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Notes on the Laboulbeniales (Ascomycota) parasitic on Diptera from Portugal and other countries

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Notes on the Laboulbeniales (Ascomycota) parasitic on Diptera from Portugal and other countries

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Abstract

Eighteen species of *Stigmatomyces* are reported for the first time from continental Portugal and/or from the Azores. These are *Stigmatomyces asteiae* W. Rossi et Cesari, *Stigmatomyces athyroglossae* W. Rossi et Cesari, *Stigmatomyces canzonieri* W. Rossi et Cesari, *Stigmatomyces ceratophorus* Whisler, *Stigmatomyces constrictus* Thaxt., *Stigmatomyces crassicollis* Thaxt., *Stigmatomyces divergatus* Thaxt., *Stigmatomyces discocerinae* Thaxt., *Stigmatomyces ensinae* Thaxt., *Stigmatomyces* cf. *ephydrae* L. Mercier et R. A. Poiss., *Stigmatomyces geomyzae* W. Rossi et Cesari, *Stigmatomyces limnophorae* Thaxt., *Stigmatomyces majewskii* H. L. Dainat, Manier et Balazuc, *Stigmatomyces papuanus* Thaxt., *Stigmatomyces platensis* Speg., *Stigmatomyces ptylomyiae* Thaxt. and *Stigmatomyces purpureus* Thaxt., *Stigmatomyces rugosus* Thaxt. New records of these species are also reported from Australia, Canada, Canary Islands (Spain), Costa Rica, Cuba, Ecuador, Finland, Germany, Great Britain, Greece, Kenya, Hungary, Israel, Kyrgyzstan, Lebanon, Morocco, Saudi Arabia, Sierra Leone, Taiwan, Thailand, Turkey, Uganda, United Arab Emirates, USA, Yemen and Zimbabwe. The new records increase, sometimes considerably, information about distribution of these parasites. Two synonymies are also established: *Stigmatomyces autriquei* Balazuc = *Stigmatomyces ensinae* Thaxt.; *Stigmatomyces psilopae* Thaxt. var. *camarguensis* H. L. Dainat et J. Dainat = *S. rugosus* Thaxt.

Keywords: *Diptera*, *entomoparasitic fungi*, *Laboulbeniales*, *Portugal*, *Stigmatomyces*

Introduction

Among the roughly 2000 Laboulbeniales described so far, the species parasitic on flies number slightly more than 200. Of these, 145 belong to the genus *Stigmatomyces* H. Karst., which is the second largest genus of the Laboulbeniales (Rossi & Leonardi 2012), outnumbered only by the genus *Laboulbenia* Mont. et C. P. Robin. However, only 25 species of the latter genus, which numbers more than 600 species, are found on the Diptera (Rossi & Kirk-Spriggs 2011).

As to Portugal, the species of *Stigmatomyces* recorded to date are six, five of which from the continental portion of the country, with the sixth from the Azores. These are *S. hydrelliae* Thaxt. reported on *Hydrellia griseola* (Fallén) (Santamaría & Rossi 1993), *Stigmatomyces inconstans* W. Rossi on *Notiphila cinerea* Fallén (Santamaría & Rossi 1998), *Stigmatomyces limosinae* Thaxt. on *Rachispoda* sp. (Santamaría &

Rossi 1993), *Stigmatomyces ptylomyiae* Thaxt. on *Atissa pygmaea* (Haliday) from the Azores (Huldén 1985), *Stigmatomyces scaptomyzae* Thaxt. on *Scaptomyza pallida* (Zetterstedt) [sub *Scaptomyza graminum* (Fallén)] (Santamaría & Rossi 1998) and *Stigmatomyces trianguliapicalis* T. Majewski on *Parydra coarctata* (Fallén) (Santamaría 1996).

In this paper, 18 species of *Stigmatomyces* are added to this short list, one of which (*Stigmatomyces limnophorae* Thaxt.) is new for the whole of Europe. New records of these same species are also reported from Australia, Canada, Canary Islands (Spain), Costa Rica, Cuba, Ecuador, Finland, Germany, Great Britain, Greece, Kenya, Hungary, Israel, Kyrgyzstan, Lebanon, Morocco, Saudi Arabia, Sierra Leone, Taiwan, Thailand, Turkey, Uganda, United Arab Emirates, USA, Yemen and Zimbabwe. The records from Kyrgyzstan and United Arab Emirates represent the first records of any of the Laboulbeniales for these countries. Two new

synonymies are also established: *Stigmatomyces autriquei* Balazuc = *S. ensinae* Thaxt.; *Stigmatomyces psilopae* Thaxt. var. *camarguensis* H. L. Dainat et J. Dainat = *Stigmatomyces rugosus* Thaxt.

Materials and methods

Insects were collected by standard entomological methods, mostly by means of an entomological net. Collected flies were initially stored in 75% ethanol for transport to the laboratory, where specimens bearing Laboulbeniales were sorted with a dissecting microscope. In addition to the freshly collected insects, several flies carrying thalli of Laboulbeniales, as either pinned specimens or preserved in alcohol, were obtained on loan from the entomologists listed in the acknowledgements. Fungal thalli were removed from the hosts utilizing an entomological pin (# 3) and mounted in Amann's lactophenol following the techniques described by Benjamin (1971). Permanent slides of all the reported specimens are preserved in the collection of WR, which will be deposited in FI (Botanical Museum of Florence, Italy) and in the collection of SS, deposited in BCB-Mycotheca (Universitat Autònoma de Barcelona, Spain).

Results

Stigmatomyces asteiae W. Rossi et Cesari 1979 (Figure 1a)

= *Stigmatomyces asteiae* M. Bechet et I. Bechet, 1982

Iconography. Rossi & Cesari Rossi (1979c); Bechet and Bechet (1982); Santamaría & Rossi (1998).

Distribution. EUROPE: Czech Republic (Rossi & Máca 2006); Italy (**type**) (Rossi & Cesari Rossi 1979c); Romania (Bechet & Bechet 1982); Spain (Santamaría & Rossi 1998).

New record from Portugal. Vila Nova de Gaia, Avintes, Parque Biológico de Gaia, 41°05'59.17"N, 8°33'34.70"W, 6.IX.2009, R. Andrade, on *Asteia amoena* Meigen (*Asteiidae*).

More unpublished records. ASIA: **United Arab Emirates**, Fujairah, 1–8.IV.2006, A. van Harten, on *Asteia afghanica* Papp.

Notes. The new record from the United Arab Emirates extends the distribution of *S. asteiae* to the Asian continent.

This parasite is well characterized by the large and very irregular outgrowths arranged spirally, which correspond to the lateral junction of the perithecial wall cells.

Stigmatomyces athyroglossae W. Rossi et Cesari 1979 (Figure 1b and c)

Iconography. Rossi & Cesari Rossi (1979c).

Distribution. EUROPE: Italy (Rossi & Cesari Rossi 1979c).

New record from Portugal. Évora, Ribeira da Pardiela, concelho de Redondo, 38°36'55.31"N, 7°42'48.13"W, 15.IX.2005, J. Rosado, on *Athyroglossa ordinata* Becker (*Ephydriidae*).

More unpublished records. ASIA: **Turkey**, Antalia, Manavgat, pine forest, 27.II.2008, N. Vikhrev, on *Athyroglossa glabra* (Meigen).

