

# New species of *Penzigomyces*, *Sporidesmium* and *Stanjehughesia* from plant debris in Spain

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**Abstract:** Four new species of *Sporidesmium* complex collected on plant debris in different protected areas of the Iberian Peninsula are described and illustrated. *Penzigomyces basiacutus* is characterized by its obclavate to rostrate conidia with a narrowly obconic-truncate basal cell and verruculose apical cell. *Sporidesmium corniculatum* is distinguished from other species of the genus by its occasional furcate and only transversely septate conidia and *Sporidesmium tunicatum* by its obclavate to rostrate, verrucose conidia with an apical mucilaginous sheath tunica. *Stanjehughesia obclavorostrata* is distinguished by its obclavate to rostrate conidia with the basal cell sometimes darker than the rest.

**Key words:** anamorphic fungi, Hyphomycetes, Spain, taxonomy.

## Introduction

The *Sporidesmium* complex is a large anamorphic group of dematiaceous fungi with nearly 250 species mostly colonizing branches, trunks and dead leaves of many plants. *Sporidesmium* was established by Link in 1809, but the traditional concept of the genus is based on the Ellis's description of *S. ehrenbergii* (Ellis, 1958, 1971). *Sporidesmium* has been considered a heterogeneous genus (Sutton & Hodges, 1979; Hughes, 1979) and repeatedly revised (Kirk 1982, Subramanian 1992, Hernández-Gutiérrez & Sutton 1997, Shoemaker & Hambleton 2001).

Following the criteria of Hughes (1979), Kirk (1982) established the genus *Sporidesmiella* P.M.Kirk for species with few septa and cuneate to obovoid conidia. Subramanian (1992) segregated a large number of *Sporidesmium* species, according to the type of conidiophore proliferation and conidial septation, into the genera *Ellisembia* Subram., *Penzigomyces* Subram., *Polydesmus* Mont., *Repetophragma* Subram., *Sporidesmiella* P.M.Kirk, *Sporidesmium* Link, and *Stanjehughesia* Subram. A few other species were transferred to other genera such as *Acarocybellina* Subram., *Gangliophora* Subram., *Hemicorynesporella* Subram., and *Janetia* M.B.Ellis. *Sporidesmium densum* (Sacc. & Roum.) Mason & S.Hughes was considered congeneric with *Polydesmus elegans* Durieu & Mont., the type species of the genus, which was not accepted by Hernández-Gutiérrez & Sutton (1997) who proposed the genus *Imimyces* A.Hern. & Sutton for *Sp. densum* and other similar species. In addition, these authors erected the genus *Linkosia* A.Hern. & Sutton to accommodate *Sp. coccothrinacis* A.Hern. & J.Mena as the type, and proposed seven new combinations. *Linkosia* was characterized by distoseptate conidia formed on conidiogenous cells, which arise directly from the fertile hyphae. Shoemaker & Hambleton (2001) did not accept *Imimyces* because they considered that the specimen designated as the type species was a *Polydesmus* and therefore proposed the genus *Imycles* for the rest of *Imimyces* species defined by Hernández-Gutiérrez & Sutton (1997). However, Réblová (1999) questioned the validity

of these genera because she considered that their diagnostic characters on the natural substrate differed from those in culture, and also due to the lack of correlation with anamorph-teleomorph connections previously established. Wu & Zhuang (2005) considered the distinction between *Penzigomyces-Sporidesmium* and *Ellisembia-Imycles* very difficult when based on conidiophore proliferation and conidiogenous cell morphology, and preferred to simplify the taxonomic system considering *Imycles* and *Penzigomyces* as synonyms of *Ellisembia* and *Sporidesmium*, respectively. Shenoy et al. (2006), using molecular techniques, demonstrated that most of these segregate anamorphic genera were phylogenetically heterogeneous, but Seifert et al. (2011) accepted all segregated genera of *Sporidesmium sensu lato* as morphologically different groups that were useful for identification purposes.

During a survey of anamorphic fungi on plant debris in different protected areas of the Iberian Peninsula four interesting species morphologically compatible with the *Sporidesmium* complex were collected. Based on the conidial morphology, size and pigmentation, these species are proposed here as new.

