
Notes on the genus *Polycoccum* (Ascomycota, *Dacampiaceae*) in Spain, with a key to the species

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Abstract: Comments on and a key to the 13 *Polycoccum* species known in Spain are presented, including synopses of their world distributions. Amongst these is *P. rubellianae* sp. nov., a lichenicolous fungus growing on thalli of *Caloplaca rubelliana* in eastern Spain (Valencia). It has relatively small ascomata, the lower part pale brown, and also small ascospores which are coarsely verrucose and have a thick gelatinous sheath when young. The new species is associated with a *Phoma*-like anamorph. The identity and systematic position of *P. opulentum* requires further study as the name has been applied to different species, and the occurrence of *P. marmoratum* in Spain is in need of confirmation. The Spanish record of *P. arnoldii* on *Lecania cyrtella* probably refers to another yet undescribed species.

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Key words: *Caloplaca*, Dothideales, galls, lichenicolous fungi, lichens, Valencia.

Introduction

The genus *Polycoccum* Sauter ex Körb. (Körber, 1865) includes lichenicolous fungi with dark perithecioid ascomata, a pseudo-parenchymatous exciple composed of dark, angular polyhedral cells, and fissitunicate asci with brown one-septate ascospores, and persisting branched and anastomosed interascal filaments. Species of this genus mainly form commensalistic symbioses with their host lichens, and often produce characteristic gall-like structures on the host thallus. Most appear to be confined to a single host lichen or a group of related species.

A synopsis of the genus was provided by Hawksworth & Diederich (1988), who

accepted 23 species. Their work facilitated studies on the genus, and since that time 14 additional species have been discovered (Diederich, 1990; Hawksworth, 1994; Calatayud & Rico, 1995; Matzer, 1996; Aptroot *et al.*, 1997; Hawksworth & Miądlikowska, 1997; Calatayud & Rambold, 1998; Etayo & Diederich, 1998; Navarro-Rosinés & Roux, 1998; Kocourková & Berger, 1999; Calatayud & Atienza, 2000; Váci & Hawksworth, 2001).

Twelve species of *Polycoccum* have previously been reported from Spain (excluding the Canary Islands), growing on various saxicolous, terricolous, and more rarely corticolous lichens. Three species have recently been described from Spain, and a further new species is described here. Comments on and a key to all *Polycoccum* species reported from the Spanish mainland are provided.

Material and Methods

The material was examined by standard microscopic techniques, and drawings were made with the aid of a

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drawing tube. Amyloid reactions were tested using Lugol's iodine solution (I), with and without pretreatment with KOH. Ascospore measurements were made in water; absolute extreme values are given in parentheses, means in italics, and the other values are extremes after rejecting 10% of the highest and 10% of the lowest values.

Additional specimens examined. *Polycoccum rugulosarium* (Lindsay) D. Hawksw.: **Antarctica:** South Shetland Islands: King George Island, Penguina Östl. Station, on *Caloplaca regalis*, 21 xi 1984, L. Kappen A751 (IMI 317261). *P. clauzadei* Nav.-Ros. & Cl. Roux: **France:** *Vauchuse:* Buoux, La Bastide-Neuve, sur tuiles exposées au N, 500 m, 9 vi 1950, G. Clauzade (MARSSJ 80—holotype).

The New Species

Polycoccum rubellianae Calatayud and V. Atienza sp. nov.

Polycoccum rugulosarium (Lindsay) D. Hawksw. similis, sed ab eo differt praecipue in ascosporis latis et plus verruculosus. Fungus in thallis lichenibus *Caloplaca rubelliana* vigens. Ascomata subglobosa, immersa, atra, c. 85–120 µm diametro. Asci subcylindrici, 8-sporei, c. 40–56 × 10–14 µm. Ascosporae distichae in asco, ellipsoideae, uni-septatae, brunneae, verrucosae, (10–)11–12·7–14(–15) × (5·5–)6–6·3–7 µm.

Typus: Spain, Comunidad Valenciana, Gátova, close to the town, UTM 30SYK1206, on *Caloplaca rubelliana*, on sandstone, 700 m, 2 February 1998, V. Calatayud (VAB-Lich. 15244—holotypus).

