



The genus *Podospora* (Lasiosphaeriaceae, Sordariales) in Brazil

Melo RFR¹, Miller AN² and Maia LC¹

¹Universidade Federal de Pernambuco, Departamento de Micologia, Centro de Ciências Biológicas, Avenida da Engenharia, s/n, 50740–600, Recife, Pernambuco, Brazil. rogerfrmelo@gmail.com

²Illinois Natural History Survey, University of Illinois, 1816 S. Oak St., Champaign, IL 61820

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Abstract

Coprophilous species of *Podospora* reported from Brazil are discussed. Thirteen species are recorded for the first time in Northeastern Brazil (Pernambuco) on herbivore dung. *Podospora appendiculata*, *P. australis*, *P. decipiens*, *P. globosa* and *P. pleiospora* are reported for the first time in Brazil, while *P. ostlingospora* and *P. prethopodalis* are reported for the first time from South America. Descriptions, figures and a comparative table are provided, along with an identification key to all known species of the genus in Brazil.

Key words – Ascomycota – coprophilous fungi – taxonomy

Introduction

Podospora Ces. is one of the most common coprophilous ascomycetes genera worldwide, rarely absent in any survey of fungi on herbivore dung (Doveri, 2008). It is characterized by dark coloured, non-stromatic perithecia, with coriaceous or pseudobombardioid peridium, vestiture varying from glabrous to tomentose, unitunicate, non-amyloid, 4- to multispored asci usually lacking an apical ring and transversely uniseptate two-celled ascospores, delimitating a head cell and a hyaline pedicel, frequently equipped with distinctly shaped gelatinous caudae (Lundqvist, 1972). Most species are coprophilous, living in dung of many herbivores.

For a historical summary regarding the nomenclature of *Podospora*, refer to Lundqvist (1972) and Cain (1934). According to the former author, the genus circumscription is based on: presence of a basal pedicel usually collapsing, clavate shape of the young ascospores and lack of a thickened apical ring in the asci. Huhndorf et al. (2004) circumscribed the Lasiosphaeriaceae as a paraphyletic "lasiosphaeriaceous complex", which included *Podospora* and 23 additional genera based on morphology or molecular analyses using partial sequences of the nuclear large-subunit (LSU) rDNA. Species with swollen agglutinated perithecial hairs and long persistent pedicels, previously placed in *Podospora*, are now treated in *Schizothecium* Corda, which has been supported by phylogenetic analyses (Huhndorf et al., 2004; Miller & Huhndorf, 2004; Cai et al., 2005; Krays et al., 2015). Thus, this genus is not covered in this work.

In Brazil, *Podospora*, as well as many other Sordariales, has received little attention. Some collectors have sent material to specialists around the world, such as Roy Franklyn Cain and Nils Lundqvist, which resulted in few records throughout the literature (Cain, 1962; Lundqvist, 1972). During a visit in 1998, Richardson (2001) recorded four species: *P. argentinensis*, *P. communis*, *P.*

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Corresponding Author: Roger Fagner Ribeiro Melo – e-mail – rogerfrmelo@gmail.com

Andrew Nicholas Miller – e-mail – amiller7@illinois.edu

Leonor Costa Maia – e-mail – leonorcmaia@gmail.com

inflatula, and *P. pauciseta*, along with an unidentified large-spored species from a small number of dung samples collected at Bonito and Pantanal do Rio Negro, Mato Grosso do Sul.

In the present work, *Podospora* species recorded in herbivore dung in Brazil from a study of herbaria and literature are discussed, along with significant recent additions from fresh material collected in Pernambuco. An identification key to all species recorded in the country is also provided.

Materials & Methods

In order to access the extent of the diversity of these fungi, dung samples were collected on farms in Recife, Caruaru and Serra Talhada, and in a Zoological park in Recife, State of Pernambuco, Northeastern Brazil. Samples were collected in clean plastic bags, taken to the laboratory and incubated in moist chambers at room temperature ($28^{\circ}\text{C} \pm 2^{\circ}\text{C}$) for at least 75 days under alternating natural light and dark periods. Material was observed directly from substrata with the aid of a stereomicroscope, and perithecia were mounted in tap water, Indian ink, Congo red, lactophenol with cotton blue or Polyvinyl-Lacto-Glycerol for identification under a light microscope. Species were identified based on macroscopic and microscopic structures according to Cain (1962), Mirza & Cain (1969), Lundqvist (1972), Bell (1983, 1995), Richardson & Watling (1997) and Doveri (2004), except in cases where more recent work was available. A careful literature revision and a survey of national herbaria were performed to access information regarding older records of *Podospora* in Brazil. High resolution images of morphological characters were taken with an Olympus QColor 3 digital camera mounted on an Olympus BX51 microscope equipped with bright-field and Nomarski interference optics. Permanent slides were mounted and deposited in URM (Pe. Camille Torrend Herbarium, Universidade Federal de Pernambuco, Recife, Brazil). For a full list of species synonyms, see Index Fungorum online database (<http://www.indexfungorum.org/>). Additional information regarding all records and deposited specimens along with high quality micrographs are available at the "INCT - Herbário Virtual da Flora e dos Fungos" database website (<http://inct.florabrasil.net/>).

Results

Fourteen species were identified from fresh material. An identification key to all known species of *Podospora* from Brazil is provided. A comparative table is presented, showing key morphological characters used to distinguish these species (Table 1). The unverified material was either unavailable or was too poor to allow an appropriate determination.

Table 1 Characteristics of *Podospora* species in Brazil

Species	Head cellsize	Asci	Apical cauda	Basal cauda
<i>P. appendiculata</i>	27.5-30 × 12.5-15 μm	8-spored	Single, lash-like, subapical	Single, lash-like, distal
<i>P. australis</i>	57.5 × 25-30.5 μm	4-spored	Single, pleated, subapical	Single, pleated, covering the small pedicel
<i>P. communis</i>	32.5-40 × 16.5-20 μm	8-spored	Four independent, cylindrical, subapical	Four independent, cylindrical, proximal
<i>P. curvicolla</i>	15-17.5 × 8.5-10 μm	Multispored	Single, lash-like, fugacious, apical	Single, lash-like, fugacious, distal
<i>P. decipiens</i>	35-42 × 17.5-22.5 μm	8-spored	Single, cylindrical to doliform, lamellate, apical	Several, in a lyre-shaped tuft, proximal
<i>P. fimiseda</i>	52.5-55 × 27.5-30 μm	8-spored	Single, lash-like, with channels, subapical	Single, lash-like, with channels, distal
<i>P. globosa</i>	35-40 × 20-25 μm	8-spored	Gelatinous sheath surrounding the whole spore	Gelatinous sheath surrounding the whole spore
<i>P. inflatula</i>	27.5-30 × 12.5-15 μm	8-spored	Single, lash-like, subapical	Single, lash-like, distal
<i>P. longicaudata</i>	40-47.5 × 22.5-25 μm	8-spored	Several in one tuft, covering the head cell	Several in one tuft, distal
<i>P. ostlingospora</i>	52-57.5 × 25-27.5 μm	8-spored	Several in two tufts not covering the head cell	Single, lash-like, distal
<i>P. pauciseta</i>	35-37.5 × 17.5-19.5 μm	4-spored	Single, cylindrical, subapical	(1) terminal, single, distal; (2) lateral, 2-4, proximal
<i>P. pleiospora</i>	30-35 × 17.5-22.5 μm	16-32-spored	Single, lash-like, lamellate, apical	2-3, lash-like, proximal