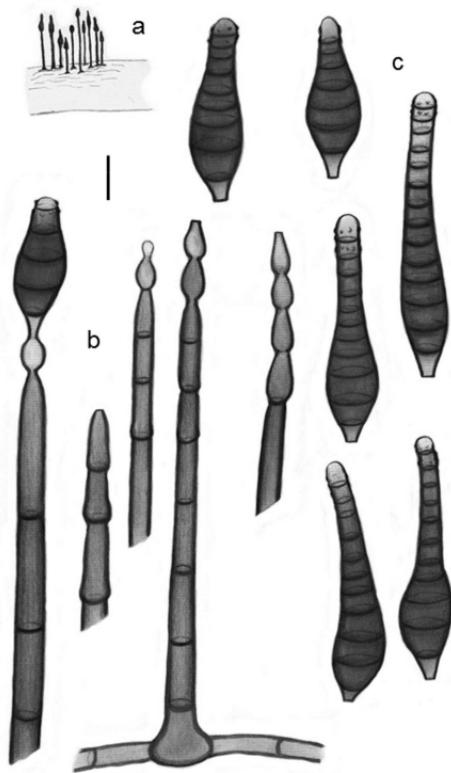
## **Materials and Methods**

Samples of plant material were processed using the methodology described by Castañeda-Ruiz (2005). Fungal specimens were studied and illustrated following Hernández-Restrepo et al. (2012). After testing different media and culture conditions, attempts to establish monoconidial cultures of the species described, failed and, therefore, only dried material could be preserved. Specimens are deposited in the herbarium of Centraalbureau voor Schimmelcultures, Utrecht, The Netherlands (CBS) and Facultat de Medicina i Ciències de la Salut, Reus, Spain (FMR).