(Figs 1, 2)

Ascomata perithecioid, immersed, with only the ostiole and surrounding zone externally visible, 3–10 per areole, the infected areoles becoming slightly bullate, without producing necrosis or bleaching, subglobose, c. 85–120 µm wide. Ascomatal wall pale brown at the base, c. 5–8 µm thick, and markedly darker, dark brown, and thickened in the upper part, up to 30 µm; in vertical section composed of several layers of radially compressed cells; in superficial view, cells elongated towards the ostiole; cells c. 3·5 × 4·5 µm thick. Interascal filaments numerous, septate, branched and anastomosing, c. 1·5–2·5 µm thick. Hymenial gelatine I–. *Asci* subcylindrical, short-stalked, fissitunicate, without a distinct ocular chamber, mature asci 8-spored, c. 40–56 × 10–14 µm, not reacting in Lugol's iodine solution. *Ascospores* monostichously

or distichously arranged in the asci, ellipsoid, obtuse, 1-septate, not constricted at the septum except in the oldest ones, both cells ± equal in size, sometimes the lower one slightly narrower, with a thick gelatinous sheath when young, almost disappearing in mature ascospores, dark brown, thick-walled, coarsely verrucose when mature, (10–)11–12·7–14(–15) × (5·5–)6–6·3–7 µm, length/width ratio (1·7–)1·6–2–2·3(–2·7) (67 ascospores measured).

Conidiomata pycnidial, occasionally present, 30–70 µm diam., brown. *Conidiomatal wall* pseudoparenchymatous, brown, composed of two to three cell layers, wall cells 6 × 3·5 µm in vertical section. *Conidiogenous cells* arising from the pseudoparenchymatous tissue, cylindrical to shortly ampulliform, colourless, 6–8·5 × 2–2·5 µm; conidiogenesis enteroblastic. *Conidia* arising singly, hyaline, simple, bacilliform, rounded at apex, smooth walled, 3–4·5 × 1–1·5 µm.

Ecology and distribution. So far, the new species has been detected exclusively in the thallus of *C. rubelliana*. Since the areoles of this lichen infected by *Polycoccum rubellianae* become slightly bullate, and are not marked by appreciable necrosis or discolouration, this fungus is regarded as a commensalistic species. The thalli of *C. rubelliana* which were abundantly infected by *P. rubellianae* grew close to ones of *C. irrubescens*. Interestingly, the thalli of *C. irrubescens* were not infected by the lichenicolous fungus, suggesting that *P. rubellianae* is selective with regard to its host species even within the same genus. The new species is known only from three collections from the Comunidad Valenciana in eastern Spain. The host *Caloplaca* is essentially a Mediterranean species with outlying sites in central Europe; in eastern Spain it occurs sporadically below 1000 m, on hard siliceous sandstone in sunny situations.

Remarks. *Polycoccum rubellianae* is primarily characterised by the relatively small ascomata, the lower part pale brown, and the narrow ascospores with a coarsely granular (verrucose) surface. The presumed