Notes. These new records are the first after the description of *Stigmatomyces athyroglossae* and extend the distribution of this parasite to the Asian continent.

The distinguishing characters of *S. athyroglossae* are the rugose surface of the perithecial venter and the stocky appendage.

Stigmatomyces canzonerii W. Rossi et Cesari 1979 (Figures 1d and 4b)

Iconography. Rossi & Cesari Rossi (1979b); Santamaría (2006).

Distribution. AFRICA: Senegal (**type**) (Rossi & Cesari Rossi 1979b). EUROPE: Spain (Santamaría 2006).

New record from Portugal. Cacula Velha, Vila Real de Santo António, 37°09'20.35"N 7°32'42.39"W, 15.XI.2004, S. Santamaría, on *Canace nasica* (Haliday) (*Canacidae*); Vila Nova de Gaia, Arcozelo (Miramar), 41°04'05.3"N, 8°39'28.1"W, 26.V.2011 and 28.X.2011, R. Andrade, on *C. nasica*.

Notes. The most evident characteristics of *Stigmatomyces canzonerii* are the large and inflated basal cell of the receptacle, followed by a small, short and distinctly narrower suprabasal cell.

Stigmatomyces ceratophorus Whisler 1968 (Figures 1e and 4a)

= *Fanniomyces ceratophorus* (Whisler) T. Majewski, 1972b

Iconography. Whisler (1968); Majewski (1972a, 1994); Hughes et al. (2004); Santamaría (2006).

Distribution. AMERICA: Guatemala (Tavares 1985); USA (**type**) (Whisler 1968). EUROPE: Poland (Majewski 1972a); Spain (Santamaría 2006). OCEANIA: New Zealand (Hughes et al. 2004).

New record from Portugal. Porto, Massarelos, 41°8'58.67"N, 8°37'35.77"W, 22.X.2008, 18.X.2011, 24.X.2011 and 25.X.2011, R. Andrade, very abundant all over the body of various specimens of *Fannia canicularis* (L.) (*Fanniidae*).

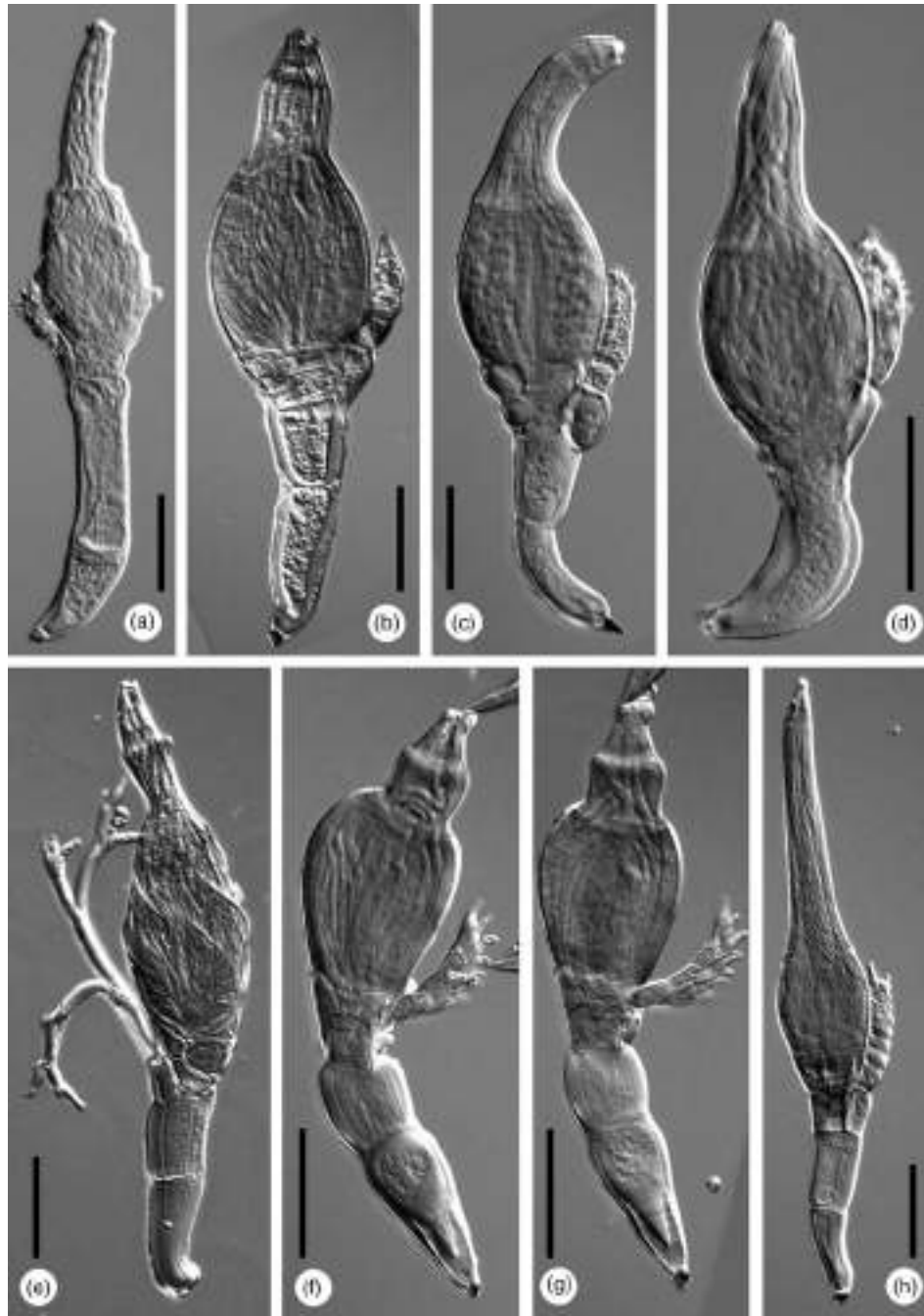


Figure 1. *Stigmatomyces* spp.: (a) *S. asteiae* (slide WR3522); (b) *S. athyroglossae* (SS2623), thallus from Portugal with unusually short perithecial neck; (c) *idem* (WR3457), thallus from Turkey; (d) *S. canzonerii* (WR3637); (e) *S. ceratophorus* (SS2651); (f and g) *S. constrictus* (WR3660); (h) *S. crassicollis* (WR3634). Scale bars = 50 μ m.

More unpublished records. ASIA: **Lebanon**, 25 km SE of Tripoli, Horsh Ehden Nature Reserve, alt. 1300–1600 m, 29.V–03.VI.2001, J. C. Deeming, on *F. canicularis*.

Notes. The new record from Lebanon is the first for the Asian continent of *Stigmatomyces ceratophorus*, which is certainly more widespread in comparison to the very few published records. This parasite is unmistakable for its highly branched and spreading appendage.

***Stigmatomyces constrictus* Thaxt. 1901**
(Figure 1f and g)

= *Stigmatomyces elachipterae* Thaxt. 1905

Iconography. Thaxter (1908, 1931); Rossi (1993); Weir & Rossi (1995).

