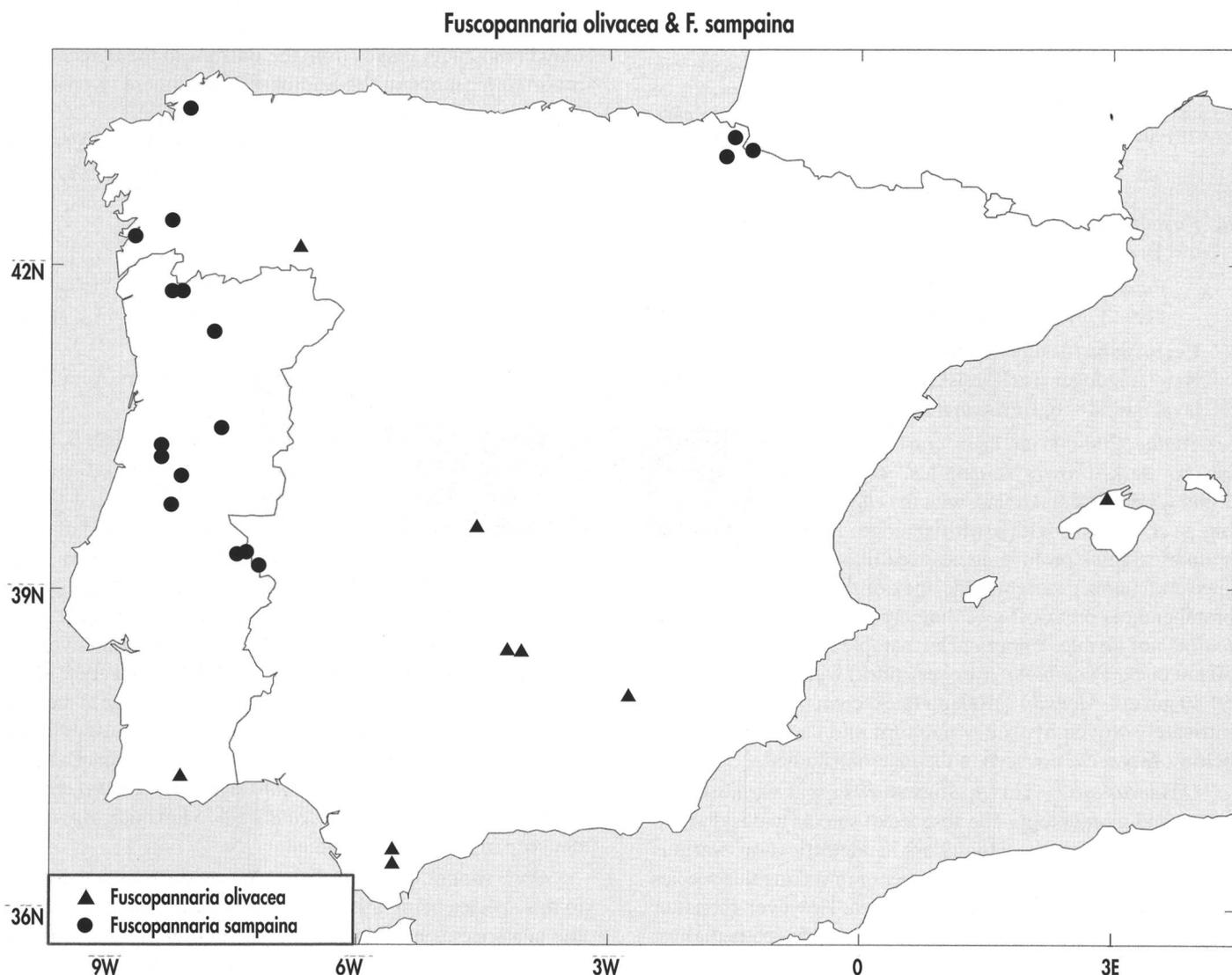


Fig. 5. – Distribution map of *Fuscopannaria olivacea* (P. M. Jørg.) P. M. Jørg. and *F. sampaina* (Tav.) P. M. Jørg.

**SPAIN. A Coruña:** Pontedeume, Caaveiro, 29TNJ7507, sobre *Castanea sativa*, 4.VI.1986, López de Silanes & Iglesias 2321 (SANT). **Navarra:** Valle de la Ulzama, Oroquieta, 750 m, sobre *Quercus robur*, 13.II.1994, Etayo 5522 (MA); Quinto Real, Alduides, cerca de la frontera, 850 m, sobre *Quercus robur*, 27.X.1993, Etayo 4469 (MA); Valle de Bertizarana, carretera de Oronoz a Zugarramurdi, collado Vendreka, sobre *Quercus robur*, 23.VI.2001, Etayo 13982 (MA); Oronoz-Mugaire, Parque Natural de Bértiz, subiendo a Aitzcolegi, 30TXN1579, 400 m, sobre *Quercus robur*, 4.I.1994, Etayo 5357 (MA). **Ourense:** Avión, Mangüeiro, 29TNG5892, 480 m, sobre *Quercus robur*, 2.II.1991, García-Molares 1065 (herb. Vigo-Lich). **Pontevedra:** Alrededores de Vigo, 1980, 848 (SANT).

8. *Fuscopannaria saubinetii* (Mont.) P. M. Jørg. in J. Hattori Bot. Lab. 76: 205. 1994.

≡ *Parmelia saubinetii* Mont. in Ann. Sci. Nat., Bot. 6: 331. 1836.

**Lectotypus** (designated by JØRGENSEN, 1978): **FRANCE.** **Aisne:** Soissons, Coucy-le-Chateau, s.d., *Saubinet s.n.* (UPS).