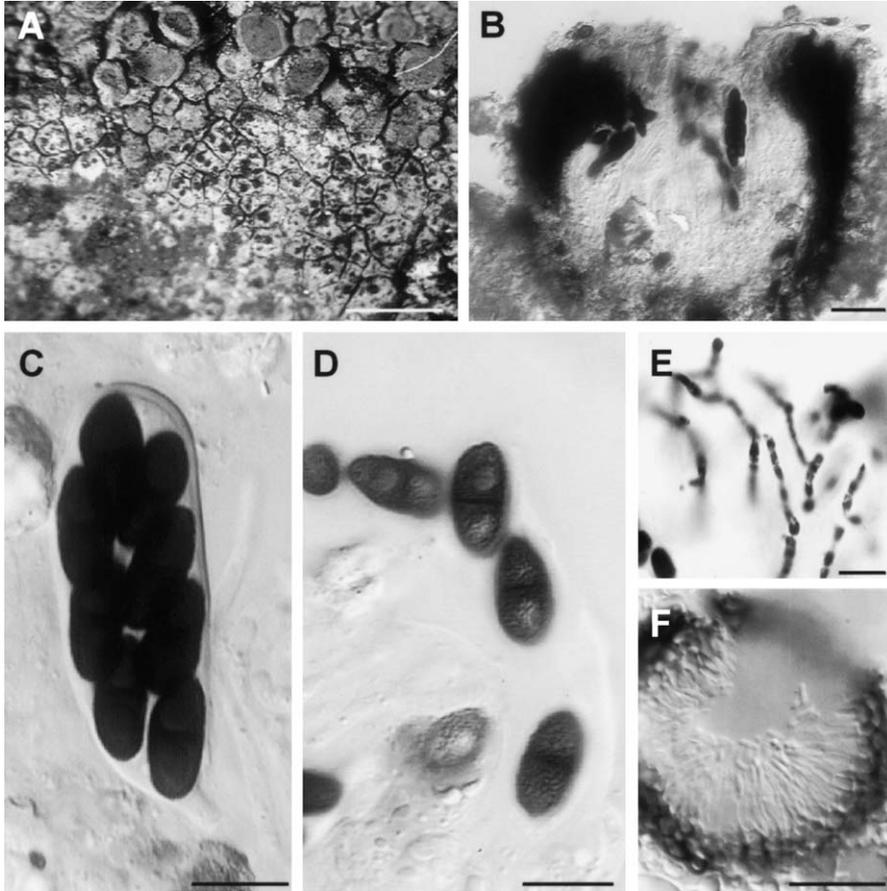


FIG. 1. *Polycoccum rubellianae* (holotype). A, infected host thallus; B, vertical section of an ascoma; C, ascus; D, surface view of the ascospores showing the wall ornamentation; E, interascal filaments; F, vertical section of a conidioma showing conidiogenous cells and conidia. Scales: A=1 mm; C–E=10 μ m; B & F=20 μ m.

anamorph is *Phoma*-like, as in *P. decolorans* (Calatayud & Rambold, 1998) rather than *Cyclothyrium*-like as in *P. peltigerae* (van de Aa, 1989). Another *Polycoccum* species known on *Caloplaca* is *P. rugulosarium* (Lindsay) D. Hawksw. (Hawksworth in Pegler *et al.*, 1980; Hawksworth & Diederich, 1988), a lichenicolous fungus primarily on Antarctic *Caloplaca* species, notably *C. cirrochrooides* (Vain.) Zahlbr., *C. regalis* (Vain.) Zahlbr., and *C. sublobulata* Nyl. That species differs from *P. rubellianae* not only by occurring on different host species, but also by a marked preference for apothecia instead of thalli, the lower

parts of the ascomata being brown, having larger asci 60–80 \times 17–20 μ m, and narrower ascospores (10–)12–15(–16) \times (4–)4.5–6(–6.5) μ m which are not as strongly ornamented as *P. rubellianae*. Two additional species of *Polycoccum* have been described on *Caloplaca*: *P. tinantii* Diederich (on *C. ferruginea*), with much larger ascospores, 18–26 \times 7.5–11 (Diederich, 1990), and *P. bryonthae* (Arnold) Vězda (on *C. stillidiorum*), a distinctive taxon which sometimes develops a second septum in the upper cell of the ascospores and has uniseriately arranged ascospores. Three further species occur on other genera of *Teloschistaceae*:

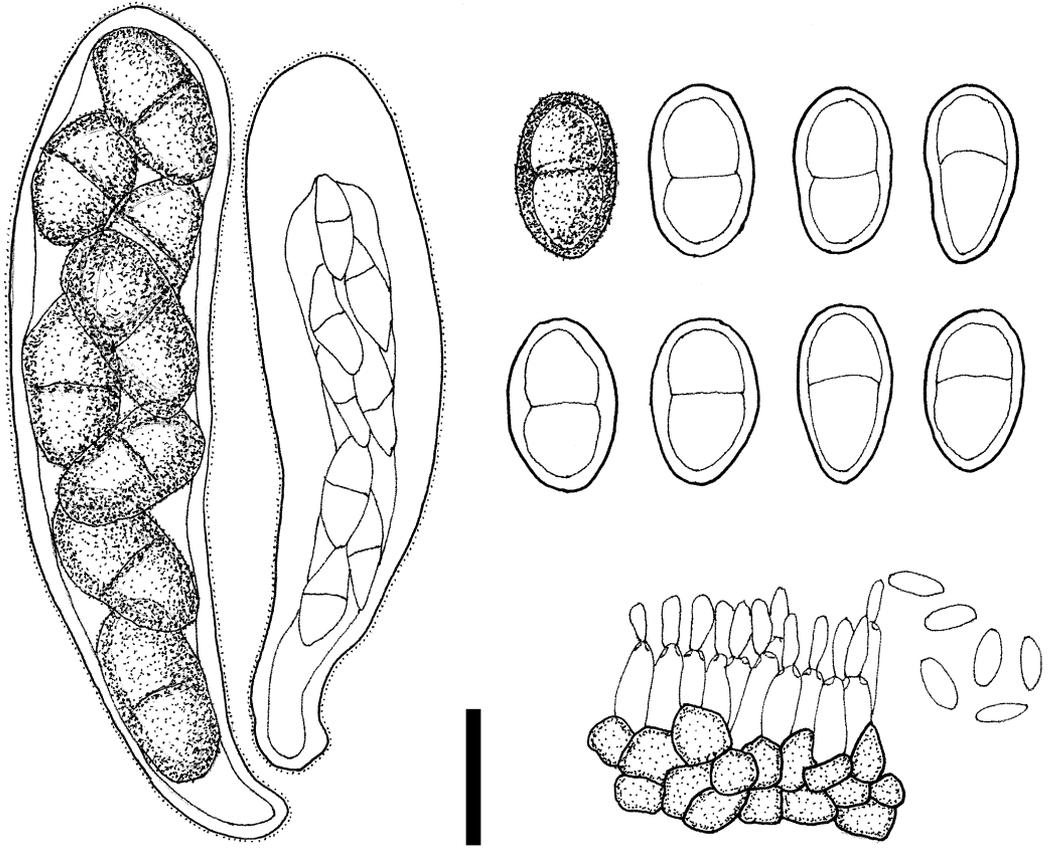


FIG. 2. *Polycoccum rubellianae* (holotype) (in H₂O). A, mature ascus; B, young ascus; C, ascospore outlines, surface ornamentation in one; D, vertical section of a conidioma showing conidiogenous cells, young and mature conidia. Scale=10 µm.

P. slaptioniense D. Hawksw. (on *Xanthoria parietina*), *P. infestans* (Speg.) Etayo (on *Teloschistes flavicans*), and *P. clauzadei* Nav.-Ros. & Cl. Roux (on *X. elegans*). The former two species produce conspicuous tubercle-like galls on the thallus of the host and have larger ascomata (mainly exceeding 200 µm diameter) than *P. rubellianae*. *Polycoccum clauzadei* is also a cecidiogenous species, and differs from *P. rubellianae* in its 4- or 6-spored asci, and larger ascospores, 15–18.5(–19.5) × (6.5–)7–9(–9.5) µm, which are also mostly obovoid to soleiform, with the lower cell markedly attenuated (Navarro-Rosinés & Roux, 1998). *Polycoccum rubellianae* resembles *P. arnoldii* (Hepp) D. Hawksw. (on *Diploschistes* and

Rhizocarpon) in the narrow ascospores but in that species the ascomata are 80 µm diameter, and the ascospores are shorter 9–11.5(–13) × 4.5–6.5(–7) µm with the lower cell somewhat tapered. *Polycoccum microcarpum* Diederich & Etayo (on *Cladonia cervicornis*) is close to *P. rubellianae* in the ascospore dimensions, but differs in that the ascomata, 30–60(–100) µm diameter, arise in groups of 20–30 immersed in convex galls in the squamules of the host.

Additional specimens examined. Spain: Comunidad Valenciana: Prov. Castelló, Benicàssim, Parreta Alta, 40°3'N, 0°1'E [=31TBE4538], on *Caloplaca rubelliana* on sandstone, 390 m, 22 iv 1993, V. Calatayud (hb. Calatayud 9); Prov. Castelló, Montán, los Agualiches,

c. 40°0'N, 0°34'W [=30TYK0732], on *Caloplaca rubelliana* on sandstone, 680 m, 28 ii 1997, V. Calatayud (hb. Calatayud 8).

Comments on Species Reported from Spain

Polycoccum arnoldii (Hepp) D. Hawksw. 1979

Polycoccum arnoldii, the type material of which occurs on *Diploschistes scruposus*, was reported from Spain for the first time on *Lecania cyrtella* from Catalonia by Boqueras et al. (1989). We have not studied this specimen, but a detailed description and drawings were given by Boqueras (2000). However, the measurements of the ascospores, (8–)10–11 × (3–)4 µm, are narrower than reported by Hawksworth & Diederich (1988), based on material growing on *Diploschistes* and *Rhizocarpon*. The Spanish material therefore seems unlikely to belong here and is treated as *Polycoccum* sp. in the key pending a re-examination of the material.