Key to known species of *Podospora* from Brazil

- 1. Asci 4-spored 2
- 1. Asci with more than 4 spores..... 3

- 2. Head cells 35-37.5 × 17.5-19.5 μm. Asci occasionally slightly constricted in the middle. Pedicel well developed *P. pauciseta*
- 2. Head cells 50-57.5 × 25-30.5 μm. Asci not constricted. Pedicel poorly developed*P. australis*

- 3. Perithecia with black tubercles near the base of the neck. Apical caudae with longitudinal lamellae and basal caudae attached to the pedicel base 4
- 3. Perithecia without black tubercles near the base of the neck. Above combined characters not present..... 6

- 4. Asci 16-spored. Head cells 30-35 × 17.5-22.5 μm..... *P. pleiospora*
- 4. Asci 8-spored. Head cells otherwise 5

- 5. Head cells 35-42 × 17.5-22.5 μm *P. decipiens*
- 5. Head cells 26-34 × 12-20 μm *P. argentinensis*

- 6. Ascospores surrounded by a thin gelatinous sheath. Caudae absent *P. globosa*
- 6. Gelatinous sheath surrounding the spores not observed. Caudae present 7

- 7. Ascospores with more than one apical or basal cauda 8
- 7. Ascospores with only one apical and one basal cauda 12

- 8. Asci 64-spored. Ascospores with small caudae attached to the pedicel base *P. brasiliensis*
- 8. Asci 8-spored. Caudae not as above 9

- 9. Gelatinous equipment of ascospores composed of four subapical caudae attached to the head cell and four basal caudae attached to the pedicel distal end *P. communis*
- 9. Gelatinous equipment of ascospores composed of multiple caudae (more than four), both on the head cell and on the pedicel..... 10

- 10. Cauda split into two tufts, not surrounding the head cell *P. ostlingospora*
- 10. Cauda tuft single, surrounding the head cell 11

- 11. Cauda long, up to 250 μm long *P. longicaudata*
- 11. Cauda very short, up to 3 μm long *P. immersa*

- 12. Perithecia with a few long flexuous, septate hairs just below the neck. Ascospores with long clavate pedicels, distally swollen *P. dolichopodalis*
- 12. Perithecia with different vestiture. Ascospores with cylindrical pedicels, not distally swollen . 13

- 13. Perithecia with tufts of setose, agglutinated, non-inflated hairs, concentrated on the neck, evenly pigmented 14
- 13. Perithecia with non-setose, non-agglutinated hairs, which can be apically inflated or not, scattered over the entire ascomata, becoming hyaline towards the tip 15

- 14. Asci (128?-)256(-512?) -spored. Pedicels obclavate, non-constricted *P. curvicolla*

14. Asci 8-spored. Pedicels cylindrical, with a conspicuous constriction, delimiting an inflated basal part and a slightly inflated apical part *P. prethopodalis*
15. Perithecial wall pseudobombardioid 16
15. Perithecial wall membranaceous 17
16. Head cells $27.5-30 \times 12.5-15 \mu\text{m}$ *P. appendiculata*
16. Head cells $52.5-55 \times 27.5-30 \mu\text{m}$ *P. fimiseda*
17. Hairs apically inflated *P. inflatula*
17. Hairs not inflated *P. longispora*

Taxonomy

Podospora appendiculata (Auersw. ex Niessl) Niessl, Hedwigia 22: 156 (1883) Fig. 1, A–C
 Basionym: *Sordaria appendiculata* Auersw. ex Niessl (1870)

Perithecia scattered to isolated, superficial, ovoid to subellipsoid, with unclear delimitation between body and neck, light brown to dark brown, darkening towards the neck, $690-775 \times 400-550 \mu\text{m}$, covered by setose, rigid, sparse, septate, cylindrical hairs, with obtuse ends, olivaceous brown, becoming lighter towards the distal tip, finally hyaline at the apex, $2.5-3.5 \mu\text{m}$ thick, slightly thicker at the distal tip, up to $5 \mu\text{m}$, $62.5-75 \mu\text{m}$ long. Neck carbonaceous, dark brown to black, smooth, glabrous. Peridium pseudobombardioid, translucent, 4-layered, outermost layer *textura angularis*, with flattened cells, thin-walled, $4.5-15 \mu\text{m}$. Paraphyses intertwined with the asci, ventricose, persistent or collapsing in maturity. Asci 8-spored, clavate, broader at the center, $200-230 \times 32.5-37.5 \mu\text{m}$, usually persistent, rounded at apex, with a long stipe. Ascospores irregularly biserial, hyaline and fusoid to clavate at first, smooth, becoming transversely septate at maturity; head cell ellipsoid, slightly umbonate at apex, truncate at base, equilateral, aseptate, dark brown to black, with an apical germ pore, $27.5-30 \times 12.5-15 \mu\text{m}$, smooth; pedicel cylindrical to obconical, usually collapsing, $12.5-17.5 \times 5-6.5 \mu\text{m}$; apical cauda single, lash-like, attached to the apical or subapical part of the head cell, usually covering the germ pore, $45-47.5 \times 5.5-7.5 \mu\text{m}$, smooth, persistent or collapsing in mounting; basal cauda single, morphologically similar to the apical caudae, slightly thinner, attached to the base of the pedicel, $45-47.5 \times 3.5-5 \mu\text{m}$, usually collapsing in mounting.

Habitat – Recorded on dung of many herbivores.

Known distribution – Central America (Costa Rica), Europe (Belgium, Czech Republic, Denmark, England, Finland, France, Germany, Iceland, Ireland, Italy, Norway, Scotland, Sweden), North America (Canada, Greenland, USA) and Oceania (Australia, New Zealand). This is the first record from Brazil (*see the discussion under "Podospora longispora"*).

Material examined – Brazil, Pernambuco, Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 31 Jul 2012, R.F.R. Melo (URM86729a, 86729b, 86729c), 29 Nov 2011, R.F.R. Melo (URM86730a, 86730b), on cattle dung, 28 Jan 2013, R.F.R. Melo (URM86731).