*Thallus* 100-160 µm thick, crustaceous, composed of small squamules with lobulate edges, up-turned at times, 0.5-1.5 mm wide, usually overlapping and forming a continuous crust, brownish-grey with bluish grey margins or totally bluish grey. *Hypothallus* not visible. Upper *cortex* paraplectenchymatous, 20-30 µm thick. *Photobiont* layer (40-)60-95 µm thick, consisting of *Nostoc* clumps. *Medulla* 20-40 µm thick. *Apothecia* 0.2-1.5 mm diam, numerous, sometimes confluent, beige with a more or less intense orange tone, the true exciple slightly paler and frequently undulate, disc plane or slightly convex. *Thalline* exciple absent, although scattered granules or lobes of the thallus, which slightly cover the true exciple may be present. *Epihymenium* light brown in vertical section. *Hymenium* 100-120 µm tall, I+ greenish blue turning red. *Sybhymenium* hyaline, 170-200 µm tall, paraplectenchymatous. *Paraphyses* unbranched, slightly swollen at the apex. True *exciple* 70-110 µm wide, paraplectenchymatous. *Asci* subcylindrical, 8-spored, 55-80 × 18-20 µm. *Ascospores* colourless, elliptical, usually with a large guttule, without an episporium, 13-18.5 × 5.5-6 µm.

**Observations.** – This species is distinguishable from the others treated here by its apothecia which lack a thalline exciple and are beige coloured, and further by the tiny lobulate squamules.

**Habitat and distribution.** – This species has been collected in Mallorca and Valencia, and also in different localities of Jaén, and always in the Mesomediterranean belt in areas with a prevailing high moisture content (Fig. 3). It occurs on evergreen species of *Quercus*. The taxon is poorly recorded, and its ecology is little known, although it seems to prefer a dry and warm microclimate where moisture levels are high. This species is known in western and north North America, and in Europe occurs, Mediterranean and central regions.

**Specimens examined.** – **SPAIN. Baleares:** Mallorca, 12.5 km of Inca, slopes of Sierra del Teix, on trunk of *Quercus ilex*, 23.V.1975, Tibell, el. P. M. Jørgensen (1976) (L-157704) 343614 (UPS). **Castellón:** Puebla de Benifassar, 31TBF695043, 700 m, *Quercus ilex*, 2.XI.1985, Atienza 285 (VAB). **Jaén:** La Iruela, Sierra de Segura, río Borosa, 30SWH1305, 900 m, sobre *Quercus rotundifolia*, 14.V.1995, Aragón & Martínez 5876 (MAF); La Iruela, Sierra de Cazorla, cortijo del Carrascal, 30SWH0703, 800 m, sobre *Quercus faginea*, 22.III.1995, Aragón & Martínez 5878 (MAF); Santiago-Pontones, Sierra de Segura, río Aguamulas, cerca del cortijo del Mulón, 30SWH1810, 950 m, sobre *Quercus rotundifolia*, 13.V.1995, Aragón & Martínez 5877 (MAF).

### Key to the species of *Fuscopannaria*

1. Thallus granular ..... 2
- 1a. Thallus squamulose ..... 3
2. Thallus dark greyish brown, of tiny squamules very divided in the apex ..... **1. *F. atlantica***
- 2a. Thallus bluish grey, dusty granules with a cortex of one cell layer ..... ***Moelleropsis nebulosa***
3. Thallus neither sorediate nor isidiate ..... 4
- 3a. Thallus sorediate or isidiate ..... 8
4. Thallus without apothecia, usually with ascending lobes and isidia-like protuberances ..... **6. *F. praetermissa***
- 4a. Thallus with apothecia ..... 5
5. Apothecia beige, convex, without a thalline exciple ..... **8. *F. saubinetii***
- 5a. Apothecia darker brown with a thalline exciple ..... 6
6. Ascospores with the episporium strongly acuminate at the apices ..... **2. *F. ignobilis***
- 6a. Ascospores without an episporium or with one not acuminate at the apices ..... 7
7. Ascospores with an episporium rounded at the apices ..... **5. *F. olivacea***
- 7a. Ascospores without an episporium ..... **3. *F. leucophaea***
8. Thallus sorediate ..... 9
- 8a. Thallus not sorediate, squamules recalling granular isidia ..... **1. *F. atlantica***
9. Soredia beige in the basal part of the the soralia, and greyish in the apical parts ..... **7. *F. sampaiana***
- 9a. Soredia bluish throughout ..... **4. *F. mediterranea***

### Conclusions

This review provides data contribution to the lichen catalogue of the Iberian Peninsula. The records of *F. leucosticta* (Tuck.) P. M. Jørg. (HLADUN & LLIMONA, 2008) are to be deleted as we found that this species had been mistaken for others of the same genus (*F. ignobilis*, *F. sampaiana*, *F. olivacea*, even a specimen of *Pannaria rubiginosa* (Ach.) Bory). This supports the hypothesis that it is now extinct in Europe (JØRGENSEN, 1978, 2000).

The review of the material collected by Tavares (near Lisboa) in Sintra in 1946, showed it to be *Fuscopannaria atlantica*, a species recently described and not previously from the Iberian Peninsula. Due to its acknowledged presence in Europe and its oceanic feature, it may prove to be more common along the Oceanic seashore of the Iberian Peninsula. This species, together with *F. praetermissa* and *F. saubinetii*, are taxa of the genus with arestricted or discontinuous distribution in the Iberian Peninsula. While *F. mediterranea* and *F. ignobilis* are present all over the Spanish territory, *F. leucophaea* and *F. olivacea* may be found only in the Mediterranean region, and *F. sampaiana* along the Atlantic coastal strip and the Atlantic area of Navarra as well as in its Pyrenean area.

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