World distribution. Europe (e.g. Hawksworth & Diederich, 1988; Santesson, 1993; Berger & Priemetzhofer, 2000) and South America (Hawksworth & Diederich, 1988).

Polycoccum crassum Vězda 1970

This fungus is restricted to *Peltigera* species (Vězda, 1970; Hawksworth & Diederich, 1988). In Spain it has been recorded on *P. rufescens* and *P. praetextata* only from Asturias & Málaga (Martínez & Hafellner, 1998; Martínez, 1999).

World distribution. Europe (Vězda, 1970; Hawksworth & Diederich, 1988; Santesson, 1993; Hafellner, 1994; Aptroot et al. 2000; Diederich & Sérusiaux, 2000).

Specimens examined. Spain: Asturias: Amieva, Picos de Europa, río Dobra, 30TUN3585, 1200 m, on *Peltigera rufescens*, on calcareous rocks, 1995, G. Aragón & A. Herrero 1272 (MA-Fungi 4470). Málaga: Parauta, Sierra de las Nieves, 30SUF1459, 950 m, on *P. praetextata*, on calcareous soil, 1995, G. Aragón & I. Martínez 1273 (MA-Fungi 4471).

Polycoccum decolorans Calatayud & Triebel 1998

Described from infected areoles of *Immersaria olivacea* which are bleached by the presence of the fungus and also become slightly bullate. A *Phoma*-like anamorph has been described in this species, although the connection has not been proved by ascospore culture. This fungus is known only from eastern Spain (Calatayud & Rambold, 1998).

World distribution. Spain.

Specimen examined. Spain: Comunidad Valenciana: Chelva, UTM 30SXX7303, 40°3'8"N, 1°0'38"E, on *I. olivacea*, on sandstone, 1 xi 1993, V. Calatayud (VAB-Lich. 7711—holotype).

Polycoccum epizoharyi Calatayud & V. Atienza 2000

Polycoccum epizoharyi is a distinctive gall-forming species with 4-spored asci growing on *Buellia zoharyi*. It is known only from the type collection from Central Spain, where the host species grew on gypsum-rich soils (Calatayud & Atienza, 2000).

World distribution. Spain.

Specimen examined. Spain: Comunidad de Madrid: Aranjuez, Mar de Ontigola, c. 40°00'N, 3°37'W, alt. c. 500 m, on *Buellia zoharyi*, on gypsum soil, 17 vii 1998, V. Calatayud, M. J. Sanz & E. Calvo (VAB-Lich. 11053—holotype).

Polycoccum evae Calatayud & V. J. Rico 1995

This species develops ascomata immersed in the thalli of *Dimelaena oreina*, and is apparently restricted to chemotypes containing stictic acid (Calatayud & Rico, 1995). It has been recorded only from Central Spain and Catalonia.

World distribution. Spain.

Specimen examined. Spain: Comunidad de Madrid: Sierra de Guadarrama, Manzanares el Real, La Pedriza, collado de Valdealcones, 1240 m, 30TVL2311, on *Dimelaena oreina* on granite, 1986, V. J. Rico 593/2 and E. Barreno (MAF-Lich. 4250—holotype).

Polycoccum kernerii Steiner 1895

Polycoccum kernerii appears to be an uncommon species, infecting the areoles of *Lecidea fuscoatra*. It has previously been reported from Navarra in the western Pyrenees of Spain (Etayo, 1997), but has also now been found in Andalucía.

World distribution. Europe (Hawksworth, 1994; Diederich & Sérusiaux, 2000; Kocourková, 2000) and Macaronesia (Hafellner, 1996).

Specimen examined. **Spain:** Andalucía: Prov. Jaén, Andújar, cerca del Santuario de la Virgen de la Cabeza, 38° 11' N, 04° 05' W, alt. c. 625 m, sobre roca silícea, sobre *Lecidea fuscoatra*, 19 iv 2000, *V. Calatayud* (hb. Calatayud 76).

