
Studies of coprophilous ascomycetes in Kenya: Sordariales from wildlife dung

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In our continuing series on coprophilous fungi from wild herbivores moist chamber dung cultures from African elephant, Cape buffalo, dikdik, giraffe, impala, Jackson's hartebeest, waterbuck and zebra found in Kenyan National Parks and Reserves were examined for sporulating coprophilous Sordariales. *Arnium arizonense*, *Sordaria fimicola* and *Zopfiella longicaudata* are reported for the first time in Kenya while *Zygopleurage zygospora* is a very frequent species on wildlife dung. *Zopfiella affinis erostrata* awaits further examination as it could be a novel species.

Key words – *Arnium* – national parks – *Sordaria* – wild herbivores – *Zopfiella* – *Zygopleurage*

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Introduction

The order Sordariales mainly comprises saprobic fungi with ascomata that are usually perithecioid or occasionally cleistothecioid growing on dung or decaying plant biomass, and are membranaceous to coriaceous and glabrous or hairy (Lundqvist 1972, Doveri 2004, Huhndorf et al. 2004). Asci are thin-walled, unitunicate or prototunicate, sometimes with non-amyloid apical structures or may lack an apical apparatus, and usually sandwiched between paraphyses (Lundqvist 1972, Doveri 2004, Bell 2005). Ascospores are hyaline to dark, one- to poly-celled, with germ pore(s) or slit(s) and often with gelatinous appendages or sheaths (Lundqvist 1972, Doveri 2004, Bell 2005, Huhndorf et al. 2004). Several members of this order are important candidates and tools for studies in genetics and biochemistry (Kendrick 2000).

In this part of our study we examine the taxonomy and occurrence of Sordariales on various dung types in Kenyan wildlife and document their diversity and distribution in

relation to wild herbivore dung types. We report on the genera *Arnium* Nitschke ex G. Winter emend. N. Lundq., *Zopfiella* G. Winter, and *Zygopleurage* Boedijn in Lasiosphaeriaceae Nannf. and *Sordaria* Ces. & De Not. in Sordariaceae G. Winter.

Materials and methods

Our work on coprophilous *Ascobolus* and *Saccobolus* from wildlife dung in Kenya (Mungai et al. 2012a, b) provides a detailed explanation of materials and methods.

Arnium Nitschke ex G. Winter

Arnium species have non-stromatic, and perithecioid ascomata covered with various kinds of hairs (Lundqvist 1972, Doveri 2004). They are paraphysate, rarely aparaphysate and their asci are 4 to multi-spored, usually cylindrical to clavate with or without an apical apparatus (Lundqvist 1972, Doveri 2004). Ascospores may be uniseriate, biseriata or multiseriate, one-celled and sometimes two-celled as a result of a transverse septum

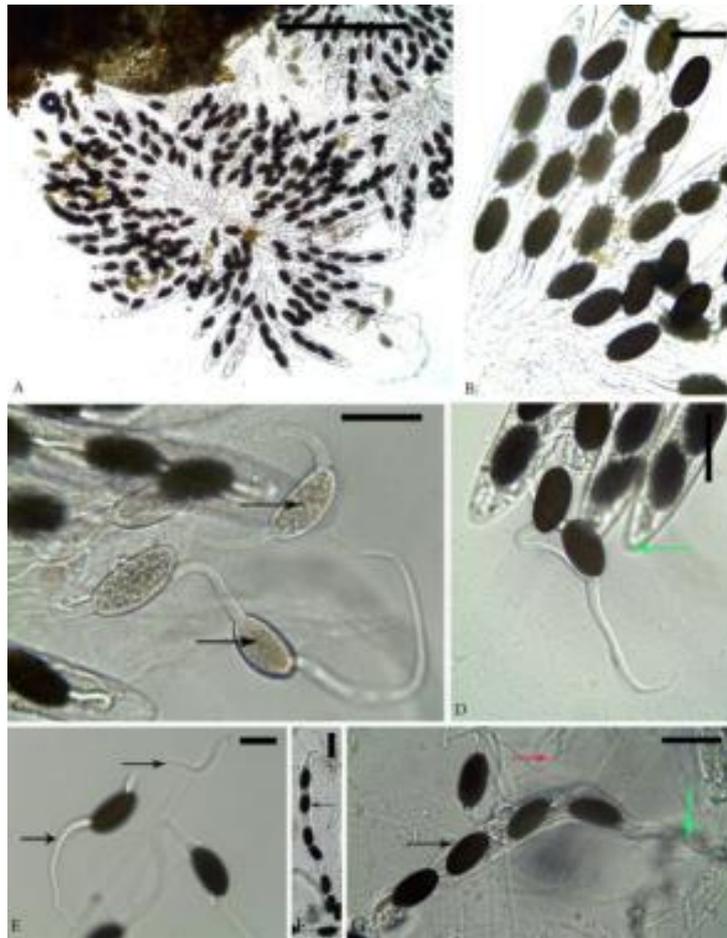


Fig. 1 – *Arnium arizonense* (KWSNNP017B-2010). **A-B** Asci and ascospores. **C** Immature inequilateral ascospores (arrows). **D** Apical chamber of asci with spores and free mature ascospores, note apex (green arrow). **E** Free mature ascospores showing almost equal sized caudae (arrows). **F-G** Ascus showing uniseriate spore arrangement (black arrows), paraphyses (red arrow) and stipe (green arrow). **Scale bars: A, F = 200 μ m B, C, D, G = 50 μ m.**

developing after pigment formation, brownish black, smooth, ellipsoidal to broadly fusiform, with 1 or 2 germ pores and usually one gelatinous cauda at each end (Lundqvist 1972, Doveri 2004). This genus is very close to *Podospora* Ces. but is easily distinguished by having ascospores lacking a pedicel in addition to the characteristic ellipsoidal or fusiform immature ascospores. *Arnium* is usually cosmopolitan and coprophilous and grows on various herbivore dung types (Lundqvist 1972, Doveri 2004, Bell 2005).