Notes – *Podospora appendiculata* was commonly found in samples collected in Recife, but absent in collections from the semi-arid region. It is distinguished by its superficial perithecia with a pseudobombardioid wall and stiff, septate perithecial hairs with a hyaline apex. Perithecia of *P. fimiseda* show a similar morphology regarding the wall and hairs, but can be easily differentiated by the larger ascospore head cells ($48-60 \times 27-31 \mu\text{m}$). *Podospora inflatula* and *P. australis* are also similar, but perithecia are clearly separated into a body and neck and have membranaceous walls. *Podospora australis* has perithecial hairs solely on the neck and four ascospores per ascus, with head cells considerably larger.

Podospora australis (Speg.) Niessl, Hedwigia 22: 156 (1883) Fig. 1, C
 Basionym: *Hypocopa australis* Speg., Anal. Soc. cient. argent. 10(3): 137 (1880)

Perithecia scattered to isolated, immersed to semi-immersed, obpyriform, light brown to olivaceous brown, darkening towards the neck to finally black, 650-850 × 390-440 µm, sparsely covered by flexuous, septate, smooth hairs, light brown in color, 2-2.5 µm thick. Neck cylindrical, carbonaceous, dark brown to black, smooth, opaque, 190-200 × 180-190 µm, adorned with smooth, simple or branched, rigid, cylindrical, septate, hairs, acute to obtuse tipped, light brown, becoming lighter towards the distal end to finally hyaline, 2.5-3.5 µm thick, extending for up to 60 µm. Peridium membranaceous, translucent, 3-layered, outermost layer *textura angularis*, with flattened cells, thin-walled, 5-12.5 µm long. Paraphyses interspersed with the asci, filiform, usually persistent. Asci 4-spored, cylindrical-clavate, 260-300 × 37.5-45 µm, usually persistent, with a rounded apex and a long stipe. Ascospores uniseriate, at first hyaline, clavate to saccate, aseptate, smooth, later becoming swollen in the upper portion; head cell ellipsoid, with apical germ pore and rounded base, equilateral, aseptate, luteous, light brown, dark brown or black, 57.5 × 25-30.5 µm, smooth; pedicel absent or, when present, reduced, diminished, obconical, up to 2.5 µm in length, hyaline or slightly pigmented; apical cauda cylindrical, gradually decreasing in diameter towards the apex, provided with multiple internal channels, marked by segments along its length, pleated, adhered to the subapical part of the head cell, not covering the germ pore, 175-215 × 7.5-10 µm, persistent; basal cauda symmetrical, covering the pedicel when present, devoid of internal channels, pleated, 150-210.5 × 10-12.5 µm, persistent.

Habitat – Recorded on dung of many herbivores.

Known distribution – Despite being worldwide, this is the first record for Brazil.

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agrônômico de Pernambuco (IPA), on goat dung, 30 Sep 2011, R.F.R. Melo (URM86732a, 86732b).

Notes – *Podospora australis* is unique in having 4-spored asci bearing ascospores with large head cells (50-57.5 × 25-30.5 µm) with a rounded base, unlike the truncated base usually observed in other *Podospora* species, reduced (or absent) pedicels, along with persistent and pleated caudae. It is distinguished from other 4-spored species such as: *Schizothecium nanum* and *S. tetraspora* by the size of the ascospores and by the absence of inflated swollen hairs on the perithecium; *P. inequalis* by the presence of a gelatinous apparatus in the ascospores; and *P. pauciseta* by the reduced state of the pedicel. Doveri (2004) presents an identification key for the 4-spored members of *Podospora* and *Schizothecium*.

Podospora communis (Speg.) Niessl, Hedwigia 22: 156 (1883)

Fig. 1, D–F

Basionym: *Hypocopra communis* Speg., Anal. Soc. cient. argent. 10(1): 14 (1880)

Perithecia scattered to isolated, semi-immersed, obpyriform, 770-800 × 370-450 µm; body dark brown to black, glabrous or covered by slender and flexuous hairs, olivaceous brown, 2-2.5 µm thick. Neck cylindrical, carbonaceous, blackening near the apex, opaque, 250-360 × 140-150 µm, smooth, glabrous, usually markedly extending towards the light, becoming bend to crooked. Peridium membranaceous, subopaque, 3-layered, outermost layer *textura angularis*, with thick-walled cells, 5-9.5 µm long. Paraphyses interspersed with the asci, ventricose, persistent or collapsing. Asci 8-spored, clavate, 240-255 × 45-55 µm, usually persistent, with narrowed, truncated apex and a long stipe. Ascospores biseriate, at first hyaline, clavate, aseptate, smooth, later becoming swollen in the upper portion; head cell ellipsoid, slightly umbonate at apex, truncate at base, aseptate, reddish brown to dark brown, with an apical germ pore, 32.5- 40 × 16.5-20 µm, smooth; pedicel cylindrical, persistent or collapsing, 6.5-7.5 × 25-28.5 µm; apical gelatinous equipment composed of four hyaline, cylindrical apical caudae, gradually decreasing in diameter towards the apex, attached to the upper part of the head cell, 20-25 × 4-5 µm, smooth, persistent or collapsing; basal gelatinous equipment composed of four hyaline caudae, similar to the apical caudae in morphology, but shorter, attached to the base of the pedicel, 2-5 × 1-3 µm, persistent or collapsing.

Habitat – Recorded on dung of many herbivores.

Known distribution – Worldwide.

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agrônômico de Pernambuco (IPA), on cattle dung, 07 Oct 2011, R.F.R. Melo (URM86733), 03 Mar 2012, R.F.R. Melo (URM86734), 03 Sep 2012, R.F.R. Melo (URM86735), Serra Talhada, Instituto Agrônômico de Pernambuco (IPA), 30 Apr 2013, R.F.R. Melo (URM86736), Recife, Universidade Federal Rural de Pernambuco (UFRPE), on cattle dung, 02 May 2012, R.F.R. Melo (URM86737).

Notes – As its epithet implies, *Podospora communis* was found to be common and widespread in herbivore dung in Pernambuco, mainly occurring on the dung of domesticated animals. It is recognized by its glabrous perithecium, strongly phototropic neck and ascospores with a gelatinous apparatus composed of four subapical caudae at the head cell and four caudae at the end of the pedicel. It differs from other multicaudate species such as *P. immersa* and *P. ostlingospora* by having only four apical and four basal caudae.

Podospora curvicolla (G. Winter) Niessl, Hedwigia 22: 156 (1883)

Fig. 1, H–J

Basionym: *Sordaria curvicolla* G. Winter 1871

Perithecia scattered to isolated, semi-immersed to immersed, obpyriform, light brown, becoming darker and finally black at the neck, 400–560 × 380–450 μm, covered by long, flexuous, brown hairs, 2–3 μm thick. Neck cylindrical, 100–170 × 80–150 μm, with tufts of long, cylindrical, setose, agglutinated hairs, extending up to 400 μm long. Peridium membranaceous, opaque to subopaque, without clear distinction between layers, outermost layer *textura angularis*. Asci (128–?)256(?–512)-spored, saccate to clavate, stipitate, 200–320 × 70–115 μm. Ascospores multiseriate, hyaline, clavate or rod-shaped when immature, later becoming swollen in the upper part; head cell ellipsoid, truncated at base, with an apical germ pore, olivaceous brown to dark brown, 15–17.5 × 8.5–10(–11.5) μm, equilateral; pedicel obclavate, 5–7 × 2–3 μm, usually collapsing; gelatinous equipment comprised of single lash-like caudae on the apical and basal ends of the spore, fugacious, hardly observable in the material examined.