Polycoccum marmoratum (Krempelh.) D. Hawksw. 1980

We have examined two Spanish collections named as this species, from Catalonia and Madrid. The former collection was mentioned by Hawksworth & Diederich (1988) on *Verrucaria calciseda*, but a re-examination of this material showed it to be conspecific with other Spanish collections on *V. calciseda* now referred to *P. opulentum* (see subsequently). In this sample, the ascospores were concave when young and, sometimes, halonate spores were observed, both characters unlike those of *P. marmoratum*. In the second collection no *Polycoccum* ascospores could be found. In addition, a description was provided by Alonso & Egea (1989), but in that the ascospore measurements are given as only 16–20 × 8–10 µm, much smaller than the (20–)25–30(–36) × 14–18 µm of Hawksworth & Diederich (1988); that report also seems to belong to some other species.

However, while the presence of this species in Spain could not be confirmed, it is nevertheless included in the Spanish *Polycoccum* key (measurements from Hawksworth & Diederich, 1988) in this article as there are many other reports of the species from the south-east of the Iberian Peninsula listed in Llimona & Hladun (2001; often as *Micro-*

thelia marmorata (Krempelh.) Hepp), the specimens of which we have not seen. The possibility that one or more of those reports might be correct cannot therefore be excluded.

World distribution. Widespread in northern and central Europe (Hawksworth & Diederich, 1988; Santesson, 1993; Sérusiaux *et al.*, 1999).

Specimen examined. **Spain:** Comunidad de Madrid: Cinglos de Perales de Tajuña, 650–780 m, 30TVK65, on calcareous rocks, 1980, *E. Merino* (MAF-Lich. 3388). (No ascospores found.)

Polycoccum microsticticum (Leight.) Arnold 1891

This species was originally reported growing on an unidentified *Acarospora* subgen. *Phaeothallia* species, and it was also found on a host in this subgenus in eastern Spain (Calatayud & Barreno, 1995). This taxon is illustrated in Calatayud & Atienza (2000), where it is also compared with *P. pulvinatum* and *P. epizoharyi*. It is also reported from *Acarospora* subgen. *Xanthothallia*, *Hymenelia*, and *Rhizocarpon* species (Alstrup & Hawksworth, 1990).

World distribution. Europe (Hawksworth & Diederich, 1988; Santesson, 1993; Sérusiaux *et al.*, 1999; Kocourková, 2000), Faeroe Islands (Alstrup *et al.*, 1994), Greenland (Alstrup & Hawksworth, 1990), and North America (Hawksworth & Diederich, 1988).

Specimen examined. **Spain:** Cuenca, Talayuelas, Pico Ranera, 1200 m, 30SXX4408, on *Acarospora* (*Phaeothallia*), 18 vii 1992, *V. Calatayud* (VAB-Lich. 7303).

Polycoccum opulentum (Th. Fr. & Alqm.) Arnold 1874

The Spanish material referred to *P. opulentum* is heterogeneous. This fungus was mentioned from the north of Spain (Asturias) for the first time by Santesson (1960), who included a description and compared it with the holotype. Renobales

(1987, 1996) mentioned a collection from Vizcaya on an unidentified crustaceous thallus on limestone. Renobales (1996) explained that this material is similar to *P. opulentum* but differs in the larger ascospores, 0.1–0.3 mm (0.17 mm in the holotype), in the ascomatal shape being slightly stalked at the base, and the ascomatal wall not being dark brown and continuous below the centrum. In our opinion, Renobales' specimen should not be included in *P. opulentum*. The species was described in detail on the basis of mainly Spanish and French collections by Navarro-Rosinés & Roux (1990) who report it as growing on endolithic thalli of different calcicolous *Verrucariaceae* (mainly *Verrucaria* species). Interestingly, Navarro-Rosinés & Roux (1990) point out some differences between the holotype (on *Polyblastia*), Santesson's specimens, and the rest of their material. We have examined two samples on *Verrucaria*, mostly conforming to the description given by Navarro-Rosinés & Roux (1990). The ascospores are depressed in the upper part (resembling apothecoid pseudothecia) and short-stalked. An ostiole is absent in young ascospores, which later opens by an irregular fragmentation as in *Weddellomyces* and not by a neat ostiole. The interascal filaments (pseudoparaphyses) apparently originate from the top of the ascomatal wall but are absent in mature ascospores. The ascospores have a torus and may remain hyaline for a long time, as well as having a distinctive sheath. This combination of characters is not typical of *Polycoccum*, but further studies are needed to understand the relevance of these features. Santesson's material and other Spanish specimens cited by Etayo (1994) as *P. opulentum* are probably different from Navarro-Rosinés & Roux's (1990) material, and from the holotype. A revision of the Spanish material named as *P. opulentum* and a fresh study of the holotype (which was not seen by Hawksworth & Diederich, 1988) are needed.