Distribution. AFRICA: Cameroon (Thaxter 1917). AMERICA: Bolivia (Rossi 1998); Brazil (Bergonzo et al. 2004); Grenada, Jamaica, Mexico, Panama (Thaxter 1917); USA (Thaxter 1905, sub

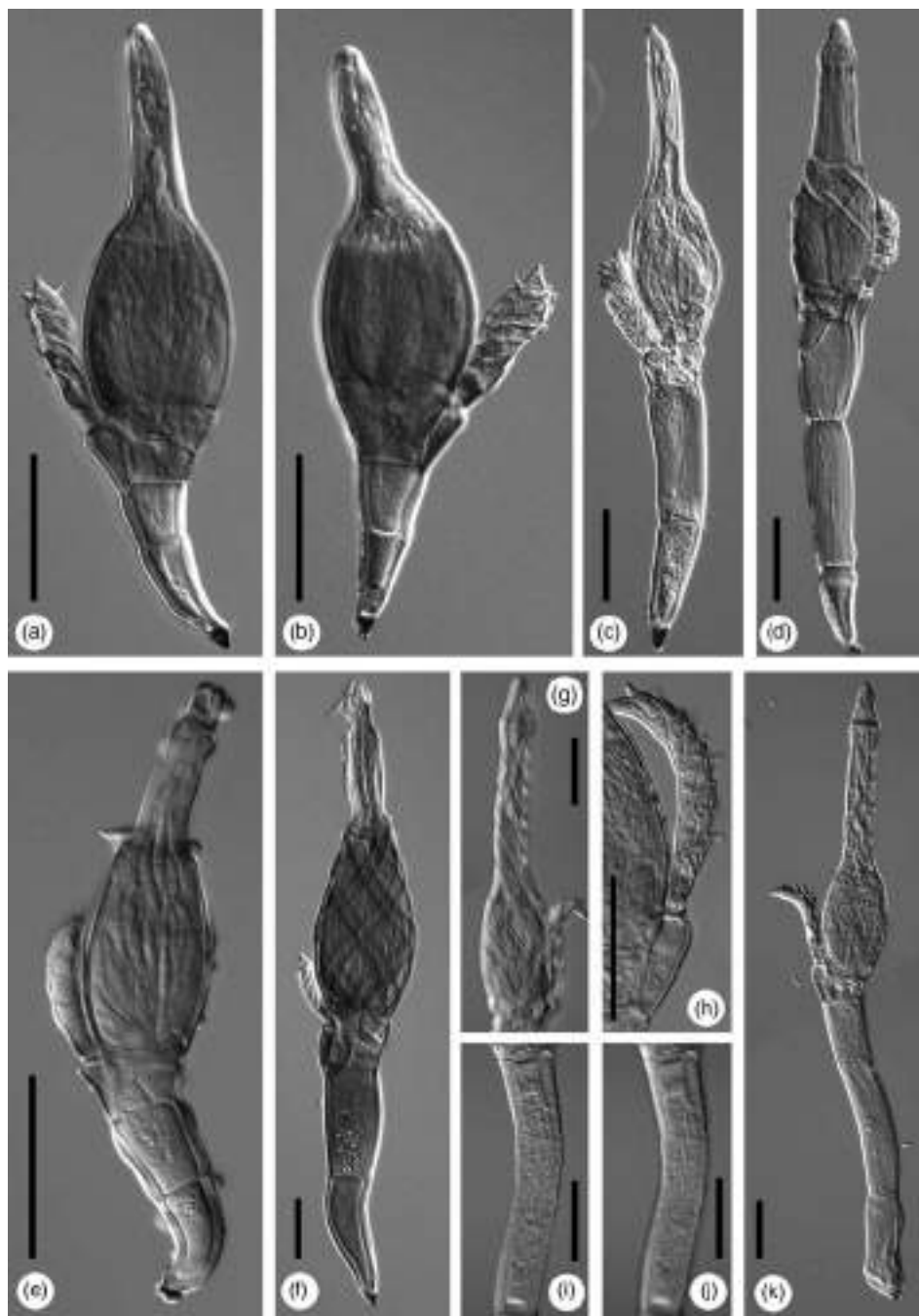


Figure 2. *Stigmatomyces* spp.: (a and b) *Stigmatomyces discocerinae* (slide WR3657); (c) *S. divergatus* (SS2655); (d) *S. ensinae* (WR3450); (e) *S. cf. ephydrae* (SS2496); (f) *S. geomyzae* (WR3656); (g) *S. limnophorae* (SS2624a), details of the wall cells of the perithecium spirally twisted; (h) idem (SS2624b), details of the del appendage; (i and j) idem (SS2624b), details of striation on the surface of cell II; (k) idem (SS2624a), general habitus. Scale bars = 50 μm .

S. elachipterae Thaxter). EUROPE: Great Britain (Weir & Rossi 1995); Italy (Rossi 1993). OCEANIA: Papua New Guinea (**type**) (Thaxter 1901).

New record from Portugal. Estarreja, Canelas, 40°43'26.1"N, 8°33'55.8"W, 21.X.2011, R. Andrade, on the sternites of *Elachiptera cornuta* Auct. non Fallén (*Chloropidae*).

More unpublished records. AFRICA, **Sierra Leone**, Western Area, Regent, 9.XII.1992, W. Rossi, on sternites of *Lasiochaeta scapularis* (Adams); **Uganda**, District Masindi, Bodongo Forest, north of Sonso, 1°45'N, 31°35'E, 15–25.1.1997, T. Wagner, on the head of *Conioscinella* sp. AMERICA, **Cuba**, Prov. Guantanamo, Alturas de Baracoa, road from north coast to La Melba, S watershed

coast/La Melba, 28.II.1992, M. von Tschirnhaus, at the base of left wing of *Apallates* sp. ASIA: **Taiwan**, Taichun Co., Taiwan Mts westside, Huisun Experim. Forest, alt. 600 m, 3–8.IX.2002, W. Schacht et al., on tergites of *Conioscinella* sp.; **Yemen**, Tai'izz, light trap, 3–24.I.1999, A. van Harten & M. Mahyoub, on hind legs of a new species of *Elachiptera*. EUROPE: **Germany**, Bad Oldesloe NW, Brenner Moor, 30. VI.1971, M. von Tschirnhaus, on *E. breviscutellata* Nartshuk; **Greece**, Kerkini Mts, Procom Site, Promohonas, 41°22'38"N, 23°21'59"E, alt. 60 m, 18–24.VII.2007, G. Ramel (Malaise trap), on the antenna of *Speccafrons cypria* Narchuk.

Notes. *Stigmatomyces constrictus* is the only species in the genus reported so far on members of the large *Chloropidae* family. The records from Taiwan and Yemen are the first for Asia.

Stigmatomyces crassicolis Thaxt. 1917
(Figure 1h)

= *Stigmatomyces hackmanii* Huldén, 1983

= *Stigmatomyces longicolis* Thaxt. 1917

= *Stigmatomyces papuanus* Thaxt. var. *leiostoma*
Maire 1920

Iconography. Thaxter (1917); Maire (1920) (sub *Stigmatomyces papuanus* var. *leiostoma* Maire); Majewski (1974), 1994; Rossi & Cesari Rossi (1979a; Huldén (1983) (sub *S. hackmanii* Huldén); Santamaría & Rossi (1993); Hughes et al. (2004); De Kesel & Hanssens (2007).