Habitat – Recorded on dung of many herbivores.

Known distribution – Europe (Belgium, Germany, Hungary, Italy, Poland, Scotland, Sweden), North America (Canada, USA), South America (Brazil, *see* 'Notes').

Material examined – Brazil, Pernambuco, Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 13 Mar 2012, R.F.R. Melo (URM86738, 86739).

Notes – Among the multispored species of *Podospora*, *P. curvicolla* differs from members of *Schizothecium* in having setose hairs around the neck, *P. araneosa* by having ascospores with larger head cells (8.5–10 × 15–17.5 μm), and *P. setosa* and *P. bifida* by having perithecial hairs forming tufts. Lundqvist (1972) mentions that Batista & Pontual had described and identified *Philocopra coprophila* from the material that, although he was not able to examine, he believed to be a specimen of *P. curvicolla* and recommends its position as *nomem dubium*. *Podospora curvicolla* was recorded in Pernambuco, Brazil, by Melo et al. (2012).

Podospora decipiens (G. Winter ex Fuckel) Niessl, Hedwigia 22: 156 (1883)

Fig. 1, K–M

Basionym: *Sordaria decipiens* G. Winter, Abh. naturforsch. Ges. Halle 13(1): 28 (1873)

Perithecia scattered, semi-immersed to superficial, obpyriform, olive brown, becoming darker and finally black at the neck, 500–950 × 300–490 μm, glabrous or covered by slender, flexuous hairs, olive brown, 1.5–2.5 μm thick. Neck cylindrical, carbonaceous, opaque, 200–320 × 150–160 μm, smooth, adorned throughout its length by dark brown to black thick-walled tubercles, numerous, obtuse, straight or sinuous, 10–20 × 4.5–5 μm, densely clustered in the neck, giving it a strongly carbonaceous texture, becoming gradually and progressively sparse in the upper body, absent in the lower part of the ascoma. Peridium membranaceous, subopaque, 3-layered, outermost layer *textura angularis*, with thick-walled cells, 7.5–12.5 μm long. Paraphyses interspersed with the asci, ventricose, usually persistent. Asci 8-spored, clavate, 300–330 × 45–47.5 μm, with narrowed truncate apex and a long stipe. Ascospores biseriolate, hyaline when immature, later becoming swollen in the upper portion; head cell ellipsoid, slightly apiculated at apex, truncate at base, aseptate, reddish brown to dark brown, with a subapical germ pore, 35–42 × 17.5–22.5 μm, smooth;

pedicel cylindrical, persistent or collapsing, $50-60 \times 5-7.5 \mu\text{m}$, with a slight distal swelling in some ascospores; apical caudae cylindrical to doliform, lamellate, attached to the apex of the head cell, $20-25 \times 10-12.5 \mu\text{m}$, smooth, persistent or collapsing, not covering the germ pore; basal caudae numerous, in a lyre-shaped tuft, attached to the proximal end of the pedicel, up to $10-12.5 \mu\text{m}$ in length, usually collapsing.

Habitat – Recorded on dung of many herbivores.

Known distribution – Despite being worldwide, this is the first record for Brazil.

Material examined – Brazil, Pernambuco, Recife, Universidade Federal Rural de Pernambuco (UFRPE), on goat dung, 05 May 2012, R.F.R. Melo (URM86740a, 86740b).

Notes – *Podospora decipiens*, a commonly recorded species in herbivore dung, is similar to *P. pleiospora* and *P. myriasporea*, especially due to the presence of black tubercles on the neck and the similarity of the ascospore caudae. It differs from the former by the number of ascospores per ascus (eight) and from the latter by the significantly larger head cells ($17.5-22.5 \times 35-40 \mu\text{m}$ in *P. myriasporea*). Lundqvist (1972) did not observe any material of *P. decipiens* from the tropics.

Podospora fimiseda (Ces. & De Not.) Niessl, Hedwigia 22: 156 (1883)

Fig. 1, N–O

Basionym: *Sordaria fimiseda* Ces. & De Not., Comm. Soc. crittog. Ital. 1: 226 (1863)

Perithecia gregarious to isolate, superficial, obpyriform, $690-930 \times 510-580 \mu\text{m}$, olive brown, becoming darker and finally black at the neck, sparsely covered by stiff, septate, cylindrical hairs, hairs obtuse ended, thick-walled, olivaceous brown, becoming lighter toward the distal end to finally hyaline at the tip, $3-3.5 \mu\text{m}$ thick, up to $85 \mu\text{m}$ long. Neck cylindrical, carbonaceous, $150-205 \times 200-225.5 \mu\text{m}$. Peridium pseudobombardioid, subopaque, coriaceous, 4-layered, outermost layer *textura angularis*, cells flattened, thin-walled. Paraphyses interspersed with the asci, ventricose, persistent or collapsing. Asci 8-spored, clavate, wider at the medial portion of the sporiferous part, $385-405 \times 50-60 \mu\text{m}$, usually persistent, with truncated apex and a long stipe. Ascospores irregularly biserial, hyaline when immature, fusoid to clavate, later becoming swollen in the upper portion; head cell ellipsoid, slightly umbonate apex, truncate at base, equilateral, aseptate, reddish brown to dark brown, with an apical germ pore, $52.5-55 \times (25-27.5-30 \mu\text{m})$, smooth; pedicel cylindrical, persistent, $30-35 \times 5-7.5 \mu\text{m}$, slightly thickened in the distal end, $7.5-8.5 \mu\text{m}$; apical caudae lash-like, with internal channels; basal caudae similar in morphology, shorter and slightly thinner, attached to the base of the pedicel.

Habitat – Recorded mainly on dung of domestic herbivores.

Known distribution – Africa (Liberia), Asia (China), Central America (Puerto Rico), Europe (Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Italy, Norway, Poland, Romania, Russia, Scotland, Spain), South America (Brazil, Chile, Venezuela), North America (USA, Canada), Oceania (Australia, New Zealand).

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agronômico de Pernambuco (IPA), on horse dung, 16 Oct 2011, R.F.R. Melo (URM86741).

Notes – *Podospora fimiseda* may initially be confused with *P. appendiculata* due to the pseudobombardioid peridium and perithecia covered with hyaline-tipped hairs. However, the former differs markedly from the latter by having perithecia with a clear delineation between the body and neck and ascospores with head cells significantly larger ($52.5-55 \times 27.5-30 \mu\text{m}$). *Podospora australis* possesses hairs with similar morphology, but has four ascospores per ascus, reduced or absent pedicel and different caudae.