World distribution. Europe (Hawksworth & Diederich, 1988; Santesson, 1960, 1993; Navarro-Rosinés & Roux, 1990; Hafellner &

Türk, 1995; Hafellner, 1999; Diederich & Sérusiaux, 2000).

Specimens examined. Spain: Vizcaya: Orozco, karst de Itxina, Kargaleku, WN 1568, 1100 m, on calcareous rocks, 25 vii 84, Herrera, Loidi, Onaindia, Oteo, Renobales and Salcedo (ASCO 2078). Catalunya: Lleida, Segria, Timoneda d'Alfés, 200 m, 31TCG0302, on *Verrucaria marmorea* on calcareous pebbles on the ground, 14 vii 1990, J. M. Pérez Redondo (BCC 8410); Sanauja (La Segarra), 500 m, on *V. calciseda* on sunny calcareous rocks, 1983, *P. Navarro 103* (IMI 298707; as *P. marmoratum*).

Polycoccum peltigerae (Fuckel) Vězda 1969

This lichenicolous fungus grows, sometimes forming galls, on several *Peltigera* species (Vězda, 1963). It is a widely distributed species in Europe and also in Spain where it has been found in several provinces: Albacete, Asturias, Gerona, Huesca, Lérida, and Navarra (Martínez & Hafellner, 1998; Martínez, 1999).

World distribution. Europe (Hawksworth & Diederich, 1988; Berger & Türk, 1993; Santesson, 1993; Miądlikowska & Alstrup, 1995; Diederich & Sérusiaux, 2000). Incorrectly reported from India (Hawksworth & Diederich, 1988).

Specimen examined. Spain: Oviedo, Somiedo, Valle de Lago, 1700 m, 29TQH3370, on *P. praetextata* on calcareous soil slopes, 1993, G. Aragón, A. Herrero & I. Martínez 1284 (MA-Fungi 40078); Albacete, Vianos, Sierra del Calar del Mundo, fuente de las Raigadas, 1450 m, 30SWH4552, on *P. rufescens* on calcareous rocks, 1996, G. Aragón & I. Martínez 1274 (MA-Fungi 40072).

Polycoccum pulvinatum (Eitner)

R. Sant. 1993

This *Polycoccum* species induces wart-like galls on *Physcia* species. It is not common but locally abundant in Spain, including the Canary Islands, and has most commonly been reported under the synonym *P. galligenum* Vězda (e.g. Calatayud & Barreno, 1994). The species is illustrated in Calatayud & Atienza (2000) and Navarro-Rosinés & Roux (1998).

World distribution. Europe (Vězda, 1969; Hawksworth & Diederich, 1988; Santesson, 1993; Kondratyuk *et al.*, 1998; Sparrius *et al.*, 2002), Macaronesia (Hafellner, 1996), New Zealand (Galloway *et al.*, 1999), North and South America (Triebel & Rambold, 1991; Wedin, 1994), and Greenland (Alstrup & Hawksworth, 1990).

Specimen examined. **Spain:** Castellón: Sierra de Espadán, Azuebar, Barranco de la Mosquera, 620 m, 30SYK2417, on *Physcia tribacia* on large boulders of hard sandstone, 25 x 1997, V. Calatayud, M. Tretiach & E. Barreno (VAB-Lich. 7825).

**Polycoccum sporastatae (Anzi)
Arnold 1814**

Polycoccum sporastatae grows on *Sporastatia testudinea* and *S. polyspora*. Although described as inducing wart-like galls (Hawksworth & Diederich, 1988), in the

Spanish sample examined on *S. testudinea*, the infected areoles are not changed significantly and no galls were observed. Curiously, in the ascomatal sections mainly 8-spored asci were observed although 4-spored asci are generally regarded as more frequent. The species is not common in the Iberian Peninsula, and is reported only from north and central Spain (López de Silanes *et al.*, 1999).

World distribution. Asia (Triebel & Rambold, 1991), Europe (Hawksworth & Diederich, 1988; Santesson, 1993; Hafellner, 1999; Triebel & Scholz, 2001), Greenland (Alstrup *et al.*, 2000) and North America (Triebel & Rambold, 1991).