Arnium arizonense (Griffiths) N. Lundq. & J.C. Krug, *Symb. bot. upsal.* 20 (no.1): 232, 1972. (Fig.1A–F)

≡ *Pleurage arizonensis* Griffiths, *Mem. Torr. Bot. Cl.* 11 (1): 57, 1901

≡ *Sordaria arizonensis* (Griffiths) Sacc., *Syll. Fung.* 17: 601, 1905.

≡ *Podospora arizonensis* (Griffiths) Cain, *Can. J. Bot.* 40: 549, 1962.

Ascomata perithecioid, semi-immersed to superficial, 300–600 μ m diam., scattered or gregarious, membranaceous to slightly coriaceous, black to translucent, pyriform. *Neck*, black, opaque sometimes curved, papilliform to cylindrical, with long, one-sided tufts of rigid and septate hairs. *Peridium* pseudoparenchymatous, layered, olivaceous brown. *Paraphyses* numerous, simple, broadly filiform, septate, exceeding the asci, variable width and tapering. *Asci* 4-spored, 251–350 \times 30–39 μ m, unitunicate, clavate, with a thickened apical ring, wall non-amyloid, with a slightly pointed apex, apical membrane thickened, sub-apical chamber 5–7 μ m broad long stipitate; stipe crooked, 100–150 \times 25–35 μ m. *Ascospores* 43.5–48.5 \times 22–29 μ m, obliquely uniseriate, one-celled, ellipsoidal,

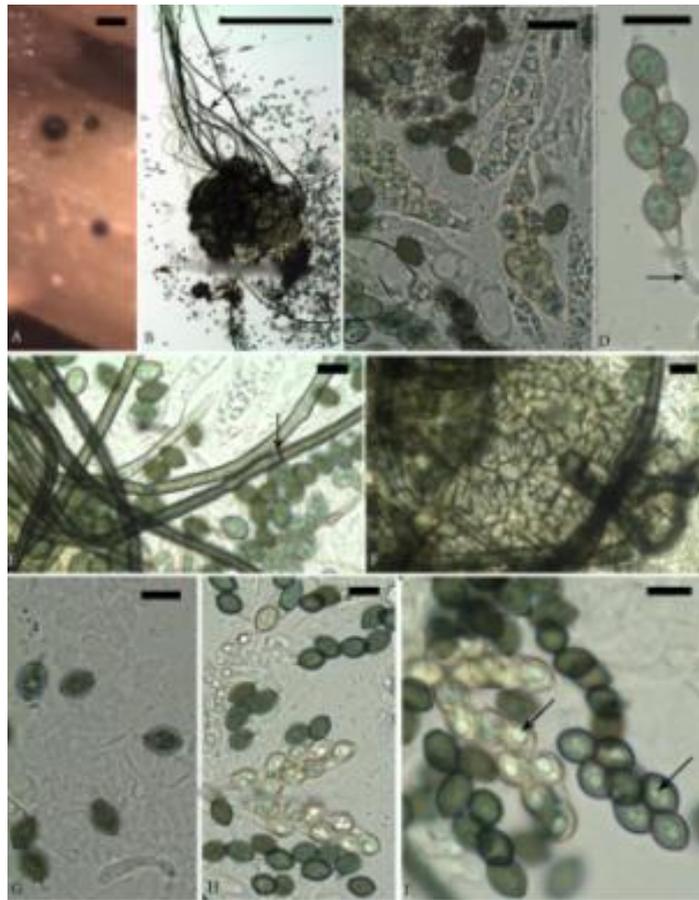


Fig. 2 – *Zopfiella* aff. *erostrata* (KWSTE005B-2009). **A** Cleistothecia on dung. **B** Squashed cleistothecium showing long flexuous hairs. **C** Asci and ascospores at various stages of maturity **D** Ascus, note stipe (arrow). **E** Cleistothecial hairs, note septation (arrow). **F** Peridial wall. **G** Free ascospores amongst hyaline swollen cells. **H** Free mature ascospores amongst immature asci. **I** Asci and ascospores showing oil droplets (arrows). **Scale bars:** **A** = 500 μ m, **B** = 200 μ m, **C-I** = 20 μ m.

sometimes inequilateral, initially hyaline, later changing through yellowish, olivaceous to brown-black, smooth, thick walled, tipped at each end with a long gelatinous cauda, almost equal in length and same morphology, lash-like, 8–10 μ m broad at base and over 100 μ m long, persistent, not swelling in water, solid, often densely transversely segmented, occasionally faintly longitudinally and proximally furrowed; one cauda sub-apical, on the flattened side of the spore, not covering the germ pore; the other cauda somewhat eccentric on the same direction of opposite side of spore. *Germ pore* apical.

Material examined – (dung incubated for 33 days) KENYA, Nairobi National Park, Nairobi Province, GPS 37M0257532 9848948, altitude 1647m, giraffe, 20 August 2010, Paul Mungai, KWSNNP017B-2010.