Podospora globosa (Masse & E.S. Salmon) Cain, Can. J. Bot. 40: 460 (1962)

Fig. 1, P

Basionym: *Sordaria globosa* Masse & E.S. Salmon, Ann. Bot., Lond. 15: 334 (1901)

Perithecia scattered, partially immersed on dung, obpyriform, light brown to olivaceous, becoming darker and finally black at the neck, $600-700 \times 500-600 \mu\text{m}$. Neck roughly cylindrical, opaque, glabrous. Peridium membranaceous, becoming carbonaceous, subopaque, 3-layered, outermost layer *textura angularis*, cells $7.5-12.5 \mu\text{m}$. Asci 8-spored, clavate, rounded at apex, with a short stipe, $270-350 \times 30-40 \mu\text{m}$. Ascospores biserial, hyaline when immature, fusoid to clavate,

later becoming swollen in the upper portion; head cell ellipsoid, truncate at base, with an apical germ pore, dark brown to black, (32.5-)35-40 × (17.5-)20-25 μm, smooth, equilateral; pedicel cylindrical, (21-)22.5-37.5 × 5-7 μm, usually persistent; gelatinous sheath surrounds the entire spore, ~2.5-4.5 μm thick, hyaline.

Habitat – Recorded on dung of many herbivores.

Known distribution – Europe (England, Spain, Sweden) and North America (Canada). This is the first record for South America.

Material examined – Brazil, Pernambuco, Recife, Horto Zoobotânico do Parque Estadual Dois Irmãos, on llama dung, 17 Mar 2010, R.F.R. Melo (URM82322), on deer dung, 22 Mar 2010, R.F.R. Melo (URM82323, 82324).

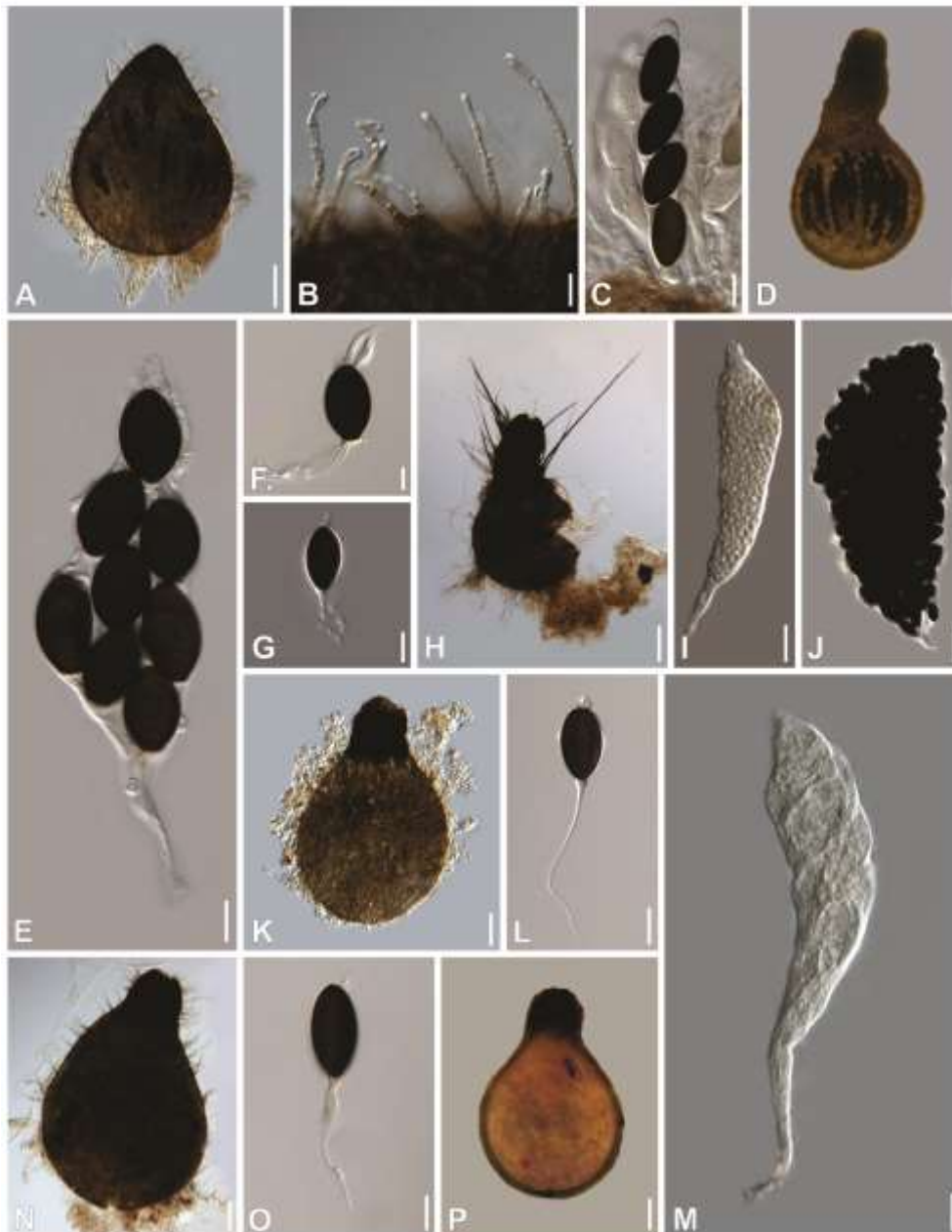


Fig. 1 – *Podospora appendiculata*. (A) Perithecium (bar = 150 μm), (B) rigid, hyaline-tipped perithecial hairs (bar = 10 μm). *Podospora australis*. (C) Ascus with four mature ascospores (bar = 25 μm). *Podospora communis*. (D) Perithecium (bar = 100 μm), (E) mature ascus (bar = 10 μm), (F) ascospore (bar = 12.5 μm). *Podospora curvicolla*. (G) Ascospore (bar = 7.5 μm), (H) perithecium (bar = 100 μm), (I) immature ascus (bar = 35 μm), (J) mature ascus (bar = 35 μm).

Podospora decipiens. (K) Perithecium (bar = 100 µm), (L) ascospore (bar = 20 µm), (M) immature ascus (bar = 25 µm). *Podospora fimiseda*. (N) Perithecium (bar = 100 µm), (O) ascospore (bar = 20 µm). *Podospora globosa*. (P) Perithecium (bar = 100µm).

Notes – *Podospora globosa* is an atypical member of the genus by having a conspicuous gelatinous layer surrounding the entire ascospore, similar to that seen in *Sordaria*. The long pedicel (22.5-37.5 µm), glabrous perithecial neck and the biseriate organization of ascospores are other important distinguishing characters of this species.