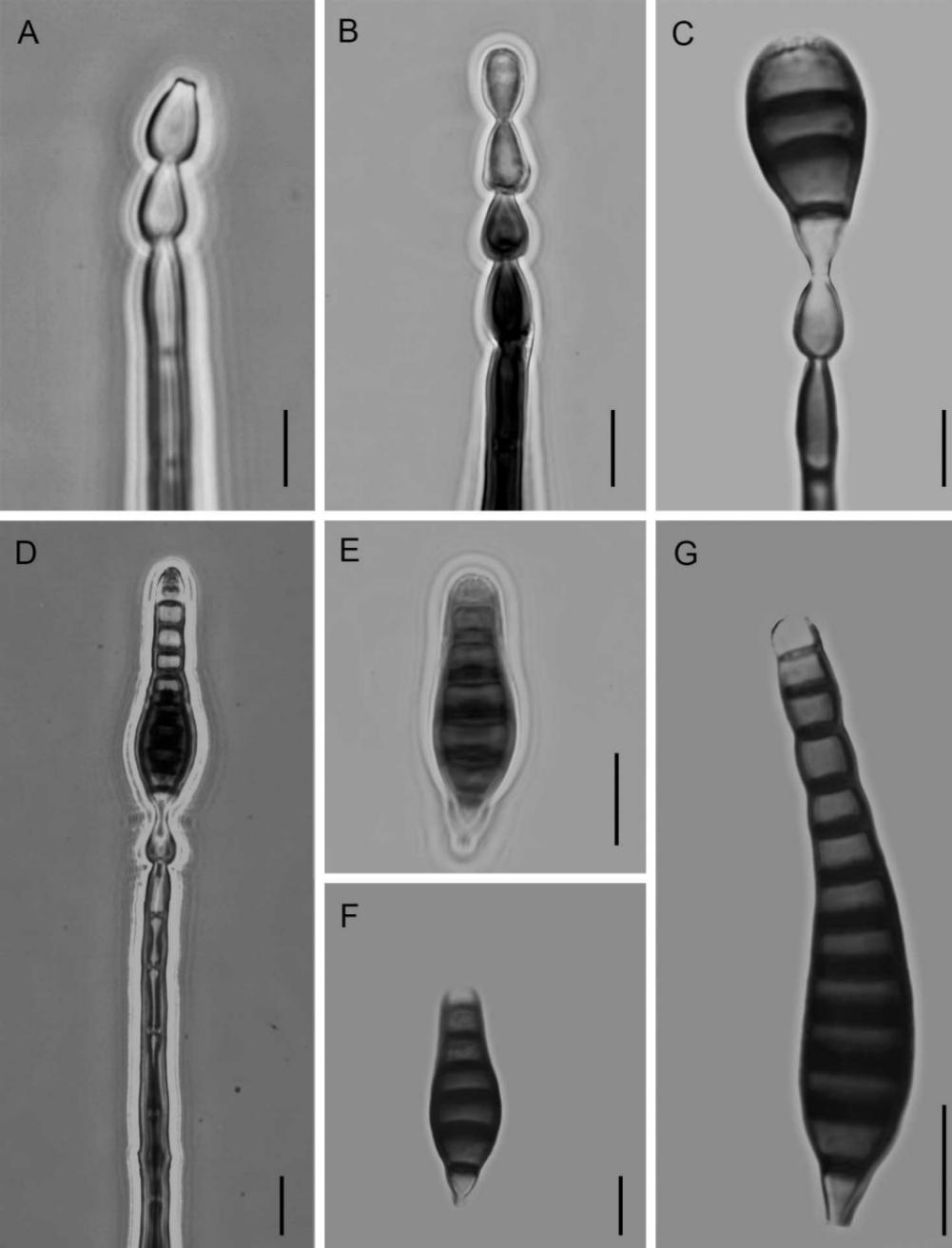
## **Taxonomy**

*Penzigomyces basiacutus* Hern.-Restr., J.Mena, Gené & Guarro, sp. nov. Figs 1-2

MYCOBANK No: MB 814910



**Fig. 1.** *Penzigomyces basiacutus*. a. Habit. b. Conidiophores. c. Conidia. Scale bar = 10  $\mu\text{m}$ .



**Fig. 2.** *Penzigomyces basiacutus*. a–d. Conidiophores. e–g. Conidia. Scale bar = 10  $\mu\text{m}$ .

ETYMOLOGY: Referring to the narrowly obconic-truncate basal cell of conidia.

DESCRIPTION: Colonies effuse, black, hairy. *Mycelium* partly immersed in the substrate, hyphae pale brown, septate, branched, 1.5–2.5  $\mu\text{m}$  wide. Conidiophores macronematous, mononematous, solitary, simple, cylindrical, straight, smooth, septate, dark brown, up to 216  $\mu\text{m}$  long, 5–7.5  $\mu\text{m}$  wide, 7.5–17.5  $\mu\text{m}$  at the bulbous base, 2.5–4  $\mu\text{m}$  at the apex. Conidiogenous cells monoblastic, terminal, lageniform, smooth-walled, brown, 6–12  $\times$  4.5–5.5  $\mu\text{m}$ , with up to seven lageniform percurrent proliferations. Conidia apical, solitary, dry, 3–15-septate, obclavate to rostrate, 28–73  $\times$  8.5–12.5  $\mu\text{m}$ , 4.5–5.5  $\mu\text{m}$  wide at the rostrate apex, 1.5–2.5  $\mu\text{m}$  wide at the acute base, brown to dark brown, becoming pale brown toward the apex, basal cell narrowly obconic-truncate, pale to mid-brown, slightly verruculose at the apex. Sexual morph unknown.

SPECIMEN EXAMINED: SPAIN, Aragón, National Park of Ordesa y Monte Perdido. On dead wood. Jun. 2009. M.Hernández-Restrepo, J.Mena & J.Cano (holotype CBS H-21044, isotype FMR 11158).

The genus *Penzigomyces* was established by Subramanian (1992) for former *Sporidesmium* species characterized by doliiform, lageniform or nodose percurrent conidiogenous cell proliferations and euseptate conidia. However, Wu & Zhuang (2005) considered *Penzigomyces* a synonym of *Sporidesmium*. Seifert et al. (2011) provisionally recognized all genera segregated from *Sporidesmium* on the basis of conidiogenous cell morphology and proliferation and conidial septation.

*Penzigomyces basiacutus* can be distinguished by its obclavate conidia with a verruculose rostrum and a truncate base with a terminal narrowly obconic cell. The conidia somewhat resemble those of *P. australiensis* (M.B.Ellis) Subram., *P. nodipes* (Penz. & Sacc.) Subram. and *P. uapacae* (M.B.Ellis) Subram. However, in *P. australiensis* the conidia are smooth, 7–9-septate and measure 40–65  $\times$  11–16  $\mu\text{m}$  (Ellis 1976). Wu & Zhuang (2005) widened its concept by including a Chinese specimen with conidia measuring 42–80  $\times$  10–13

$\mu\text{m}$ , (1.5–3  $\mu\text{m}$  at the rounded apex and 3–5  $\mu\text{m}$  at the conico-truncate base) and 9–13 septa. In *P. nodipes* the conidia are smooth-walled, 11–14-septate, sometimes constricted at the septa, and measure 36–67  $\times$  6.5–8  $\mu\text{m}$ , (1.5–4  $\mu\text{m}$  wide below the acute apex and 2.5–4  $\mu\text{m}$  at the base); in addition this species is mainly found on palms and orchids in tropical areas (Ellis 1976, Wu & Zhuang 2005). The conidia of *P. uapacae* are 5–8-septate, pale to mid brown and smooth-walled and measure 50–80  $\times$  7–10  $\mu\text{m}$ , tapering to 3–4  $\mu\text{m}$  wide near the apex and 3–4  $\mu\text{m}$  wide at the base (Ellis 1958, 1976).