Specimen examined. **Spain:** Palencia, Pico Curavacas, 2050 m, 30TUN66, on *Sporastatia testudinea* f. *coracina* sobre conglomerado silíceo de Curavacas, 9 ix 1990, A. Terrón (LEB Lichenes 1586).

Key to *Polycoccum* species in Spain

- | | | |
|------|--|--------------------------|
| 1 | Asci 4(–)6-spored (see also <i>P. microsticticum</i> and <i>P. sporastatae</i>) | 2 |
| | Asci 8-spored | 3 |
| 2(1) | Asci 4-spored; ascospores (14–)15–17(–)18 × (7–)8–9(10) μm, coarsely verruculose; ascomata 100–230 μm diameter; immersed in galls; galls with up to 40 ascomata; on <i>Buellia zoharyi</i> | P. epizoharyi |
| | Asci 4(–)6-spored; ascospores (24·5–)26·2–31·2 × 7·5–8·5 μm, rugulose with labyrinthiform ornamentation; not forming galls; on thalli of <i>Peltigera</i> species | P. crassum |
| 3(1) | Ascomata mostly <150 μm diameter | 4 |
| | Ascomata mostly >150 μm diameter | 7 |
| 4(3) | Ascospores mainly not exceeding 7 μm in width | 5 |
| | Ascospores mainly exceeding 7 μm in width | 6 |
| 5(4) | Ascospores (8–)10–11 × (3–)4 μm, smooth, the lower cell often somewhat tapered; ascomata 70 × 80 μm diameter; on thalli of <i>Lecania cyrtella</i> | Polycoccum sp. |
| | Ascospores (10–)11–12·7–14(–)15 × (5·5–)6–6·3–7 μm, verruculose, rounded at both ends; ascomata 85–120 μm diameter; on thallus areoles of <i>Caloplaca rubelliana</i> | P. rubellianae |
| 6(4) | Ascospores (13–)14–18 × 7–8(–)9 μm, verruculose; ascomata (50–)100–150 μm diameter; asci sometimes 4(–)6-spored, but then with (2–) 4 abortive spores visible in younger asci; on <i>Acarospora</i> subgen. <i>Phaeothallia</i> in Spain | P. microsticticum |
| | Ascospores (16–)18–22 × 6–8 μm, rugose; ascomata 75–150 μm diameter; asci 8-spored; immersed in the thallus of <i>Immersaria olivacea</i> . . . | P. decolorans |

- 7(3) Ascospores mainly less than 20 µm in length 8
 Ascospores mainly exceeding 20 µm in length 9
- 8(7) Ascospores 13–15 × (4–)5–6 µm, monostichously arranged; ascomata 160–190 µm diameter; asci 8-spored; on *Peltigera* thalli, sometimes forming swellings on the host thallus **P. peltigerae**
 Ascospores 13–16(–17) × 7–9 µm; ascomata 200–300 µm diameter frequently in dense groups; on the areoles of *Lecidea fuscoatra* **P. kernerii**
- 9(7) Ascospores mainly exceeding 25 µm in length 10
 Ascospores mainly less than 25 µm in length 11
- 10(9) Ascospores 28–30 × 12–14 µm, with a well-developed gelatinous sheath; asci 8-spored; ascomata 100–170 µm diameter; growing on sterile lichen thalli on calcareous rocks **P. opulentum**
 Ascospores (20–)25–30(–36) × 14–18 µm, coarsely verruculose; asci 8-spored; ascomata (150–)200–250–(300) µm diameter; on pyrenocarpous and crustose lichens on limestone **P. marmoratum**
- 11(9) Ascospores mainly exceeding 10 µm in width 12
 Ascospores (14–)18–21(–23) × (6–)7·5–8·5(–9) µm, verruculose; asci 8-spored; ascomata 150–200 µm diameter; forming wart-like galls on *Physcia* species **P. pulvinatum**
- 12(11) Ascospores (16–)20–24(–27) × (6–)10–11(–12) µm, verruculose; ascospore cells unequal in size; asci (4–)8-spored; ascomata 150–200 µm diameter; immersed in the thallus areoles of *Sporastatia* **P. sporastatiae**
 Ascospores (17–)18–23(–25) × (6–)7–10(–11) µm, coarsely verruculose; ascospores cells ± equal in size asci (6–)8-spored; ascomata 100–200 µm diameter; immersed in the thallus of *Dimelaena oreina* **P. evae**

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