Notes – *Arnium arizonense* is similar to *Podospora australis* (Speg.) Niessl, but *P.*

australis has a prominent apiculum on each narrowly ovoid spore and does not have rigid, agglutinated neck hairs (Lundqvist 1972, Doveri 2004). *A. hirtum* (E.C. Hansen) N. Lundq. & J.C. Krug is another similar taxon having sometimes 4-spored asci, but it has non-fasciculate neck hairs (Doveri 2004) and differently placed and structured gelatinous caudae. *A. arizonense* is a new record for Kenya.

Zopfiella G. Winter

Zopfiella species usually have dark to olivaceous brown, non-stromatic, usually superficial cleistothecia with a peridium adorned with varying degrees of hair. They have highly evanescent asci that usually are 8-spored, cylindrical to clavate, lacking an apical apparatus (Udagawa & Furuya 1974, Huhndorf et al. 2004, Bell 2005, Cai et al. 2006, Kirk et al. 2008). *Ascospores* lack a gelatinous

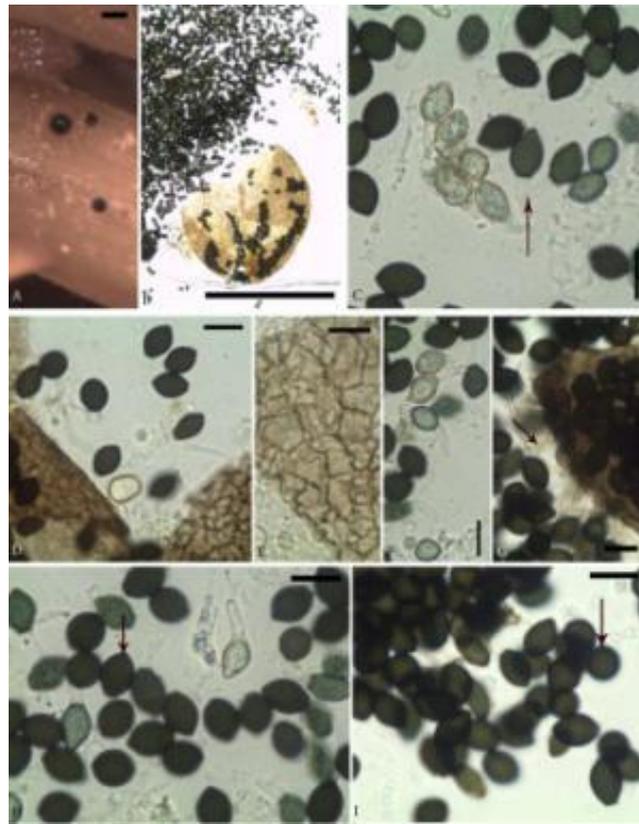


Fig. 3 – *Zopfiella longicaudata* (KWSTE005B-2009). **A** Ascomata on dung. **B** Squashed ascoma. **C** Immature ascus among free mature ascospores, note pedicels (arrow). **D-E** Details of peridial wall. **F** Immature and mature ascospores. **G** Ascomal wall section showing hairs (arrow). **H-I** Ascospores, note germ pores (arrows). **Scale bars:** **A** = 500 μm , **B** = 200 μm , **C-I** = 20 μm .

equipment, are 1-celled and hyaline in the early stages, transversely septate and 2- sometimes 3-celled at maturity, with an ellipsoidal, smooth, pigmented, often dark brown apical cell, and a hyaline, basal pedicel. The apical cell (head) has an apical or subapical germ pore (Udagawa & Furuya 1974, Guarro et al. 1991, Huhndorf et al. 2004, Bell 2005, Kirk et al. 2008).

This genus is cosmopolitan (Guarro et al. 1991) and has been isolated from dung and soil. *Zopfiella* and *Podospora* are similar but the former can be distinguished by its cleistothecial ascomata and ascospores without gelatinous equipment and with short, easily collapsing pedicels. The pedicel shape is a very important character in delimiting species (Doveri 2004).

Zopfiella aff. *erostrata* (Griffiths) Udagawa & Furuya, Trans. Mycol. Soc. Japan 15: 208, 1974. (Fig. 2A-I)

Ascomata cleistothecioid, superficial, 280–300 μm diam., scattered or in small

groups, black, globose to subglobose, with long flexuous, olivaceous brown to dark, robust and septate hairs evenly distributed, 2–5 μm broad, hair ends straight, smooth and pointed; *Peridial wall* olivaceous brown, membranaceous, *textura angularis* of cells 5.5–8 \times 4.5–6 μm . *Paraphyses* not observed. *Asci* 8-spored, 43–56 \times 10–14.5 μm , unitunicate, clavate, broadly rounded above and tapering below into 8–15 μm long, very evanescent stipes, apical apparatus not distinct/observed, surrounded by hyaline swollen cells, collapsing in water mounts. *Ascospores* irregularly biseriata, hyaline at first and one-celled, transversely septate later and two-celled. Upper cell 9.5–11 \times 6.5–8 μm , broadly limoniform, umbonate, with truncate base, greyish to black, guttulate; *pedicel* 4–6 \times 1.5–4.5 μm , triangular, soon collapsing. *Germ pore* apical.

