

PRELIMINARY STUDIES ON COPROPHILUS PYRENOAMYCETES FROM TAIWAN

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Abstract: Sixteen species of coprophilous Pyrenomyces found from dung samples are treated in this report. They are: *Bombardia coprophila*, eight species of *Chaetomium*, *C. aureum*, *C. caprinum*, *C. congoensis*, *C. dolichotrichum*, *C. gangliferum*, *C. globosum*, *C. microcephalum*, *C. thermophile*, three species of *Podospora*, *P. absinilis*, *P. communis*, *P. prethopodalis*, two species of *Sordaria*, *S. fimicola*, *S. humana*, *Sporormiella minima* and *Zygopleura zygospore*. All these species are new records to Taiwan fungal flora.

INTRODUCTION

Coprophilous fungi are very interesting group for their special dung inhabitants. These fungi had investigated by many mycologist in Europe early this century. Recently in Asia area, Japan is the beginning contributor in this field (Furuya and Udagawa 1972). In Taiwan, however, the investigation of these fungi were quite few (Liou and Chen 1977). The report here provided preliminary a little knowledge of these fungi to Taiwan fungal flora.

From March 1976 to June 1977, the authors collect the dung samples from four northern Taiwan localities. A total of 153 dung samples were comprised seventeen species of animals. All samples were cultivated for 40 days. Following incubation, dungs were carefully examined with binocular stereomicroscope. All characteristics of dung fungi were described in fresh condition.

DESCRIPTION

Bombardia coprophila (Fr.) Kirschst., Krypt. Fl. Brandenb. 7: 185, (1911).

(Plate 2, Fig. E-F)

Synonym: *Sphaeria coprophila* Fr., Syst. mycol. 2: 342. (1823). *Hypoxylon coprophilum* (Fr.) Fr., Summa Veg. Scand. 2: 384. (1849). *Sordaria coprophila* (Fr.) Ces. & De Not., Comm. Soc. crit. ita. 1: 226. (1863). *Cercophora mirabilis* Fuck. Jb. nassau. Ver. Nat. 23-24: 245. (1870). *Sphaeria bovilla* Cooke, Handb. Brit. Fungi. 2: 874. (1871). *Bovilla capronii* Sacc., Syll. Fung. 2: 360. (1883). *Podospora coprophila* (Fr.) Wint., Rab., Krypt. Fl. 1: 172. (1887). *Pleuraea coprophila* (Fr.) O. Kuntze, Rev. Gen. Pl. 2: 505. (1898). *Pleuraea albicans* Griff., Mem. Torrey bot. Cl. 2: 79. (1901). *Lasiosordaria coprophila* (Fr.) Chenant., Bull. Soc. mycol. France 24: 87. (1919).

Perithecia elongated pear-shaped, short ostiolate, the base immersed in the substrate, 0.5-1.0 × 0.4-0.5 mm, dark brown to black, covered with white tomentum formed of thin-walled, septate hairs. Asci cylindrical, long-stalked, with a apical ring, up to 250 × 20 μ , 8-spored, biserial, hyaline, containing 8-10 large oil drops, with pointed appendages at each end, 25-50 μ long, mature ascospores with an elliptical dark brown body in the upper end, 20-25 × 10 μ and a long cylindrical, hyaline primary appendage at the base or at each end. Paraphyses sausage cylindrical, septate, hyaline, 12-15 μ in diameter, with curved end.

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Habitat: on elephant dung, NTU 438, Apr. 16, 1976, on oxen dung, NTU 447, Dec. 22, 1976, Taipei.

Distribution: cosmopolitan.

Chaetomium aureum Chivera, Proc. Am. Acad. Arts & Sciences 48: 86, (1912).

(Plate I, Fig. A-B)

Synonym: *Chaetomium minium* v. Beyma, Antonie van Leeuw. 10: 42, (1944).

Perithecia ostiolate, globular to subglobular, dark brown to black, bluntly pointed at the base, $100-130 \times 90-120 \mu$. Terminal hairs arcuate, stright or incurved at the tips, septate, smooth or finely roughened, gray to gloden yellow, $3-4.5 \mu$ in diameter. Lateral hairs stright to slightly curved, septate, yellowish brown, finely roughened, $3-4 \mu$ in diameter. Asci club-shaped, 8-spored, $40-45 \times 8-10 \mu$. Ascospores irregularly ovate, occasionally flattened on one side, $9-11 \times 5-7 \mu$, olive brown, filling with refractive globules when young, apiculate at one or both ends.