***Sporidesmium corniculatum* J.Mena, Hern.-Restr., Gené & Guarro, sp. nov. Figs 3–4**

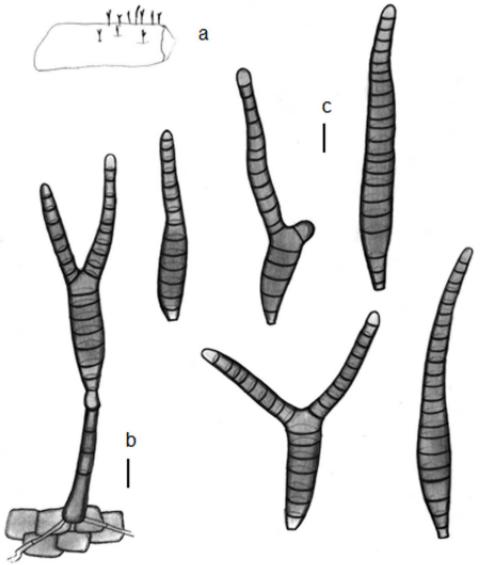
MYCOBANK No.: MB 814911

ETYMOLOGY: referring to the occasional presence of furcate conidia.

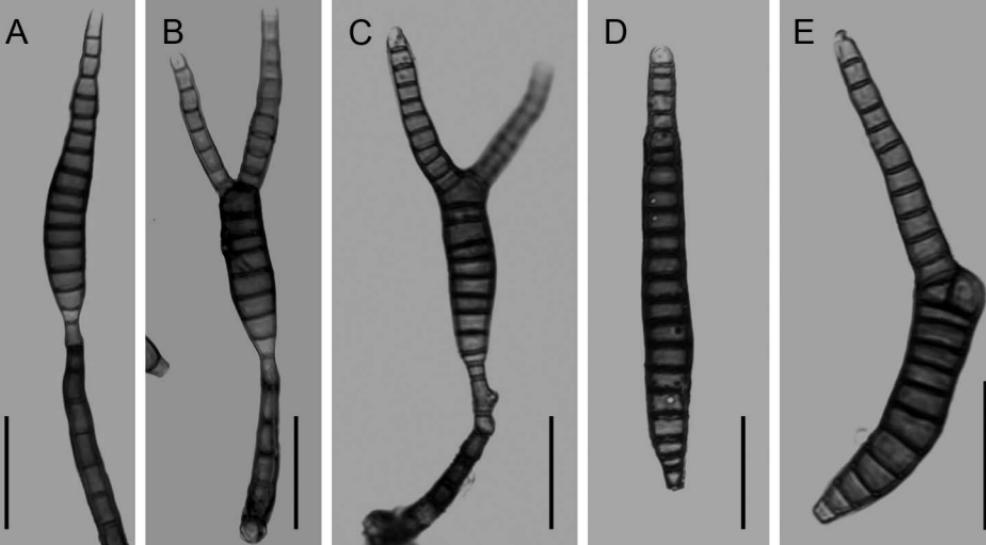
DESCRIPTION: Colonies effuse, black, hairy. Mycelium partly immersed in the substratum, hyphae pale brown, septate, branched, 1.5–2  $\mu\text{m}$  wide. Conidiophores macronematous, mononematous, solitary, simple, cylindrical, straight, septate, dark brown, smooth, 45–70  $\mu\text{m}$  long, 5–7  $\mu\text{m}$  wide, 7.5–8  $\mu\text{m}$  at the base, 3.5–5  $\mu\text{m}$  at the apex. Conidiogenous cells monoblastic, integrated, terminal, smooth-walled, brown, 5–10  $\times$  5  $\mu\text{m}$ . Conidia apical, solitary, dry, 13–26-septate, obclavate to rostrate, sometimes furcate with two arms, 60–137.5  $\times$  10–12.5  $\mu\text{m}$ , 3–5  $\mu\text{m}$  wide at the base, 4–8.5  $\mu\text{m}$  at the apex, mid- to dark brown, remaining pale brown towards the apex, smooth-walled; arms 5–17-septate, 25–92.5  $\times$  6–9  $\mu\text{m}$ . Sexual morph unknown.