Distribution. AFRICA: Algeria (Maire 1920, sub *S. papuanus* var. *leiostoma* Maire). AMERICA: Bolivia (Rossi 1998); Jamaica (**type**) (Thaxter 1917). EUROPE: Belgium (De Kesel & Hanssens 2007); Finland (Huldén 1983, sub *S. hackmanii* Huldén); Italy (Rossi & Cesari Rossi 1979a); Poland (Majewski 1974); Slovakia (Rossi et al. 2010); Spain (Santamaría & Rossi 1993). OCEANIA: New Zealand (Hughes et al. 2004).

New record from Portugal. Estarreja, Canelas, 40°43'26.1"N, 8°33'55.8"W, 14.IX.2011, R. Andrade, on *Spelobia luteilabris* (Rondani) (*Sphaeroceridae*).

More unpublished records. AMERICA: **Costa Rica**, Prov. Cartago, Cerro de la Muerte, La Turbera, km 70 Carretera Interamericana (no. 2), alt. 2900 m, 22.I.2007, W. Rossi, on *Leptocera* sp. nova [near *L. erythrocer* (Becker)]. EUROPE: **Germany**, Nordrhein-Westfalen, Cologne-Poll, SSE city periphery, Malaise trap, 18–27.VII.1989, J. Wehlitz, on *Limnophora fontinalis* (Fallén).

Notes. *Stigmatomyces crassicolis* is a variable species, especially as to the length of the perithecial neck; it is distinguished from the allied *S. papuanus*

by its longer appendage, the more compact perithecial basal cells and the obtuse perithecial apex.

Stigmatomyces discocerinae Thaxt. 1917
(Figure 2a and b)

Iconography. Thaxter (1931); Rossi (1993); Bergonzo et al. (2004).

Distribution. AMERICA: Argentina and Brazil (Bergonzo et al. 2004); Jamaica (**type**) and Trinidad (Thaxter 1917). EUROPE: Italy (Rossi 1993); Spain (Santamaría & Rossi 1993).

New record from Portugal. Azores, São Miguel, Salga nr. Achadinha, 6.IX.2006, J. Roháček, on *Discocerina obscurella* (Fallén) (*Ephydriidae*). Vila do Conde, Mindelo, 41°19'26.5"N, 8°44'16.3"W, 29. X.2011, R. Andrade, on *D. obscurella*.

More unpublished records. AMERICA: **Costa Rica**, Turrialba, alt. 860 m, 6.II.1991, Berghammer, on *Discocerina trilineata* Cresson. **Ecuador**, Pichincha, La Union del Toachi, Otongachi Natural Reserve, alt. 850 m, 21–30.VII.2005, W. Rossi, on *D. obscurella*. EUROPE: **Greece**, Makedonia, Lake Petron near Petres, alt. 560 m, 9.IX.2004, R. P. Ponziani, on *D. obscurella*.

Notes. Thalli on *D. trilineata* are distinctly more slender than the ones observed on *D. obscurella*, but otherwise not distinguished.

Stigmatomyces divergatus Thaxt. 1931 (Figure 2c)

= *Stigmatomyces chthonicus* Huldén 1983

= *Stigmatomyces subterraneus* Huldén 1983

Iconography. Thaxter (1931); Huldén (1983) (sub *S. chthonicus* and *S. subterraneus*); Majewski (1990, 1994) (sub *S. chthonicus* and *S. subterraneus*); Santamaría & Rossi (1993).

Distribution. ASIA: Indonesia (**type**) (Thaxter 1931). EUROPE: Belgium (De Kesel & Hanssens 2007); Finland (Huldén 1983, sub *S. chthonicus* and *S. subterraneus*); Poland (Majewski 1990, sub *S. subterraneus*; Majewski 1990a, sub *S. chthonicus*); Spain (Santamaría & Rossi 1993).

New record from Portugal. Lisboa, 19.IV–24. IV.2007, C. Prado e Castro, on *Spelobia parapusio* (Dahl) (*Sphaeroceridae*).

More unpublished records. AMERICA: **USA**, Oregon, Anthony Lakes, 22.VIII.1994, W. Rossi, on *Spelobia maculipennis* (Spuler).

Notes. The new record from the USA extends to the American continent, the distribution of *Stigmatomyces divergatus*. The misleading variability of this parasite has been documented by Santamaría and Rossi (1993).

Stigmatomyces ensiniae Thaxt. 1917 (Figure 2d)

= *Stigmatomyces autriquei* Balazuc, Int. J. Myc. Lich. 1(1): 44. 1982. **syn. nov.**

Iconography. Thaxter (1931); Balazuc (1982) (sub *S. autriquei*).

Distribution. AFRICA: Burundi (Balazuc 1982, sub *S. autriquei*). AMERICA: Jamaica (**type**) (Thaxter 1917).

New record from Portugal. Azores, São Miguel, Ponta Delgada, 37°46'N 25°41'W, 2. IX.2006, J. Roháček, on mesonotum and tergites of a male specimen of *Dioxyna sororcula* Wiedeman (*Tephritidae*).

Notes. The only distinguishing character between *S. autriquei* and *S. ensiniae* is the number of cells forming the axis of the free appendage, which is said to be six in the former species (Balazuc 1982), while it is four in the latter (Thaxter 1917). However, the late Jean Balazuc kindly supplied one of us (WR) with two slides of the type series (paratypes) of *S. autriquei* in which all the thalli (a total of 17) have the axis of the appendage consisting of four cells (rarely three). Moreover, the host of *S. autriquei* is *D. sororcula*, the same host of *S. ensiniae* in the Azores.

Stigmatomyces* cf. *ephydrae L. Mercier et R. A. Poiss. 1927 (Figure 2e)

= *Stigmatomyces bottnicus* Huldén 1983
(sub *Stigmatomyces bottnica*)

= *Stigmatomyces setacerae* Huldén 1983

Iconography. Mercier & Poisson (1927); Huldén (1983); Rossi (1993); Weir & Rossi (1995); Hughes et al. (2004); Shen & Ye (2006).

Distribution. AMERICA: Brazil (Bergonzo et al. 2004). ASIA: China (Shen & Ye 2006). EUROPE: Finland (Huldén 1983); France (**type**) (Mercier & Poisson 1927); Italy (Rossi 1993); Russia (Huldén 1983); UK (Weir & Rossi 1995). OCEANIA: New Zealand (Hughes et al. 2004).

New record from Portugal. Vila Real de Santo António, Guadiana estuary, 37°10'37.42"N, 7°24'34.71"W, 19.XI.2004, S. Santamaría, on *Glenanthe nigripes* Czerny (*Ephydriidae*).

More unpublished records. AMERICA: **Canada**, B. C., Kamloops, 9.VI.1935, Spencer, on *Ephydra pectinulata* Cresson; **USA**, Oregon, Burnt River, SE Baker City, 25.VIII.1994, W. Rossi, on *Setacera aldrichi* Cresson. ASIA: **Kyrgyzstan**, Lake Yssyk-Köl, SW-shore, E a salt/sand/*Phragmites* peninsula, W Ottuk, about 600 m N coast road, 42.18,31E 76.28,95N, alt. 1608 m, 30.VIII.2008, M. von Tschirnhaus, on *Ephydra afghanica* Dahl.