Material examined – (dung incubated for 14 days) KENYA, Tsavo East National Park, Coast Province, GPS S03°02'29.7" E038°41'35.8", savannah, altitude 354 m, dikdik, 27 August 2009, Paul Mungai,

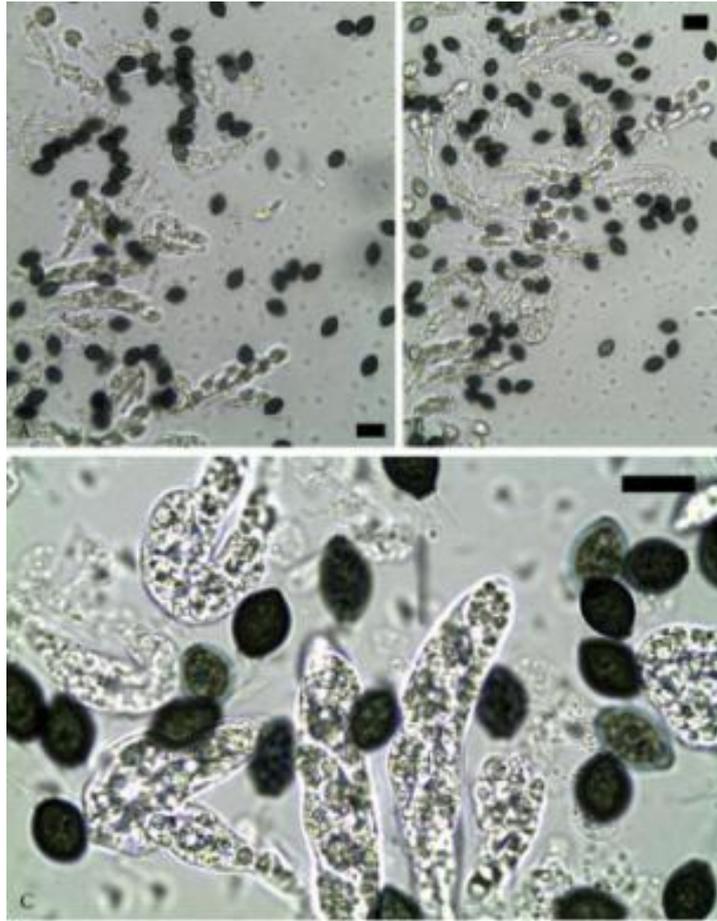


Fig. 4 – *Zopfiella longicaudata* (KWSTE005B-2009). **A-C** Details of asci and ascospores at various stages of development. **Scale bars: A-B** = 50 µm, **C** = 20 µm.

KWSTE005B-2009.

Notes – Apart from the triangular pedicel this collection has matching features to descriptions of *Zopfiella erostrata* from Australia and Japan (Bell 2005, Udagawa & Furuya 1974). It is also close to *Z. longicaudata* but the latter has larger spore heads and pedicels and sporulates late in incubation. This specimen does not fully fit the existing keys on account of the triangular and small ascospores, therefore it is identified as *Zopfiella* "affinis" *erostrata*. Further collections will be made to determine whether this is a new species.

Zopfiella longicaudata (Cain) Arx, Proc. Konink. Nederl. Akad. van Wetensch. 76(3): 291, 1973. (Figs. 3A–I, 4A–C, 5A–H)

≡ *Tripterospora longicaudata* Cain, Can. J. Bot. 34: 703, 1956.

Ascomata cleistothecioid, superficial, 170–220 µm diam., scattered or in small

groups, brown, globose to subglobose, with olivaceous brown to light grey, septate, unbranched hairs evenly distributed; hairs 10.5–18 × 2–3 µm, hair ends almost straight, smooth and blunt. *Peridial wall* semi-transparent, olivaceous brown, *textura angularis* of polygonal cells 7–11.5 × 4.5–10 µm. *Paraphyses* not observed. *Asci* 8-spored, 61–82 × 13.5–16 µm, unitunicate, clavate to cylindrical, broadly rounded above and tapering below into evanescent long stipes measuring 10–17 × 3–4 µm, lacking apical apparatus, surrounded by hyaline swollen cells, collapsing in water mounts. *Ascospores* irregularly biserial, hyaline at first and one-celled, transversely septate later and two-celled. Upper cell 13–17.5 × 9.5–11 µm, broadly limoniform, slightly inequilateral, initially light greyish to black, with a truncate base; *pedicel* 8–11 × 3–4 µm, hyaline, slightly curved, cylindrical with rounded ends, collapsing with maturity, umbonate at the apex,