SPECIMEN EXAMINED: SPAIN, Aragon, Natural Park Valles Occidentales. On bark. Mar. 2012. M.Hernández-Restrepo & J.Capilla (holotype CBS H-21046, isotype FMR 12431).

The occasional presence of branched conidia and several percurrent proliferations could justify the inclusion of this species in other genera such as *Actinocladium* Ehrenb., *Ceratosporaella* Höhn. or *Triposporium* Corda. The conidiogenesis of the members of these genera is similar to that of the *Sporidesmium* complex. However, the low frequency of furcate



**Fig. 3.** *Sporidesmium corniculatum*. a. Habit. b. Conidiophore. c. Conidia. Scale bar = 10  $\mu\text{m}$ .



**Fig. 4.** *Sporidesmium corniculatum*. a–c. Conidiophores with conidia attached.  
d–e. Conidia. Scale bar = 10  $\mu\text{m}$ .

conidia observed in the Spanish specimen was the reason for including our isolate in *Sporidesmium sensu* Subramanian (1992).

The only species of *Sporidesmium* having typically furcate conidia is *Sp. taiwanense* Matsushima (1983), but in this species the conidiophores are 0–2-septate, highly variable in length (6–50 µm), the conidiogenous cells are determinate, and in the conidia, septa are constricted, sometimes oblique and rarely longitudinal, and the basal cell is obconic, pedicellate and brown. Wu & Zhang (2005) suggested that *Sp. taiwanense* was better accommodated in *Stanjehughesia* on the basis of its euseptate and clavate conidia on discrete conidiogenous cells. However, a new combination was not established since the authors did not study the type material.

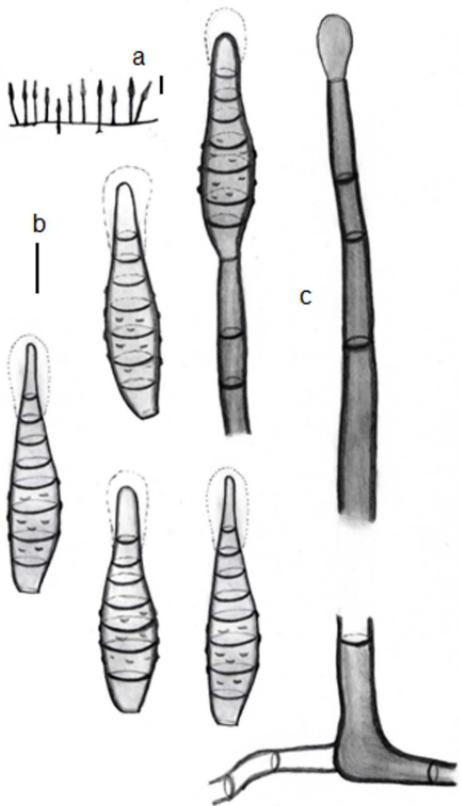
*Ellisembia karadkensis* Rajeshkumar & SK Singh has been recently described with simple or branched conidia (Rajeshkumar et al. 2012); however, they are distoseptate, a character used by Subramanian (1992) to segregate *Ellisembia* from *Sporidesmium*. Other characters that distinguish *E. karadkensis* from *Sp. corniculatum* are that the furcate conidia are longer (190–250 µm long), narrower below the apex (2–2.7 µm wide) and have 10–35 distosepta.