Podospora inflatula Cain, Can. J. Bot. 40: 454 (1962)

Fig. 2, A–B

Perithecia scattered to gregarious, superficial, obpyriform, 550-650 × 390-410 µm, olive brown, becoming darker to finally black towards the neck, covered along its entire length by sparse, septate, cylindrical, setose hairs, thick-walled, becoming clearly inflated at the apex, initially olivaceous brown, becoming lighter towards the distal end to finally hyaline, 3.5-5 µm thick near the base, swelling up to 8-8.5 mm thick at the apex, extending up to 70 µm long. Neck cylindrical, carbonaceous, opaque, 90-120 × 100-110 µm, smooth, glabrous. Peridium pseudobombardioid, subopaque, 3-layered, outermost layer *textura angularis*, cells flattened, thin-walled. Paraphyses ventricose, usually persistent. Asci 8-spored, clavate, slightly wider at the medial portion of the sporiferous region, 150-200 × (20-)25-32.5 µm, usually persistent, narrowed and rounded above, with a long stipe. Ascospores irregularly biseriate, hyaline when immature, fusoid, later becoming swollen in the upper portion; head cell ellipsoid, slightly umbonate at apex, truncate at base, equilateral, asseptate, reddish brown to dark brown, with an apical germ pore, 27.5-30 × 12.5-15 µm, smooth; pedicel cylindrical, persistent or collapsing, 25-30 × 5-6 µm; apical caudae lash-like, with internal channels, attached to the subapical portion of the head cell, 20-35 × 5-5.5 µm; basal caudae similar in morphology, shorter and thinner, adhered to the base of the pedicel, ~1-1.5 mm diam.

Habitat – Recorded on horse dung.

Known distribution – Central America (Mexico), Oceania (Society Islands) and South America (Brazil).

Material examined – Brazil, Pernambuco, Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 12 Mar 2012, R.F.R. Melo (URM86742), 13 Mar 2012, R.F.R. Melo (URM86743a, 86743b).

Notes – *Podospora inflatula* possesses perithecial hairs that are similar to those in *P. fimiseda* and *P. appendiculata*, but can be distinguished by the capitate apices. It differs from *P. fimiseda* by having ascospores with shorter head cells (27.5- 30 × 12.5-15 vs. 52.5-55 × 27.5-30 µm), and from *P. appendiculata* by having obpyriform perithecia, with a clear distinction between the body and neck. It was recorded on incubated cattle dung collected in Rio Grande do Sul, Brazil by Cain (1962).

Podospora longicaudata (Griffiths) Cain, Can. J. Bot. 40: 460 (1962)

Fig. 2, C–D

Basionym: *Pleurage longicaudata* Griffiths, Mem. Torrey bot. Club 11: 81 (1901)

Perithecia scattered to gregarious, semi-immersed, obpyriform, 610-650 × 500-560 µm, olivebrown, becoming black towards the neck, glabrous or covered by slender, flexuous, olivaceous hairs, 2-3 µm thick. Neck cylindrical, carbonaceous, black near the ostiole, opaque, 150-175 × 130-145 µm, smooth, glabrous. Peridium membranaceous, subopaque, 3-layered, outermost layer *textura angularis*, with thin-walled cells, 4.5-10 µm long. Paraphyses interspersed with asci, ventricose, usually collapsing. Asci 8-spored, clavate, 250-295 × 30-42.5 µm, with narrowed truncated apex and a long stipe. Ascospores biseriate, hyaline when immature, clavate, later becoming swollen in the upper portion; head cell ellipsoid, slightly umbonate at apex, slightly truncate at base, aseptate, reddish brown to dark brown, with an apical germ pore, 40-47.5 × 22.5-25 µm, smooth; pedicel clavate to cylindrical, persistent or collapsing, 35-40 × 6.5-7.5 µm; apical caudae numerous, hyaline, slender, attached to the apex of the head cell, assuming a conical shape,

extending up to 250 µm long, smooth, persistent or collapsing; basal caudae similar in morphology, attached to the base of the pedicel, slender, 2-3 mm thick, persistent or collapsing.

Habitat – Recorded on dung of domestic herbivores.

Known distribution – Asia (Pakistan), Central America (Mexico, Puerto Rico), North America (Canada) and South America (Brazil).

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agrônômico de Pernambuco (IPA), on goat dung, 07 Oct 2011, R.F.R. Melo (URM86744).

Notes – *Podospora longicaudata* is distinguished by its glabrous perithecia with ascospores adorned by two conical crowns composed of several caudae at the head cell. *Podospora communis*, which also has multiple basal and apical caudae, differs from *P. longicaudata* in that the caudae do not form mucilaginous crowns on the ascospores. Mirza & Cain (1969) emphasized the great variation in the ascospore measurements in this species (40-47.5 × 22.5-25 µm in the examined material).

Podospora ostlingospora Cain, Can. J. Bot. 40: 456 (1962)

Fig. 2, E

Perithecia scattered, immersed, obpyriform, 870-900 × 650-700 µm, faintly reddish brown, glabrous or covered by slender, flexuous, dark brown hairs, 2-2.5 µm thick. Neck cylindrical, carbonaceous, black near the ostiole, opaque, 230-250 × 150-155 µm, smooth, glabrous. Peridium membranaceous, subopaque, outer layer *textura angularis*, cells thick-walled. Paraphyses interspersed with asci, ventricose, usually collapsing. Asci 8-spored, clavate, 285-340 × 50-60 µm, with truncated narrowed apex and a long stipe. Ascospores biseriate, hyaline when immature, clavate, later becoming swollen in the upper portion; head cell fusoid to long-ellipsoid, slightly umbonate at apex, truncate at base, aseptate, reddish brown to dark brown, with an apical germ pore, 52-57.5 × 25-27.5 µm, smooth to slightly rough; pedicel subclavate to cylindrical, hyaline or rarely pigmented, persistent or collapsing, 27.5-32.5 × 6.5-7.5 µm, usually with slight distal swelling; apical caudae numerous, split into two tufted tails, usually united, attached to the apex of the head cell, assuming a roughly conical shape, smooth, persistent or collapsing; basal cauda single, cylindrical, smooth, attached to the base of the pedicel, usually collapsing.

Habitat – Recorded on goat and horse dung.

Known distribution – Central America (Mexico). This is the first record from South America.

Material examined – Brazil, Pernambuco, Serra Talhada, Instituto Agrônômico de Pernambuco (IPA), on horse dung, 09 Jan 2012, R.F.R. Melo (URM86745), Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 11 Mar 2013, R.F.R. Melo (URM86746).

Notes – *Podospora ostlingospora* differs from other species of the genus by the head cell shape, fusoid to long-ellipsoid, and size (52-57.5 × 25-27.5 µm), and by the two tufts of caudae at the apical end. *Podospora longicaudata* differs in having a single tuft of caudae. *Podospora ostlingospora* was first described by Cain (1962) from material growing on incubated burro dung collected in San Luis Potosi, Mexico, in 1960.