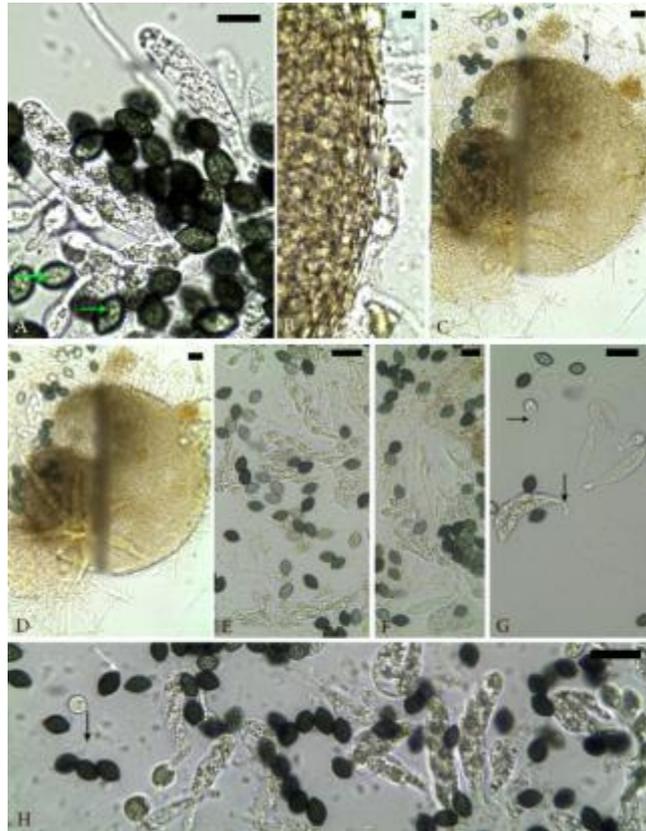


Fig. 5 – *Zopfiella longicaudata* (KWSTE005B-2009). **A** Immature asci and free ascospores showing oil droplets (green arrows). **B** Details of peridium in section, note double layered polygonal cells (arrow). **C-D** Ascoma squash showing vestiture (arrow). **E-H** Mature and immature asci and ascospores showing stipe, pedicel and germ pore (arrows). **Scale bars:** **A-C** = 20 μm , **D-H** = 50 μm .

immature ascospores guttulate. *Germ pore* conspicuous, sub-apical.

Material examined – (2 ascomata on dung incubated for 80 days) KENYA Tsavo East National Park, Coast Province, GPS S03°02'29.7" E038°41'35.8", savannah, altitude 354 m, dikdik, 27 August 2009, Paul Mungai, KWSTE005B-2009; GPS S03°21'66.6" E038°38'77.2", altitude 514 m, riverine bushed-grassland, African elephant, 23 September 2008, Paul Mungai, KWSTE005A-2009.

Notes – The ascospores of *Z. longicaudata* measuring 9.5–11.5 \times 6.5–8 μm (in this study) are larger than those of *Z. erostrata* but smaller than *Z. flammifera* L.H. Huang, which measure 16–21.5 \times 9.5–13 μm (Doveri 2004). *Zopfiella longicaudata* is apparently more frequent than *Zopfiella affinis erostrata* and sporulates very late on incubated wildlife dung. *Z. longicaudata* is a new record for Kenya.

Zygopleurage Boedijn

The main characteristics distinguishing *Zygopleurage* from other Lasiosphaeraceae is the unique ascospore morphology which consists of two dark ellipsoidal cells connected by an elongated cylindrical hyaline cell. The hyaline, intercalary cells are often coiled in the central part of ascus before spore discharge and separate two sets of polar pigmented cells. The size and shape of the intercalary cells and pigmented cells (spore heads), with their gelatinous sheath, and claw-shaped appendages vary in *Zygopleurage* and are very useful in species delimitation.

Currently there are only three described species of *Zygopleurage*: *Z. faiyumensis* N. Lundq., *Z. multicaudata* Mirza and *Z. zygospora* (Speg.) Boedijn.

This unique coprophilous and cosmopolitan genus was reported by Lundqvist (1969) from Europe, North America, South America and Africa. Records from other parts

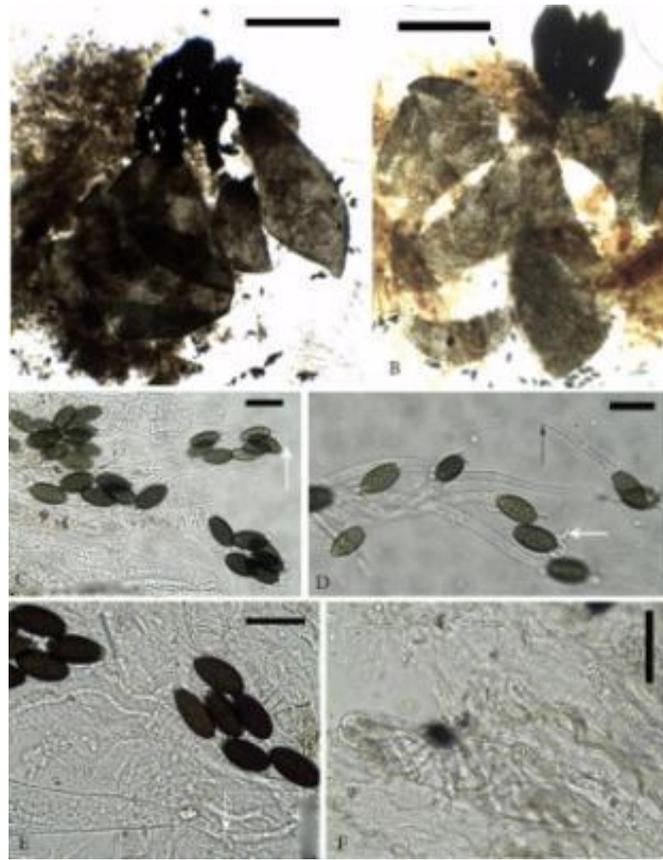


Fig. 6 – *Zygopleurage zygospora* (KWSNNP002-2009). **A-B** Squashed ascomata. **C** Asci with ascospores. **D** Free mature ascospores, note intercalary cell and short caudae (arrows). **E** Ascus stipe (arrowed) and free ascospores. **F** Immature asci with young filamentous ascospores amongst paraphyses. **Scale bars:** **A-B** = 500 μm , **C-F** = 50 μm .

of the world include Thailand in South East Asia (Mungai et al. 2011), South America (Richardson 2001), the Middle East (Abdullah & Rattan 1978) and Australia (Bell 2005).

Zygopleurage zygospora (Speg.) Boedijn, Persoonia 2: 316, 1962. (Figs. 6A–F, 7A–F)

= *Sordaria zygospora* Speg., Michelia 1: 227, 1878.

= *Philocopra zygospora* (Speg.) Sacc., Syll. fung. (Abellini) 1: 251, 1882.