Notes. The finding of *Stigmatomyces ephydrae* on *G. nigripes* is unexpected. To date, this parasite was

observed only on species of the two allied genera *Ephydra* and *Setacera* (Tribe *Ephydrini*), which are not closely related to *Glenanthe* (Tribe *Hecamedini*). Moreover, *G. caribea* Mathis from the central and south America bears a species of *Stigmatomyces* very different from *S. ephydrae* (Bergonzo et al. 2004). At present, we are unable to suggest any plausible explanation for this surprising finding.

Stigmatomyces geomyzae W. Rossi et Cesari 1979 (Figures 2f and 4c)

Iconography. Rossi and Cesari Rossi (1979c); Santamaría & Rossi (1993); Weir & Rossi (1995).

Distribution. EUROPE: Great Britain (Weir & Rossi 1995), Italy (**type**) (Rossi & Cesari Rossi 1979c); Spain (Santamaría & Rossi 1993).

New record from Portugal. Vila do Conde, Mindelo, 41°19'26.5"N, 8°44'16.3"W, 29.X.2011, R. Andrade, on the mesonotum of *Opomyza petrei* Mesnil (*Opomyzidae*).

Notes. *Stigmatomyces geomyzae* is easily recognized by the spirally arranged ridges on the perithecial venter, which describe almost a full turn. This parasite was reported so far only on species of the genus *Geomyza* (*Opomyzidae*).

Stigmatomyces limnophorae Thaxt. 1901 (Figure 2g–k)

= *Stigmatomyces matilei* Balazuc 1986

= *Stigmatomyces sarcophagae* Thaxt. 1905

Iconography. Thaxter (1908); Krejzova & Weiser (1968); Balazuc (1986) (sub *S. matilei*).

Distribution. AFRICA: Cameroon (Thaxter 1917). AMERICA: Bolivia (Rossi 1998); Brazil (Bergonzo et al. 2004); Cuba (Krejzova & Weiser 1968); Grenada, Guatemala and Jamaica (Thaxter 1917); Mexico (Balazuc 1986, sub *S. matilei*; Thaxter 1917); Venezuela (Thaxter 1905, sub *S. sarcophagae*); USA (**type**) (Thaxter 1901). ASIA: Indonesia and Philippines (Thaxter 1917).

New record from Portugal. Évora, Ribeira da Pardiela, Concelho de Redondo, 38°36'55.31"N, 7°42'48.13"W, 7.IX.2006, J. Rosado, on *Limnophora obsignata* Rondani (*Muscidae*).

More unpublished records. AFRICA: **Canary Islands** (Spain), Tenerife, N part, 25–30.III.2011, N. Vikhrev, on *L. obsignata* (Rondani); **Kenya**, Laikipia, Mpala Res. Centre, on *Acacia nilotica* flowers, 6.VII.2004, K. Baldock, on tergites of a female specimen of *Rhyncomya forcipata* Villeneuve (*Rhiniidae*); **Morocco**, pond S of Essaouria, 31.37N, 9.71 W, N. Vikhrev, on *L. obsignata*; **Uganda**, Kabarole distr., NE of Kanyanchu, Kemirondwa valley, small brook near its spring in primary forest,

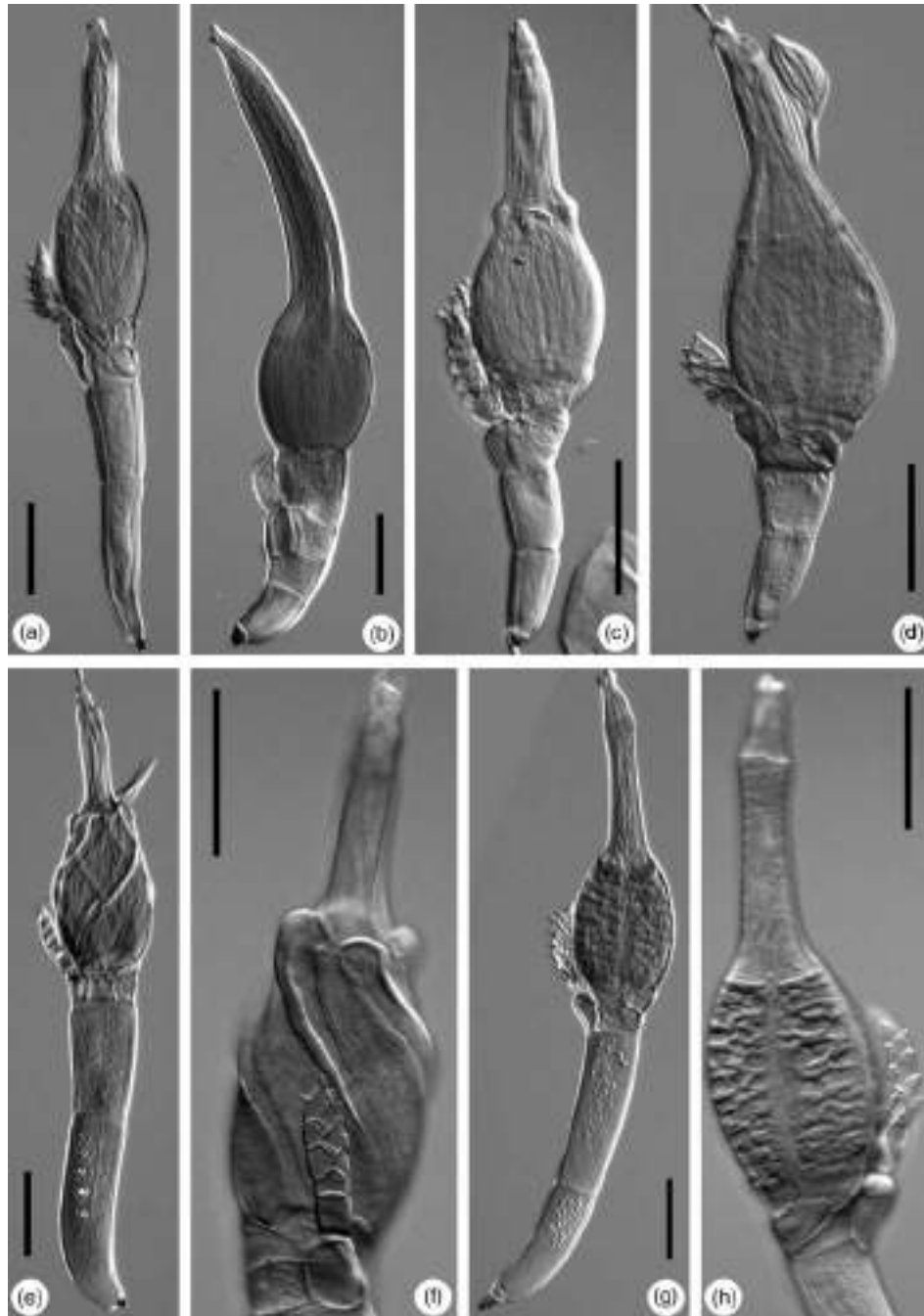


Figure 3. *Stigmatomyces* spp.: (a) *S. majewskii* (slide WR3523); (b) *S. papuanus* (WR3659); (c) *Stigmatomyces platensis* (WR3635); (d) *S. pilomyiae* (WR3524); (e) *S. purpureus* (WR3655); (f) *idem* (WR3655), details of the wall cells of the perithecium and of the appendage; (g) *S. rugosus* (WR3642); (h) *idem* (WR3642), details of the rugosity of the perithecial venter. Scale bars = 50 μ m.