Habitat: on filter paper of rabbit dung, NTU 461, Jan. 12, 1977, Taipei.

Distribution: America, Canada, England, Japan, Taiwan.

Chaetomium caprinum Bainier, Bull. Soc. Myc. France 25: 223, (1909).

Perithecia ostiolate, widening at the base, then cylindrical at the upper, greyish-black to black, covered with spreading grey hairs, $300-500 \times 150-200 \mu$, seating on a subiculum of yellowish-brown rhizoids. Terminal hairs straight below, spirally coiled above with 2-4 coils, septe, smooth to finely roughened, olive-brown to dark brown, $5-7 \mu$ in diameter, with loose or irregularly coiled branches. Lateral hairs straight, septate, finely roughened, olive to brown, 5μ in diameter. Asci club-shaped, 8-spored, $40-50 \times 10 \mu$. Ascospores ovate, $5-7 \times 5-6 \mu$, hyaline to greenish, apiculate at both ends.

Habitat: on sambar dung, NTU 462, on rhinoceros dung, NTU 463, Jan. 8, 1977, Taipei.

Distribution: cosmopolitan.

Chaetomium congoensis Ames, Bibliotheca Mycologia 17: 18. (1969). (Plate I, Fig. C-D)

Perithecia ostiolate, globose to subglobose, gray to brown, $200-300 \times 150-200 \mu$, attached to the substratum by rhizoids. Terminal hairs straight below, closely coiled above, indistinctly septate, gray to brown, branching, coiling regular or contorted, $4-5 \mu$. Lateral hairs flexed, septate. Asci cylindrical, 8-spored, $70-75 \times 5-7 \mu$. Ascospores ovate to lemon-shaped, olive brown, $6.5-8.5 \times 4.5-6.5 \mu$.

Habitat: on sheep dung, NTU 463, Jan. 12, 1977, Taipei.

Distribution: America, Belgian Congo, Taiwan.

Chaetomium dolichotrichum Ames, Mycologia. 37: 145, (1945). (Plate I, Fig. E-F)

Perithecia ostiolate, globular to subglobular, gray to black, $90-120 \times 80-150 \mu$. Terminal hairs of two kinds: (a) those forming a compact mass, dishotomously branched, yellowish-brown, septate, finely roughened, $2.5-3.0 \mu$ in diameter. (b) those forming long, unbranched hairs, dark brown, smooth, septate, sometimes dichotomously branched, branching may be at right angles to the axis or somewhat reflexed, $5-6 \mu$ in diameter. Lateral hairs short, brown below, lighter colored at the apex, smooth or finely roughened, septate, $3-4 \mu$ in diameter, with a blunt or collapsed tips. Asci club-shaped, 8-spored. Ascospores light brown, ovate to ellipsoid, $6-7.5 \times 4-5 \mu$.

Habitat: on filter paper of oxen dung, NTU 464, Dec. 28, 1976, Taipei.

Distribution: America, Canada, Taiwan.

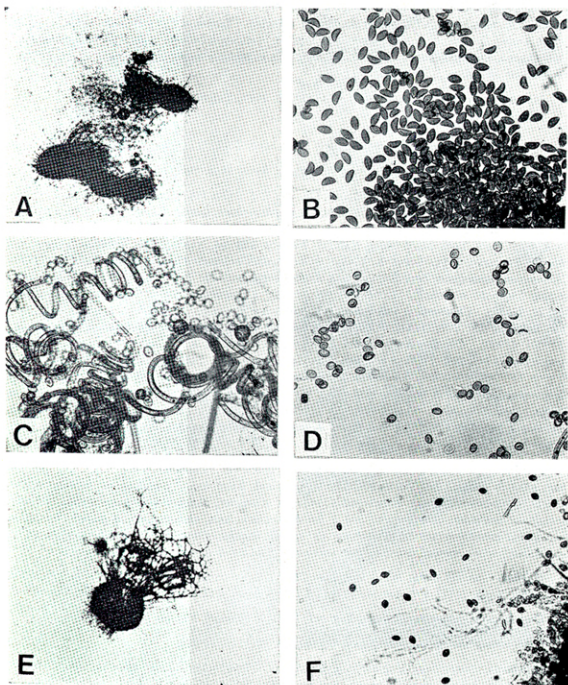


Plate 1. A-B. *Chaetomium aureum*, Perithecium and Ascospores;
C-D. *Chaetomium congoensis*, Hairs and Ascospores;
E-F. *Chaetomium dolichotrichum*, Perithecium and Ascospores.
(Scales, A, E=5 μ ; B, C, D, F=12 μ)

Chaetomium gangligerum Ames, Mycologia 41: 640, (1949).