Podospora pauciseta (Ces.) Traverso, Fl. ital. crypt., Fungi 2, 2: 431 (1907)

Fig. 2, F–H

Basionym: *Sphaeria pauciseta* Ces., Bot. Ztg. 10: 396 (1852)

Perithecia usually gregarious, partially immersed to superficial, obpyriform, 630-700 × 350-420 µm, reddish brown to dark brown, glabrous or rarely covered by brown slender, flexuous, hairs, olivaceous brown to golden, 2-2.5 µm thick. Neck cylindrical, rarely conical, carbonaceous, black near the ostiole, opaque, 150-185 × 110-140 µm, glabrous or adorned on one side only by a tuft of non-inflated stiff hairs, long, setose, erect, septate, with acute tips, olivaceous brown, 2.5-3.5 mm thick, extending up to 100 µm. Peridium membranaceous, opaque, outer layer *textura angularis*, cells thick-walled, 5-12.5 µm long. Paraphyses interspersed with the asci, usually surpassing them in length, ventricose, persistent or collapsing. Asci 4-spored, clavate, occasionally with a medial constriction, with narrowed truncated apex and a short stipe, 200-250 × 25-27.5 µm, usually persistent, occasionally with aborted spores that are significantly smaller than the others. Ascospores irregularly uniseriate, hyaline when immature, clavate, becoming swollen in the upper

portion; head cell ellipsoid, slightly umbonate at apex, truncate at base, dark brown to black, aseptate, with an apical germ pore, 35-37.5 × 17.5-19.5 µm, smooth; pedicel cylindrical, usually collapsing, 3-3.5 × 15-17.5 µm; apical cauda cylindrical, gradually decreasing in diameter towards the apex, 70-75 × 6.5-9 µm, usually collapsing; basal caudae of two kinds: (1) terminal cauda, similar to the single apical cauda, attached to the base of the pedicel, 60-70 × 2.5-5 µm, collapsing; (2) lateral caudae, 2-4, attached to the proximal end of the pedicel, ~1.5-2 µm thick, extending up to 20 µm long.

Habitat – Recorded on dung of many herbivores.

Known distribution – Worldwide.

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agronômico de Pernambuco (IPA), on horse dung, 30 Nov 2011, R.F.R. Melo (URM86747), Serra Talhada, Instituto Agronômico de Pernambuco (IPA), on horse dung, 08 Sep 2011, R.F.R. Melo (URM86748), Recife, Universidade Federal Rural de Pernambuco (UFRPE), on cattle dung, 03 Apr 2012, R.F.R. Melo (URM86749).

Notes – *Podospora pauciseta* is a common component of the coprophilous mycobiota of Pernambuco, being the dominant species in this study sampled throughout the state. It can be distinguished from *P. australis*, which also has 4-spored asci, by the smaller head cells (35-37.5 × 17.5-19.5 µm). Due to the easily collapsing gelatinous appendages, it can be confused with *Arnium arizonense*, which also has four ascospores per asci, perithecia of similar size and tufts of erect hairs, but is distinguished by the smaller head cells.

Podospora pleiospora (G. Winter) Niessl, Hedwigia 22: 156 (1883)

Fig. 2, I–L

Basionym: *Sordaria pleiospora* G. Winter, Abh. naturforsch. Ges. Halle 13(1): 13 (1873)

Perithecia usually gregarious, partially immersed to immersed, obpyriform, 750-930 × 430-550 µm, olive-brown to dark brown, glabrous or covered by slender, flexuous hairs, olivaceous, 1.5-2 µm thick. Neck cylindrical, carbonaceous, black near the ostiole, opaque, 195-250 × 140-185 µm, smooth, glabrous, adorned throughout its length by several dark brown to black thick-walled tubercles, obtuse, straight or sinuous, simple, 17.5-20 × 3-4.5 µm, densely clustered in the neck giving it a strongly carbonaceous texture, becoming gradually and progressively sparse in the upper body, absent in the part of the perithecium. Peridium membranaceous, subopaque, 3-layered, outermost layer *textura angularis*, with thick-walled cells, 5-10 µm long. Paraphyses interspersed with the asci, ventricose, usually persistent. Asci 16-32-spored, saccate to clavate, 275-300 × 60-67.5 µm, usually collapsing, with narrowed truncated apex and a long stipe. Ascospores multiseriate, hyaline when immature, clavate, becoming swollen in the upper portion; head cell ellipsoid, slightly umbonate at apex, truncate at base, aseptate, reddish brown to dark brown, with an apical germ pore, 30-35 × 17.5-22.5 µm, smooth; pedicel cylindrical, persistent or collapsing, 5-7.5 × 37.5-45 µm, with distal swelling in some ascospores; apical caudae lash-like, lamellate, head cell 20-25 × 4-5 µm, smooth, persistent or collapsing, not covering the germ pore; basal cauda 2-3, similar to the apical caudae in morphology, but shorter, attached to the proximal end of the pedicel, 7.5-10 µm long, usually collapsing.

Habitat – Recorded on dung of many herbivores.

Known distribution – Asia (Taiwan), Central America (Mexico), Europe (Czech Republic, Germany, Denmark, Greece, Hungary, Italy, Norway, Poland, Romania, Sweden, Switzerland, Spain, United Kingdom), North America (Canada, USA), Oceania (Australia, New Zealand) and South America (Argentina, Chile). This is the first record from Brazil.

Material examined – Brazil, Pernambuco, Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 15 Feb 2012, R.F.R. Melo (URM86750a, 86750b), 23 Mar 2012, R.F.R. Melo (URM86751).

Notes – Three species of *Podospora* have black tubercles on the perithecia and lamellate gelatinous caudae. Among them, *P. pleiospora* can be easily distinguished from *P. decipiens*, which has only eight ascospores per ascus, and from *P. myriasporea*, which has 64 ascospores per ascus. These species may also be distinguished based on the size of the head cell: *P. decipiens* (36-42 ×

20-22 μm) > *P. pleispora* (30-35 \times 17.5-22.5 μm) > *P. myrisaspora* (25-34 \times 14-19 μm). Some ascospores of *P. pleispora* had pedicels with obvious distal swelling.

Podospora prethopodalis Cain, Can. J. Bot. 40: 458 (1962)

Fig. 2, M

Perithecia scattered to gregarious, partially immersed to superficial, subglobose to obpyriform, 320-520 \times 225-365 μm , light brown to brown, abundantly covered by slender, septate, flexuous hairs, olivaceous to golden, 2-2.5 μm thick. Neck cylindrical, carbonaceous, black near the ostiole, opaque, 100-120 \times 90-115 μm , smooth, adorned by tufts of non-inflated, septate, straight, simple, setose hair, olivaceous brown, ~1.5-2 μm thick, extending up to 300 μm long. Peridium membranaceous, subopaque, 3-layered, outermost layer *textura angularis*, with thick-walled cells, 5-12.5 μm long. Paraphyses interspersed with the asci, ventricose, persistent or collapsing. Asci 8-spored, clavate, 190-215 \times 37.5-50 μm , with truncated apex and a long stipe. Ascospores biserial, hyaline when immature, clavate, becoming swollen in the upper portion; head cell long-ellipsoid to fusoid, slightly umbonate at apex, truncate at base, aseptate, reddish brown to dark brown, with a subapical germ pore, 32-42.5 \times 15-20 μm , smooth, usually symmetrical; pedicel cylindrical, usually collapsing, notably inflated medially and slightly distally, 5-7.5 \times 22.5-30 μm ; apical cauda single, cylindrical, attached to the apex of the head cell, 35-42.5(-57.5) \times 6-8.4 μm , smooth, persistent or collapsing; basal cauda single, similar to the apical cauda in morphology, but thicker, attached to the base of the pedicel, 18.5-35 \times 2.5-7.5 μm , usually collapsing.