= *Pleurance zygospora* (Speg.) Kuntze 3: 1–576, 1898.

= *Podospora zygospora* (Speg.) Niessl, Hedwigia 22: 156, 1883.

Ascomata perithecioid, immersed to semi-immersed, 600–1340 μm high, 400–760 μm diam., scattered or in small groups, olivaceous brown, pyriform, with a venter usually covered with long, brown, septate, flexuous hairs. *Neck* 200–530 \times 120–370 μm , cylindrical, covered with short hair-like cells, darker, ostiole 105–115 μm diam. *Peridium* 3-

layered; *exoperidium* thin, semi-translucent of *textura angularis* cells, 65 μm thick, *mesoperidium* of smaller vertically elongated cells, *endoperidium* consisting of subhyaline to light brown *textura angularis* cells. *Paraphyses* simple, hyaline, septate, evanescent. *Asci* 8-spored, 250–322 \times 40–49.5 μm , clavate, unitunicate, long-stipitate, rounded apex. *Ascospores* filamentous, one-celled and hyaline when young, loosely coiled in the ascus, 3-celled at maturity, composed of two dark brown end cells, 29–37 \times 17.5–23 μm , usually smooth, ellipsoidal, each with an apical germ pore, joined by a long subhyaline intercalary cell, cylindrical, 211–228 \times 5.5–7.5 μm ; 7–9 μm broad at the point of insertion to dark cell, staining blue in lactophenol cotton blue, usually parallel or coiled, each dark end cell with 4 distinct, short, claw-shaped, hyaline, apical, gelatinous appendages, 11–15 \times 3–4 μm long and 4 short gelatinous caudae arising at the septa of the intercalary cell, 10–13 \times 3–4 μm .

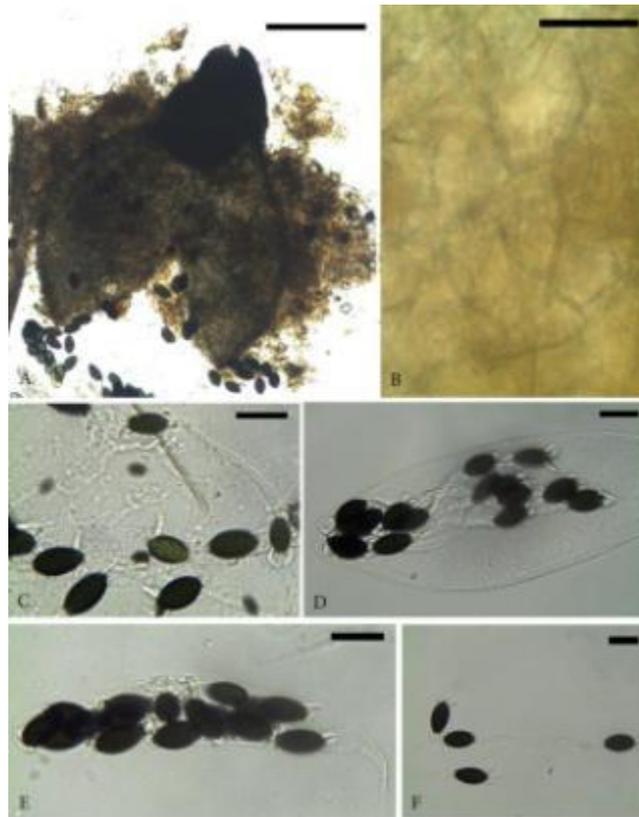


Fig. 7 – *Zygopleurage zygospora* (KWSNNP002-2009). **A** Squashed ascoma. **B** Details of peridial wall. **C** Free mature ascospores. **D** Mature asci with ascospores showing spore arrangement, intercalary cell and short caudae. **E** Mature ascus with ascospores. **F** Free mature ascospores. **Scale bars:** **A** = 500 μ m, **B** = 20 μ m, **C-F** = 50 μ m.

Material examined – (10 ascomata from dung incubated for between 40 and 79 days) KENYA, Tsavo East National Park, Coast Province, GPS S03°02'29.7" E038°41'35.8", altitude 354 m, African elephant, 27 August 2009, Paul Mungai, KWSTE003A-2009; GPS S03°21'06.4" E038°37'50.1", altitude 514 m, Cape buffalo, 27 August 2009 Paul Mungai, KWSTE008B-2009; GPS S03°02'52.3", E038°54'37.0", altitude 354 m, African elephant, 27 August 2009, Paul Mungai, KWSTE003B-2009; Aberdare Country Club Game Sanctuary, Central Province, GPS S00°19'28.1", E036°55'54.3", altitude 2161 m, zebra, 30 August 2009, Paul Mungai KWSACC002-2009; Aberdare National Park, Central Province, GPS S00°20'23.2", E036°47'11.1", altitude 2075 m, waterbuck, 29 August 2009, Paul Mungai, KWSANP005-2009; Shimba Hills National Reserve, Coast Province, GPS S04°14'22.4", E039°26'07.2", altitude 374 m, impala, 24 September 2008, Paul Mungai, KWSSH005B-2008; GPS S04°14'35.6", E039°26'07.1", altitude 360 m,

Cape buffalo, 26 August 2009, Paul Mungai, KWSSH004-2009; GPS S04°14'14.4", E039°26'01.0", altitude 361 m, Jackson's hartebeest, 26 August 2009, Paul Mungai, KWSSH003-2009; Nairobi National Park, Nairobi Province, GPS 37M0255191, 9849808, altitude 1693 m, Cape buffalo, 20 August 2010, Paul Mungai, KWSNNP015-2010; GPS UTM370253715, M9849130, altitude 1876 m, zebra, 18 August 2009, Paul Mungai, KWSNNP002-2010.