***Sporidesmium tunicatum* M. Hern.-Restr., J. Mena, Gené & Guarro sp. nov. Fig. 5–6**

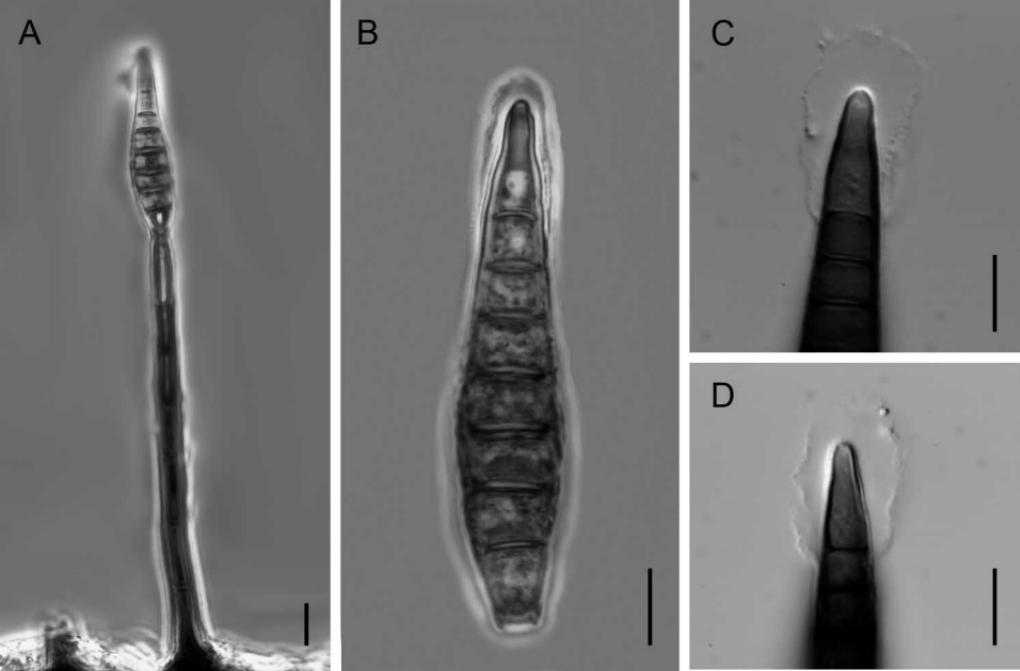
MYCOBANK No.: MB 814912

ETYMOLOGY: referring to the tunica, a mucilaginous sheath surrounding the conidial apex.

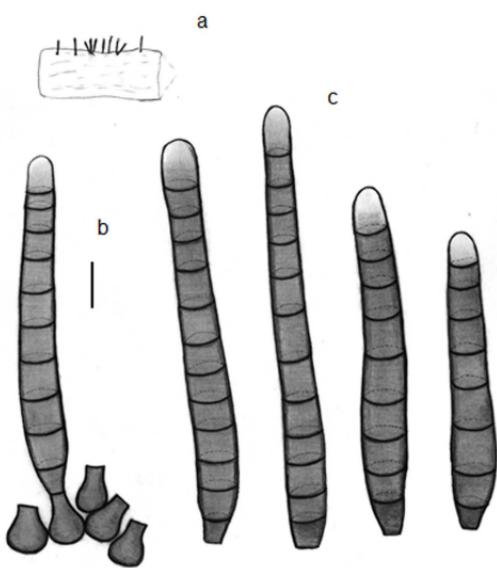
DESCRIPTION: Colonies effuse, black, hairy. Mycelium partly immersed, hyphae pale brown, septate, branched, 1.5–3 µm wide. Conidiophores macronematous, mononematous, solitary, simple, cylindrical, straight, septate, dark brown, smooth, 110–180 µm long, 6–7.5 µm wide, 8.5–12.5 µm at the base, 4–5 µm at the apex, proliferation 0–1, percurrent. Conidiogenous cells monoblastic, integrated, terminal, smooth-walled, brown, 19–25 × 5–6 µm. Conidia apical, solitary, dry, 6–10 (mostly 8)-septate, obclavate, sometimes rostrate, 43–75 × 9–13 µm, 3–5 µm wide at the base, 2.5–3.5(–5) µm at the apex, dark olivaceous brown, becoming