1380—1420 m, 14.III.2012, M. von Tschirnhaus, on the abdomen of a female specimen of *Fainia albitarsis* (Macquart) (*Rhiniidae*). ASIA: **Saudi Arabia**, Al Hassa, palm grove, 23.VI.2008, K. Alhudaïd, on the tergites of a female specimen of *L. quaterna* Loew; Baha, Wadhi Turubah, alt. 918 m, 10.V.2011, H. Al Fadly et al., on the legs of a male specimen of *Isomyia terminata* (Wiedemann) (*Rhiniidae*); **Israel**, Menahamiya, 32.67N, 35.57E, 27.X.2011, N. Vikhrev, on *L. quaterna*; **Taiwan**,

Kaohsiung Co., Jungyang Mts, Tengir Endemic Spec. Res. Inst., alt. 1700 m, 6–10.VII.2000, W. Schacht, on mesonotum and tergites of *Sumatria flava* (Villeneuve) (*Rhiniidae*); **Thailand**, Phuket, 26.II.2009, N. Vikhrev, on *Heliographa ceylanica* Emden (*Muscidae*); Surat Thani Prov., Rajjaprapa dam, 26–28.XII.2009, N. Vikhrev, on *H. ceylanica*; **Turkey**, Antalya, Manavgat, pine forest, 27.II.2008, N. Vikhrev, on *Dasyphora albofasciata* Macquart (*Muscidae*). OCEANIA: **Australia**, NSW, Bruns-

wick Heads, VIII.1963, D. E. Havenstein, on *Calliphora augur* (Fabricius) (*Calliphoridae*).

Notes. Within the large genus *Stigmatomyces*, *S. limnophorae* represents a very unusual case of “polyphagy”, having been reported so far on five different families of flies, i. e. *Muscidae*, *Calliphoridae*, *Sarcophagidae*, *Anthomyiidae* and *Rhiniidae* (the latter for the first time in the present paper).

The new records not only extend the distribution of *S. limnophorae* to Europe and Oceania, but also make it obvious that this species is much more common and widespread than suggested by previous records.

The parasites observed on *Heliographa ceylanica* are up to 1.43 mm tall, thus overcoming the previous record of 1.39 mm held by *Stigmatomyces novozelandicus* A. Weir & W. Rossi (1997). Actually, the Laboulbeniales longer than 1 mm are very few, as well as the species of *Stigmatomyces* exceeding in length one-half millimetre.

Stigmatomyces majewskii H. L. Dainat, Manier et Balazuc 1974 (Figure 3a)

Iconography. Dainat et al. (1974); Christian (2001); Haelewaters et al. (2012).

Distribution. EUROPE: Austria (Christian 2001); Czech Republic (Rossi et al. 2010); France (**type**) (Dainat et al. 1974); the Netherlands (Haelewaters et al. 2012).

New record from Portugal. Vila Nova de Gaia, Oliveira do Douro, Parque da Lavandeira, 41°7'15.11"N, 8°35'38.55"W, 28.X.2010, R. Andrade, on *Drosophila* (*Sophophora*) *ambigua* Pomini (*Drosophilidae*); Valongo, Campo, 41°09'04.3"N, 8°28'53.8"W, 1.X.2011, R. Andrade, on *D. ambigua*.

More unpublished records. AFRICA: **Zimbabwe**, Harare, Natn. Botanic Garden, 11.VI.1997, W. Rossi, on a female specimen of *Drosophila* (*Sophophora*) sp. (*montium* species group). ASIA: **Taiwan**, N-Nantou Co., Road No. 14, NE Puli Reyen Shi-Reg., Meifeng, alt. 2200 m, 9–11. IX.2002, W. Schacht et al., on *D. (S.)* cf. *takahashii* Sturtevant. EUROPE: **Germany**, Nord-Hessen, Kreis Schwalm-Eder, Der Halberg SW Neu-mörschen/Fulda, alt. 210 m, 16.VI.2007, M. von Tschirnhaus, on *D. (S.) ambigua* Pomini; Nordrhein-Westfalen, Cologne-Poll, SSE city periphery, Malaise trap, 25.VII–1.VIII.89, J. Wehlitz, on *D. (S.) subobscura* Collin; **Great Britain**, Sussex, Motts Mill, 17.VII.2011, D. J. Obbard, on *D. (S.) subobscura*.

Notes. The new records make it possible to better understand the taxonomic position, hosts and distribution of *Stigmatomyces majewskii*, which was reported so far only from Europe. The diagnostic

character, which distinguishes this species from the allied *S. entomophilus* (Peck) Thaxt., is the axis of the appendage consisting of four cells. These cells are usually six in the latter parasite, which also has a more slender habit (on average). In all the new records the host insects belong to the subgenus *Sophophora* of the genus *Drosophila*, while *Stigmatomyces entomophilus* seems to be associated with species of *Drosophila* subgenus *Drosophila* (Thaxter 1896; Blair 1947; Máca 1982; Rossi 1998).

Stigmatomyces papuanus Thaxt. 1901 (Figure 3b)

= *Stigmatomyces italicus* Spegazzini 1915

Iconography. Thaxter (1908); Spegazzini (1915) (sub *S. italicus* Speg.); Dainat et al. (1974); Rossi & Cesari Rossi (1979a).

Distribution. AFRICA: Cameroon (Thaxter 1931). EUROPE: France (Dainat et al. 1974); Italy (Spegazzini 1915, sub *S. italicus* Speg.); Spain (Santamaria & Rossi 1993). OCEANIA: Papua New Guinea (**type**) (Thaxter 1901).

New record from Portugal. Estarreja, Canelas, 40°43'26.1"N, 8°33'55.8"W, 14.IX.2011 & 21. X.2011, R. Andrade, on *Leptocera nigra* Olivier (*Sphaeroceridae*).

More unpublished records. AFRICA: **Sierra Leone**, Northern Province, river near Fadugu, 12. XII.1992, W. Rossi, on the sternites of a female specimen of *Rachispoda afra* Roháček (*Sphaeroceridae*).

Notes. The characters more useful for identification of *S. papuanus* are the elongation of the basal cells of the perithecium and its unequally bilobed apex.

Stigmatomyces platensis Speg. 1917 (Figure 3c)

= *Stigmatomyces affinis* Thaxt. 1918

Iconography. Spegazzini (1917); Thaxter (1931); Majewski (1990, 1994).

Distribution. AFRICA: Cameroon (Thaxter 1918, sub *S. affinis* Thaxter); AMERICA: Argentina (**type**) (Spegazzini 1917); ASIA: Indonesia (Thaxter 1931); EUROPE: Czech Republic & Italy (Rossi et al. 2010); Poland (Majewski 1990).

New record from Portugal. Vila Nova de Gaia, Avintes, 41°05'58.7"N, 8°33'35.4"W, 20.VI.2011, R. Andrade, on *Pullimosina vulgesta* Roháček (*Sphaeroceridae*).