Notes – *Zygopleurage zygospora* is characterized by ascospores with longer intercalary cells always coiled inside the asci and four distinct, short, claw-shaped, hyaline gelatinous processes on the polar cells (Abdullah & Rattan 1978). These characters vary within the taxa of *Zygopleurage* and are very useful in delimitation (Lundqvist 1969, 1972, Abdullah & Rattan 1978). In addition, *Z. zygospora* has an olivaceous brown perithecium. The ascospores of *Z. zygospora* are intermediate in size between those of *Z. multicaudata*, which are smaller and *Z.*

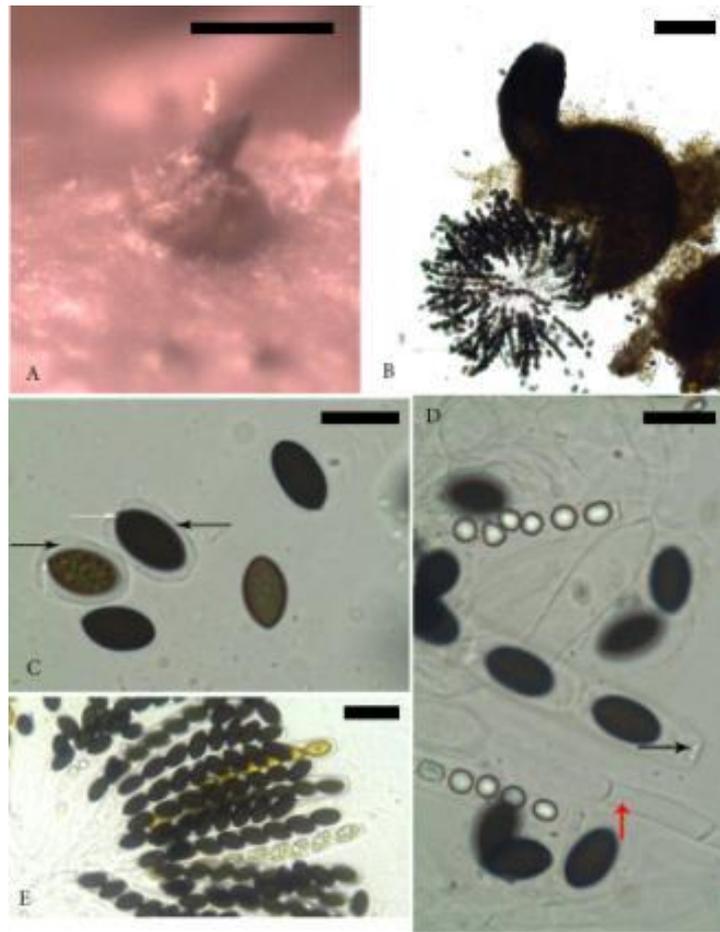


Fig. 8 – *Sordaria fimicola* (KWSKIN004-2009). **A** Ascoma on dung. **B** squashed ascoma. **C** Free mature ascospores showing gelatinous sheath and germ pore (arrows). **D** Ascus apex and paraphyses. **E** Mature asci with ascospores. **Scale bars:** **A** = 500 μm , **B** = 200 μm , **C** = 20 μm , **D** = 20 μm , **E** = 50 μm .

faiyumensis, which are larger (Abdullah & Rattan 1978). *Z. zygospora* is a very unique species and therefore not easy to confuse with any other known species (Lundqvist 1969, 1972, Abdullah & Rattan 1978).

Sordaria Ces. & De Not.

Sordaria is characterized by dark, superficial or semi-immersed, non-stromatic perithecia and a layered, pseudoparenchymatous peridium (Cain 1934, Lundqvist 1972, Doveri 2004, Bell 2005). Ascus are unitunicate, non-amyloid, cylindrical, usually 8-spored, each with a well developed apical apparatus (Lundqvist 1972, Doveri 2004, Bell 2005). Ascospores are one-celled, broadly ovoid to ellipsoidal, sometime subglobose or subfusiform, dark pigmented at maturity, with a basal germ pore and usually surrounded by a hyaline mucilaginous sheath (Lundqvist 1972, Doveri

2004, Bell 2005). *Sordaria* species have very similar morphological features thus creating a challenge in species delimitation. According to Lundqvist (1972) and Guarro & von Arx (1987) analysis of the perithecial structure, ascus and spore size is a very reliable way of delimiting *Sordaria* species.

This genus is composed of mainly fimicolous species. However, several *Sordaria* species have been isolated from remains of plant biomass, live plants, seeds and from soil (Doveri 2004). *Sordaria* has been recorded worldwide (Lundqvist 1972, Khan & Krug 1989, Doveri 2004, Bell 2005, Jeamjitt et al. 2007, Richardson 2008).

Sordaria fimicola (Roberge) Ces. & De Not., Comm. Soc. Critt. Ital. 1: 226, 1863. (Figs. 8A–E, 9A–G)

≡ *Sphaeria fimicola* Roberge in Desm., Ann.