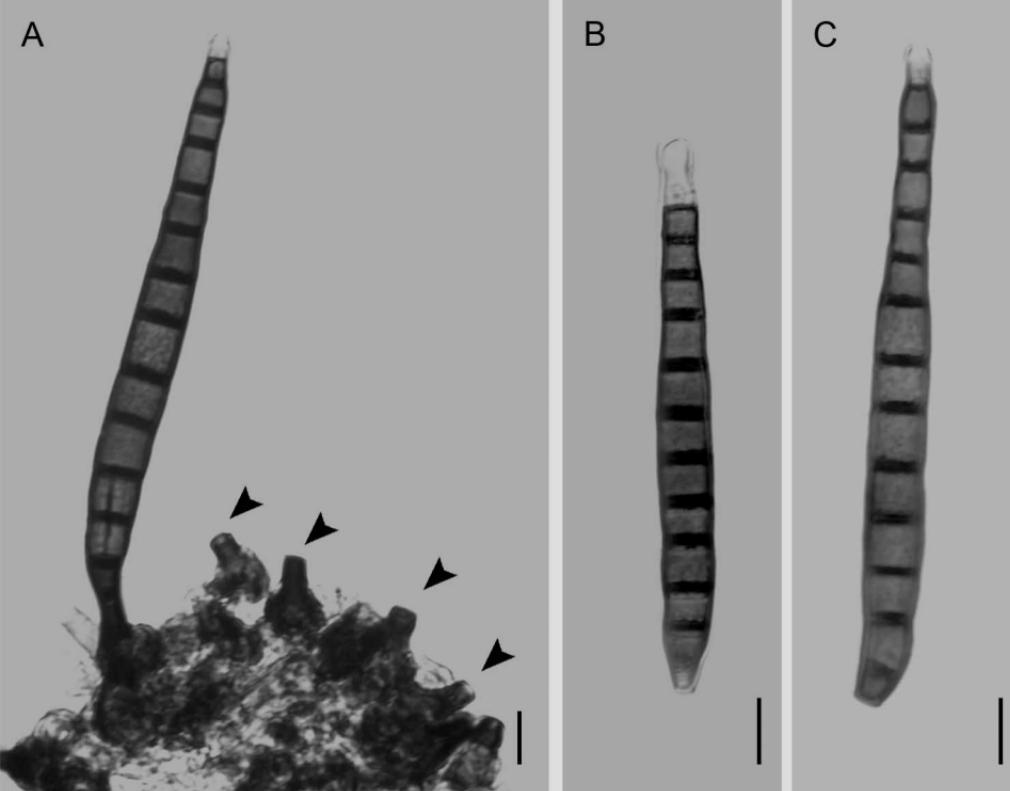
**Fig. 5.** *Sporidesmium tunicatum*. a. Habit. b. Conidia. c. Conidiophores. Scale bar = 10  $\mu\text{m}$ .



**Fig. 6.** *Sporidesmium tunicatum*. a. Conidiophore. b-d. Conidia. Scale bar = 10  $\mu\text{m}$ .



**Fig. 7.** *Stanjehugesia obclavorostrata*. a. Habit. b. Conidiophores. c. Conidia. Scale bar = 10  $\mu\text{m}$ .



**Fig. 8.** *Stanjehugesia obclavorostrata*. a. Conidiophores (arrows indicate the conidiogenous cells). b, c. Conidia. Scale bar = 10  $\mu\text{m}$ .

pale brown towards the apex, verrucose at the central cells, apical tunica 9–15 × 10–30 µm.

Sexual morph unknown.

SPECIMEN EXAMINED: SPAIN, Galicia, Natural Park As Fragas do Eume. On dead wood. May 2010. M.Hernández-Restrepo, J.Mena & J.Guarro (holotype CBS H-21045, isotype FMR 11243).

*Sporidesmium tunicatum* differs from congeneric species (Ellis, 1958, 1971, 1976; Matsushima, 1971, 1975; Wu & Zhuang, 2005) by the unique combination of the sometimes rostrate, usually 8-septate, verrucose conidia with an apical mucilaginous sheath. *Sporidemium hainanense* W.P.Wu is the most similar species, but its conidia are smooth and shorter (40-50 µm) (Wu & Zhuang, 2005).

***Stanjehughesia obclavorostrata* J.Mena, M.Hern.-Restr., Gené & Guarro, sp. nov. Figs 7–8**

MYCOBANK No.: MB 814913

ETYMOLOGY: referring to the conidial morphology.

DESCRIPTION: Colonies on natural substrate effuse, black. Mycelium partly immersed, hyphae branched, septate, subhyaline to pale brown, 1.5–3.5 µm wide. Conidiophores reduced to a single conidiogenous cell. Conidiogenous cells monoblastic, determinate, ampulliform or lageniform, erect, straight or flexuous, thick and smooth-walled, mostly solitary, sometimes caespitose, brown to dark brown, 13.5–20(–24) µm long, 7.5–12.5 µm wide at the bulbous base, 4.5–5 µm wide at the truncate apex. Conidia apical, solitary, dry, (7–)9–16-euseptate, straight or slightly curved, obclavate, sometimes rostrate, rarely obclavate-fusiform, 52.5–145 × 10–15 µm, brown, smooth-walled; apical cell rounded, light brown, 5.5–9(–11) µm wide; basal cell obconical, frequently slightly darker than the rest of cells, 3.5–4 µm wide. Sexual morph unknown.