Habitat – Recorded on goat and horse dung.

Known distribution – Africa (Kenya), Asia (Pakistan, Taiwan), Central America (Mexico), North America (Canada), Oceania (Australia, Society Islands). This is the first record from South America.

Material examined – Brazil, Pernambuco, Caruaru, Instituto Agronômico de Pernambuco (IPA), on goat dung, 15 Jun 2012, R.F.R. Melo (URM86752), Serra Talhada, Instituto Agronômico de Pernambuco (IPA), on horse dung, 03 May 2012, R.F.R. Melo (URM86753), Recife, Universidade Federal Rural de Pernambuco (UFRPE), on horse dung, 13 Jun 2012, R.F.R. Melo (URM86754).

Notes – The tufts of agglutinated perithecial hairs and ascospores with medially inflated pedicels distinguishes *Podospora prethopodalis*. It was first described by Cain (1962) from material growing on incubated horse dung collected in Toronto in 1956. The currently known records suggest a worldwide distribution

Unverified and doubtful species

Podospora argentinensis (Speg.) J.H. Mirza & Cain, Can. J. Bot. 47(12): 2008 (1970) [1969]

Pleurage argentinensis (Speg.) C. Moreau, Encyclop. Mycol. 25: 252 (1954)

Sordaria argentinensis Speg., Anal. Mus. nac. Hist. nat. B. Aires 23: 49 (1912)

This species, whose material was described from Argentina, Mexico and USA, was found in Brazil by Richardson (2001) and sent to his personal collection (MJR 64/98). The original material was identified as *P. decipiens*, which indeed shows *P. decipiens*-like perithecia but, according to the author, with smaller ascospores (29-32 \times 16 μm). The caudae at the tip of the pedicel were not observed. Although this material was not examined in this study, based on the author's description, it may be a good species that should be included in the list of *Podospora* species recorded in Brazil.

Podospora brasiliensis Cain, Can. J. Bot. 40: 447 (*mistyped as 449 in some databases*) (1962)

Along with other new species and combinations of *Podospora*, Roy Franklyn Cain (1962) proposed *P. brasiliensis* from material on incubated cattle and sucuri (*Eunectes murinus*) dung collected by Alfons Theobald in São Leopoldo, Rio Grande do Sul, Brazil in 1936 (TRTC 35445), and by Augusto Chaves Batista in Pernambuco in 1957 (TRTC 35593), respectively. These specimens show some resemblance to *P. pleiospora* regarding the multispored asci and the small, black tubercles on the neck of the perithecia, but can be distinguished by the smaller ascospores.



Fig. 2 – *Podospora inflatula*. (A) Perithecium (bar = 100 μ m), (B) rigid hairs with inflated tips (bar = 10 μ m). *Podospora longicaudata*. (C) Mature ascus (bar = 10 μ m), D. ascospore (bar = 10 μ m). *Podospora ostlingospora*. (E) Ascospore (bar = 15 μ m). *Podospora pauciseta*. (F) Mature ascus (bar = 10 μ m). (G) perithecium (bar = 100 μ m), (H) ascospore (bar = 10 μ m). *Podospora pleiospora*. (I) Tubercles on the perithecial neck (bar = 7.5 μ m), (J) Mature ascus (bar = 12.5 μ m), (K) immature ascospore (bar = 5 μ m), (L) Mature ascospore (bar = 12.5 μ m). *Podospora prethopodalis*. (M) Mature ascospore (bar = 15 μ m).

The main distinguishing feature of this species is the gelatinous equipment, composed of (1) a single lash-like apical caudae, (2) a single lash-like basal caudae, usually collapsing, attached to distal end of the pedicel, and (3) a single lateral caudae attached to the proximal end of the pedicel. Material not examined in this study.

Podospora dolichopodalis J.H. Mirza & Cain, Can. J. Bot. 47(12): 2018 (1970) [1969]

This species was first described by Mirza & Cain (1969) from material growing in dung collected in Toronto, Canada. It is a peculiar species, in which the ascospore pedicel possesses a conspicuous distal swelling, appearing somewhat clavate rather than cylindrical. It was recorded in Minas Gerais, Southeast Brazil (Lundqvist, 1973; Jahn, 2000). Material not examined in this study.

Podospora immersa (R. Stratton) Cain, Can. J. Bot. 40: 460 (1962)

Basionym: *Pleurage immersa* R. Stratton, Ohio St. Univ. Bull. 26: 93 (1921)

As in *Podospora longicaudata*, *P. immersa* has several small caudae completely enveloping the head cell in its ascospores. It can be distinguished, however, from the former by the narrower head cells (30-43µm) and, additionally from *P. ostlingospora* by the shorter caudae. It was also recorded in Minas Gerais (Lundqvist, 1973; Jahn, 2000). Material not examined in this study.

Podospora longispora (Bat. & Pontual) N. Lundq., Symb. Bot. Upsal. 20(1): 135 (1972)

Basionym: *Sordaria longispora* Bat. & Pontual, Bol. Secr. Agric. (Pernambuco) 15: 39 (1948)

After studying the type material labeled as *Podospora longispora*, collected on horse dung from Dois Irmãos, Pernambuco, Mirza & Cain (1969) placed it as a synonym of *P. appendiculata*. Lundqvist (1972), however, examined the same original material, deposited in IPA Herbarium (Pernambuco, Brazil) and stated that, despite the poor state of the exsiccati and the similar rigid, hyaline-tipped hairs, there are some differences, such as the membranaceous, subopaque, brown peridium (vs. the pseudobombardioid peridium in *P. appendiculata*) and the slightly shorter dark ascospore cell (24-29 µm). Material not examined in this study.

***Podospora* sp.**

After a visit to Brazil, Richardson (2001) published a brief note about an unidentified species of *Podospora*, which resembled the illustrations of *P. ostlingospora* in Mirza & Cain (1969) (MJR 60/98). The limited material of this large-spored species prevented it from being formally described in his paper. However, the author provided a brief description: Perithecia globose, partially immersed, glabrous or with long, brown, flexuous hyphal hairs, and some *P. decipiens*-type papillae. Ascospores with head cells 48-54.5 × 21-27 µm; pedicel slightly clavate distally, 22-30 × 6-7 µm; caudae inconspicuous, either in the ascus or in free spores. Material not examined in this study.

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