Notes. The parasites observed on *Pullimosina vulgesta* from Portugal have a perithecial venter more inflated than usual and resemble *Stigmatomyces divergatus*, except for the stocky perithecial neck ending in two distinctly unequal lobes.

Stigmatomyces purpureus Thaxt. 1901
(Figure 3e and f)

= *Stigmatomyces scatellae* S. Batra 1963

= *Stigmatomyces purpureus* f. *scatellae* (S. Batra)
Santam, Balazuc & Tavares 1991

Iconography. Thaxter (1908); Batra (1963) (sub *S. scatellae*); Dainat & Dainat (1973); Rossi and Cesari Rossi (1979a); Majewski (1981, 1994); Huldén (1983); Huges et al. (2004).

Distribution. AFRICA: Algeria (Rossi 1988). AMERICA: USA (**type**) (Thaxter 1901). ASIA: India (Batra 1963, sub *S. scatellae*). EUROPE: Finland (Huldén 1983); Great Britain (Biffen 1909); France (Dainat & Dainat 1973); Italy (Rossi & Cesari Rossi 1979a); Poland (Majewski 1981, 1994); Spain (Santamaria & Rossi 1993). OCEANIA: New Zealand (Weir & Rossi 1997).

New record from Portugal. Vila do Conde, Mindelo, 41°19'26.5"N, 8°44'16.3"W, 29.X.2011, R. Andrade, on the abdomen of *Scatella stagnalis* (Fallén) (Ephydridae).

More unpublished records. AMERICA: **Canada**, BC, Vancouver Island, Kesley Bay, 17.VII.1961, Scudder leg., on *Scatella (Neoscatella) setosa* Coquillett; B. C., Vancouver, University of British Columbia, campus, 14.VIII.1994, W. Rossi, on *S. stagnalis*.

Notes. *S. purpureus* is a common and widespread species, easily recognizable for the spirally arranged perithecial cells and for the "furcate" apex through the presence of two unequal, erect projections.

Stigmatomyces ptilomyiae Thaxt. 1931 (Figure 3d)

= *Stigmatomyces micrandrus* Thaxt. var. *atissae*
Thaxt. 1917

Iconography. Thaxter (1931); Rossi & Cesari Rossi (1979a); Huldén (1985).

Distribution. AMERICA: Brazil (Bergonzo et al. 2004); Grenada and Jamaica (**type**) (Thaxter 1917, sub *S. micrandrus* var. *atissae*). EUROPE: Italy (Rossi & Cesari Rossi 1979a); Portugal – Azores (Huldén 1985).

New record from Portugal. Estarreja, Canelas, 40°43'25.24"N, 8°34'18.17"W, 12.VIII.2010, R. Andrade, on *Ptilomyia orsovana* (Enderlein) (Ephydridae).

More unpublished records. AFRICA: **Sierra Leone**, Western Area, Regent, 6–7.III.1992, W. Rossi, on *Ptilomyia africana* (Cresson) (Ephydridae).

Notes. The new record from Sierra Leone extends the distribution of *Stigmatomyces ptilomyiae* to Africa. The distinguishing characters of this fungus are the distinctly asymmetrical apex of the

perithecium and the free appendage consisting of three cells bearing five antheridia.

Stigmatomyces rugosus Thaxt. 1901 (Figure 3g and h)

= *Stigmatomyces harantii* H. L. Dainat 1970 (sub *S. haranti*)

= *Stigmatomyces psilopae* Thaxt. 1917

= *Stigmatomyces psilopae* Thaxt. var. *camarguensis*
H. L. Dainat et J. Dainat, Bulletin Société
Mycologique France 89 (3–4): 345. 1973 **syn.**
nov.

Iconography. Thaxter (1908); Thaxter (1931) (sub *S. psilopae*); Dainat (1970) (sub *S. haranti*); Dainat & Dainat (1973) (sub *S. psilopae* var. *camarguensis*); Rossi (1988).

Distribution. AFRICA: Algeria, Botswana, Kenya and Sudan (Rossi 1988). AMERICA: Bolivia (Rossi 1998); Brazil (Bergonzo et al. 2004); Grenada and Jamaica (Thaxter 1917, sub *S. psilopae*); USA (Thaxter 1908). ASIA: Thailand (Rossi 1988). EUROPE: Austria (Rossi 1988); France (Dainat 1970); Italy (Rossi 1988); Spain (Santamaria & Rossi 1998); Russia (Rossi 1988). OCEANIA: New Zealand (Hughes et al. 2004); Papua New Guinea (**type**) (Thaxter 1901).

New record from Portugal. Vila Nova de Gaia, Gulpilhares, 41°4'28.84"N, 8°39'23.21"W, 5.IX.2009, R. Andrade, on tergites and left wing of *Psilopa rutilans* Canzoneri et Meneghini (Ephydridae); Viana do Castelo, Vila Nova de Anha, 41°40'12.6"N, 8°49'24.2"W, 6.IX.2011, R. Andrade, on tergites and right wing of *P. nitidula* Fallén.

More unpublished records. AFRICA: **Sierra Leone**, Northern Province, Tabai river near Makeni, 6.IV.1996, W. Rossi, on *Psilopa violacea* Canzoneri et Meneghini. AMERICA: **Canada**, BC, Vancouver, Stanley Park, 15.VIII.1994, W. Rossi, on *P. girshneri* von Roder. ASIA: **Saudi Arabia**, Abha Madenat Ameer Sultan, 10.V.2002, H. A. Dawah, on *P. nilotica* Becker. EUROPE: **Greece**, Crete, nr. Heraklion, salt marsh nr. Almyras of Malevisi, 24.IV.1985, C. E. Dyte, on *P. leucostoma* (Meigen); Makedonia, Lake Vegorititis near Arnissa, alt. 540 m, 30.VIII.2004, R. P. Ponziani, on *P. compta* Meigen; Corfu Island, Agnou, northern coast WNW Roda, 7.X.2001, M. von Tschirnhaus, on *Clanoneurum cemiciforme* (Haliday); **Hungary**, Tokaj, 2.VIII.2002, J. Máca, on *Psilopa pappi* Canzoneri et Meneghini; OCEANIA: **Australia**, Northern Territory, Darwin, 08.VIII.1999, W. Rossi, on *Leptopsilopa pollinosa* (Kertész).