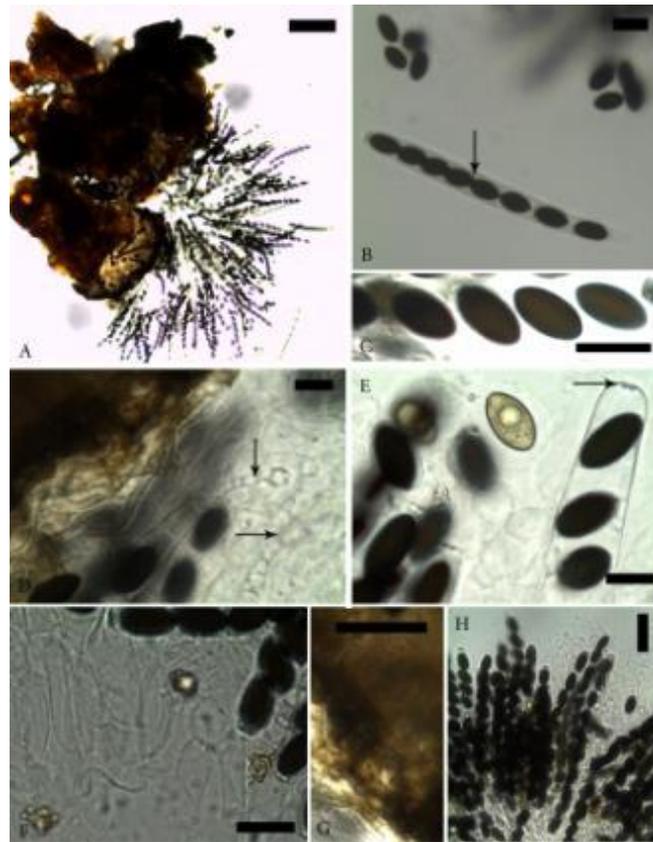


Fig. 9 – *Sordaria fimicola* (KWSKIN004-2009). **A** Squashed ascoma. **B** Mature ascus with spores, note uniseriate arrangement (arrow). **C** Free mature spores. **D** Asci stipes (arrows). **E** Asci apex showing apical ring (arrow). **F** Paraphyses. **G** Details of peridial wall. **H** Mature asci with spores. **Scale bars:** **A** = 200 μm , **B** = 50 μm , **C** = 20 μm , **D** = 20 μm , **E** = 20 μm , **F** = 20 μm , **G** = 20 μm , **H** = 50 μm .

Sci. Nat. 3 sér. Bot. 11: 353, 1849.

An extensive list of synonyms is provided by Doveri (2004). *Ascomata* perithecioid, semi-immersed to superficial, 550–620 μm , high, 450–500 μm , diam., scattered or more often gregarious or even crowded, membranaceous, dark brown, sparsely covered with hyphoid hairs, ovoid to pyriform. *Neck* conical or subcylindrical, 100–120 \times 120–150 μm . *Peridial wall* layered, pseudoparenchymatous; exostratum a *textura angularis* of polygonal cells in the venter, a *textura globulosa* in the neck, 10.5–17 \times 8.5–13 μm . *Paraphyses* moniliform, septate, with segments 4.5–12.5 μm broad, abundant, containing hyaline vacuoles. *Asci* 8-spored, 111–163 \times 10.5–14 μm , cylindrical, flattened at apex, short stipitate, with a lobate stipe, and prominent apical apparatus. *Ascospores* 15.5–18.5 \times 9.5–11.5 μm , obliquely to vertically uniseriate, dark brown, ellipsoidal, occasionally ovoid, smooth, slightly pointed

and apiculate at the base, surrounded by a gelatinous sheath usually invaginated at the apiculum. *Germ pore* single and basal.

Material examined – (dung incubated for 14 days) KENYA, Kinondo Forest Reserve, Coast Province, GPS S04°25'197" E039°32'602", coastal forest, altitude 18m, dikdik, 19 April 2009, Paul Mungai, KWSKIN004-2009.

Notes – *Sordaria* species are very homogenous and therefore are very difficult to delimit. *Sordaria fimicola* differs from *S. superba* De Not. and *S. macrospora* Auersw. in having smaller spores, ellipsoidal rather than broadly ellipsoidal and smaller perithecia and asci (Doveri 2004). Other similar taxa namely *S. sicutii* Cailleux and *S. conoidea* Cailleux lack a gelatinous perisporium on their spores. *S. fimicola* is homothallic with four hardly differentiated heterothallic relatives, namely, *S. thermophila* Fields, *S. sclerogenia* Fields & Gear, *S. tomentoalba* Cailleux and *S.*

brevicollis L.S. Olive & Fantini (Doveri 2004). Although reported as a very common cosmopolitan pyrenomycete by other investigators (Lundqvist 1972, Doveri 2004), *S. fimicola* was isolated only once in this study. This is a new record for Kenya.

Discussion

Ecology

Zygopleurage zygospora on 72% of dung samples was the most common species and occurred on the widest range of dung types. Ten isolates of *Z. zygospora* sporulated on six dung types. *Arnium arizonense*, *Sordaria fimicola* and *Zopfiella* aff. *erostrata* (7% each) were the least common.

Sordaria fimicola and *Zopfiella* “affinis” *erostrata* sporulated quite early on incubation. *Arnium arizonense* sporulated in the mid-incubation period, while *Zopfiella longicaudata* and *Zygopleurage zygospora* sporulated in the last period of incubation.

The age of dung at sampling and the time taken from sampling to incubation had a notable influence on the composition of Sordariales sporulating with most of the early sporulating species being less common on old or preserved dung.

According to dung types, zebra, Cape buffalo, giraffe and impala, all exhibiting different feeding habits, had the highest number of specimens and species.

A single isolate of *Arnium arizonense* and *Sordaria fimicola* sporulated on just one dung type each. This may be due to a taxon substrate preference or rarity.

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