SPECIMEN EXAMINED: SPAIN, Castilla-La Mancha, Natural Park Alto Tajo. On dead wood. 5 May 2011. M.Hernández-Restrepo, J.Mena & J.Guarro (holotype CBS H-21047, isotype FMR 12067).

Only other two species of *Stanjehughesia* such as *St. hormiscioides* (Corda) Subram. and *St. curviapicis* (Goh & K.D.Hyde) D.A.C.Almeida & Gusmão (=*St. hamatiella* W.P.Wu) have conidia with a subhyaline or pale brown apical cell and conico-truncate basal cell usually darker than the rest as occurs in *St. obclavorostrata* (Subramanian 1992, Wu & Zhuang 2005, Almeida et al. 2014).

*Stanjehughesia hormiscioides*, the type species of the genus, has become objected to complex taxonomic and nomenclatural problems. The current name for this species, as recognized by both Index Fungorum (<http://www.indexfungorum.org/>) and MycoBank (<http://es.mycobank.org/>) is *Sporidesmium hormiscioides* Corda, which would imply the establishment of a new type for *Stanjehughesia* Subram. Based on Ellis (1958, 1976) and Hughes & Illman (1974), conidia are described and illustrated as arising from single conidiogenous cells from micronematous conidiophores. We follow Subramanian (1992) and Wu & Zhuang (2005) including this species in *Stanjehughesia*.

In contrast to *St. obclavorostrata*, conidia of *St. hormiscioides* are cylindrical-fusoid to subcylindrical and larger, i.e.  $65\text{--}270 \times 10\text{--}17 \mu\text{m}$  (Ellis 1958, 1976; Hughes & Illman 1974). Hughes (1958) observed that the conidia of *St. hormiscioides* are morphologically very variable; some specimens produced long conidia with subulate distal ends (conidia in an European collection were up to  $400 \mu\text{m}$  long), while in other specimens the conidia are shorter and more cylindrical with a broad blunt apex.

*Stanjehughesia curviapicis* is distinguished by its hamate conidia with a characteristic curved or circinate apex, which are also narrower than those of *St. obclavorostrata*. The conidia of a specimen of *St. curviapices* described as *Janetia curviapices* Goh & K.D.Hyde measure  $65\text{--}100 \times 5.5\text{--}7.5 \mu\text{m}$  (Goh & Hyde 1996) while those of the specimen described as *St. hamatiella* measure  $70\text{--}140 \times 7\text{--}8.5 \mu\text{m}$  (Wu & Zhuang 2005).

*Stanjehughesia obclavorostrata* also slightly resembles *St. fasciculata* J.Mena, G.Delgado & Guarro, *St. fusiformis* W.P.Wu, *St. polypora* W.P.Wu and *St. ventricosa*

Marinc., M.J.Wingf. & Crous. However, conidia of *St. fasciculata* are smaller ( $70\text{--}100 \times 9\text{--}10.5 \mu\text{m}$ ) and have a globose mucilaginous appendage at the apex (Mena et al. 2001, Wu & Zhuang 2005); in *St. fusiformis* they are shorter and narrower ( $6\text{--}8\text{-septate}, 65\text{--}85 \times 7\text{--}8 \mu\text{m}$ ) (Wu & Zhuang 2005); conidia of *St. polypora* are longer ( $110\text{--}165 \mu\text{m}$  long) and conidial cells have a germ pore (Wu & Zhuang 2005); while those of *St. ventricosa* are somewhat similar in size and septal number, but the basal cell is not darker than the rest (Marincowitz et al. 2008).

Some species described in *Janetia* could belong to *Stanjehughesia*, mainly after Goh & Hyde (1996) who modified Ellis' original generic concept of *Janetia* to include species with simple conidiophores or synnemata, monoblastic or polyblastic, denticulate conidiogenous cells, and euseptate or distoseptate, and obclavate or cylindrical conidia. Among species of *Janetia* with a darker conidial basal cell, *J. capnophila* S.Hughes is comparable with *St. obclavorostrata* by their similar conidial morphology. However, *J. capnophila* is associated with sooty moulds, its conidia germinate at the apex to produce a hypha frequently anastomosing with other conidia, and several conidial cells may become conidiogenous (Hughes 1983).

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