Notes. The new records from all the five continents, together with the previous ones, make it

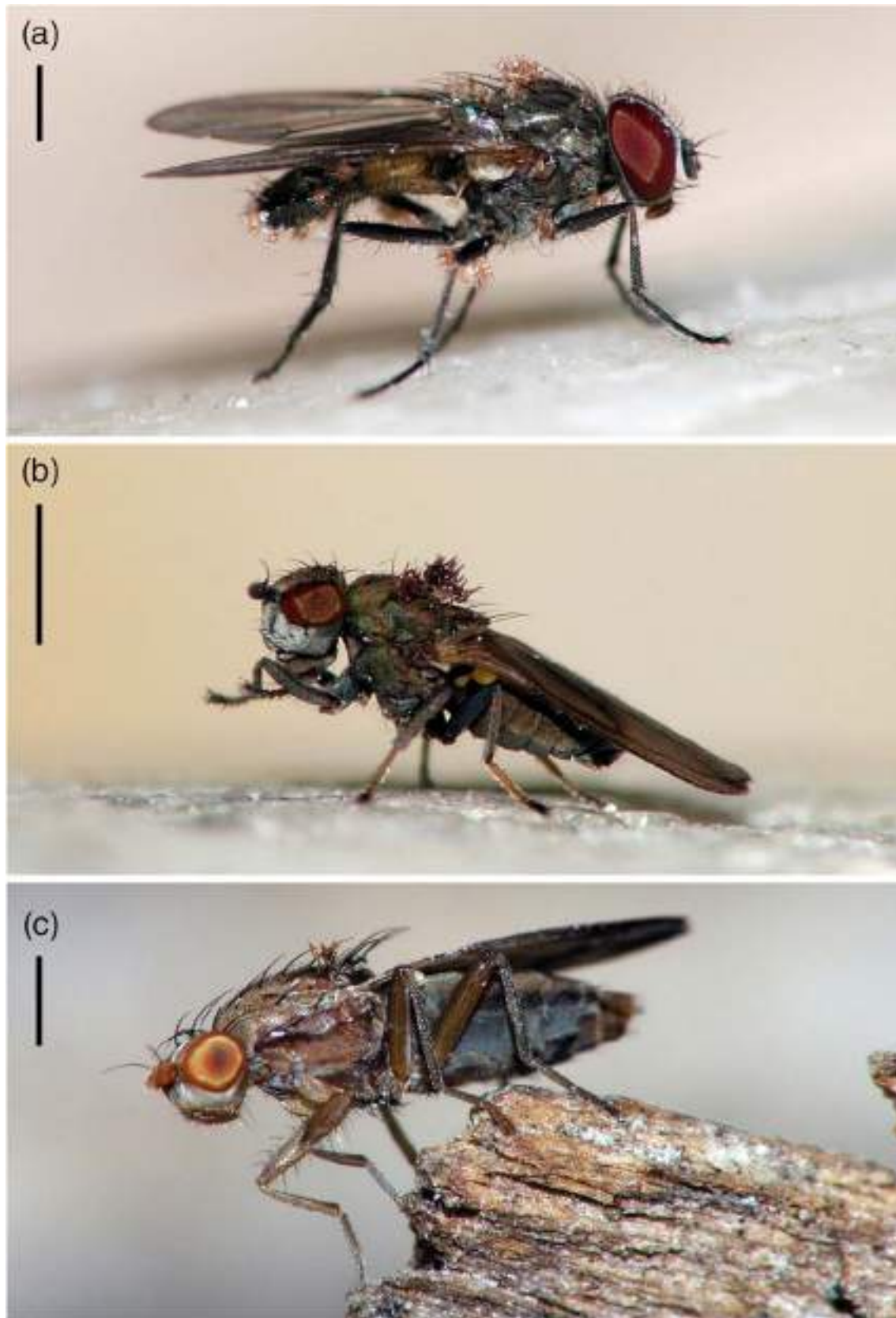


Figure 4. *Stigmatomyces* spp.: (a) *F. canicularis* with thalli of *S. ceratophorus* covering the body; (b) *C. nasica* with several thalli of *S. canzonerii* on the mesonotum; (c) *O. petrei* with a few thalli of *S. geomyzae* on the mesonotum. Photos by Rui Andrade. Scale bars = 1 mm.

obvious that *S. rugosus* is one of the most common and widespread species in the genus.

It has not been possible to examine the type series of *S. psilopae* var. *camarguensis* because to date the "collection Dainat" has not been deposited in a scientific institution. However, the table (Dainat & Dainat 1973, p. 346) in which the characters are summarized distinguishing this variety from *S. haranti* (= *S. rugosus*) shows very clearly that these characters fall within the variability of *S. rugosus* outlined by Rossi (1988).

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1	Axis of the free appendage consisting of cells distinctly shorter than broad	2
1	Axis of the free appendage consisting of at least some cells distinctly longer than broad	6
2	Basal cells of perithecium elongate, forming a well-defined stalk usually as long or longer than the appendage	3
2	Basal cells of perithecium not distinctly elongate	4
3	Apex of perithecium obtuse or sub-truncate	<i>limosinae</i>
3	Apex of perithecium distinctly asymmetrical, the posterior lip cells forming an oblique, finger-like projection.	<i>papuanus</i>
4	Neck of perithecium distinctly longer than the venter	<i>crassicolis</i>
4	Neck of perithecium about as long as the venter	5
5	Apex of perithecium distinctly asymmetrical	<i>platensis</i>
5	Apex of perithecium blunt	<i>divergatus</i>
6	Lower cell of the free appendage bearing antheridia	12
6	Lower cell of the free appendage sterile	7
7	Apex of perithecium bearing sub-erect, free projections	8
7	Apex of perithecium lacking projections	9
8	Apex of perithecium bearing a single, sub-acute projection	<i>hydrelliae</i>
8	Apex of perithecium bearing two unequal projections	<i>purpureus</i>
9	Wall cells of perithecial venter arranged spirally	<i>ensinae</i>
9	Wall cells of perithecial venter not arranged spirally	10
10	Venter of perithecium oblong, the margins very slightly convex; perithecial tip abruptly distinguished	<i>ephydrae</i>
10	Venter of perithecium not oblong, the margins distinctly convex; perithecial tip gradually tapered	11
11	Venter of perithecium symmetrically	<i>majewskii</i>
11	Venter of perithecium gradually broader from the base upward	<i>scaptomyzae</i>
12	Suprabasal cell of receptacle (cell II) distinctly shorter than the basal	<i>canzonerii</i>
12	Suprabasal cell of receptacle from slightly shorter to distinctly longer than the basal	13
13	Axis of the free appendage branched	<i>ceratophorus</i>
13	Axis of the free appendage consisting of a single row of superimposed cells	14
14	Free appendage slender and elongate, about as long as the venter, its distal portion \pm distinctly curved	<i>limnophorae</i>
14	Free appendage \pm shorter than the venter, straight or very slightly curved	15
15	Wall cells of perithecial venter arranged spirally	16
15	Wall cells of perithecial venter not arranged spirally	17
16	Venter of perithecium bearing large and very irregular outgrowths	<i>asteiae</i>
16	Venter of perithecium without outgrowths	<i>geomyzae</i>
17	Neck of perithecium relatively short and stout, abruptly distinguished both from the venter and from the tip	<i>constrictus</i>
17	Neck of perithecium not very abruptly distinguished from the venter	18
	Venter of perithecium usually rugose, the neck slender and slightly longer, ending with four small, unequal, diverging lips	<i>rugosus</i>
18	Venter of perithecium smooth or granulose, the neck shorter than, or sub-equal to the venter	19
19	Axis of the free appendage consisting of three cells	<i>ptilomyiae</i>
19	Axis of the free appendage consisting of more than three cells	20
20	Free appendage as long or even longer than the venter of the perithecium	<i>inconstans</i>
20	Free appendage shorter than the venter of the perithecium, sometimes distinctly so	21
21	Apex of perithecium distinctly asymmetrical in lateral view, subtriangular in front view	<i>trianguliapicalis</i>
21	Apex of perithecium symmetrical or almost so	22
22	Axis of the free appendage consisting of four cells	<i>discocerinae</i>
22	Axis of the free appendage consisting of five to six cells	<i>athyroglossae</i>

Key to the species of Stigmatomyces reported so far from Portugal.