Perithecia ostiolate, ovate to subglobose, light brown to olive brown, 200–250 × 150–200 μ , attached to substratum with numerous brown rhizoids. Terminal hairs straight below, spirally coiled above, 3–7 coils, finely roughened, septate, yellowish-brown, 3–5 μ in diameter. Asci club shaped, 8-spored, 50 × 10 μ . Ascospores ovate to broadly ovate, olive-brown, 11–16 × 7–11 μ , rounded or apiculate at both ends.

Habitat: on sambar dung, NTU 469, Jan. 2, 1977, Taipei.

Distribution: America, Taiwan.

Chaetomium globosum Kunze ex Fries, Syst. Myc. 3: 225, (1829). (Plate 2, Fig. A-B)

Synonym: *Chaetomium chartarum* Ehrenberg, Sylv. Myc. Berol. 15, 27, (1818).

Chaetomium ferberi Corda, Icones 1: 24, pl. 7, f. 293c, (1837). *Chaetomium offine* Corda, Icones 4: 37, pl. 8, 101, (1840). *Chaetomium amphitrichum* Corda, Icones 4: 37, pl. 8, f. 103, (1840). *Chaetomium araliae* Corda, Icones 4: 37, pl. 8, f. 102, (1840). *Chaetomium lanosum* Peck, Rep. New York State Mus. Natural History 28: 64, (1876). *Chaetomium fieberi* var. *chlorina* Saccardo, Myc. Venet X, (1876). *Chaetomium orientale* Cooke, Grevillea 5: 103, (1877). *Chaetomium kunzeanum* Zopf, Nova Acta Acad Leop-Carol 42: 278, (1881). *Chaetomium macrosporum* Saccardo & Penzig, Michelia 2: 591, (1882). *Chaetomium cymatotrichum* Cooke, Grevillea 12: 21, (1883). *Chaetomium kunzeanum* var. *fimicolum* Bommer & Rousseau, Bull. Soc. Roy. Bot. Belgique 23: 207, (1884). *Chaetomium oospora* Beauverie, Ann. Univ. Lyon. Nouv. Ser. 13: 201, (1900). *Chaetomium elasticae* Koorders, Verhand. d. K. Akad. v. Wernschappen te Amsterdam 134: 185, (1907). *Chaetomium kunzeanum* var. *chlorina* Mich., Bull. Soc. Myc. France 25: 202, (1910). *Chaetomium setonium* Bainier, Bull. Soc. Myc. France 25: 209, (1910). *Chaetomium spirilliferum* Bainier, Bull. Soc. Myc. France 25: 207, (1910). *Chaetomium undulatum* Bainier, Bull. Soc. Myc. France 25: 208, (1910). *Chaetomium subterraneum* Swift & Povah, Mycologia 21: 210, (1929). *Chaetomium deustum* Batista & Pontual, Bol. Sec. Agri-Inc. & Com. Pernambuco 15: 72, (1948).

Perithecia ostiolate, globular to subglobular, somewhat elongated with a bluntly pointed base, gray to black, 200–350 × 200–280 μ . Terminal hairs long, undulate to loosely coiled, septate, olive-brown, finely roughened, 3–4 μ in diameter. Lateral hairs numerous, slender, straight or undulate, olive-brown, 3–4 μ in diameter. Asci club-shaped, 8-spored, 60 × 10 μ . Ascospores broadly ovate or subglobose to lemon shaped, filled with refractive globules in immaturity, when mature olive to dark brown, 8.5–11 × 8–9 μ , apiculate at both ends.

Habitat: on ass dung, NTU 465, June 21, 1976, on oxen dung, NTU 466, May 31, 1976, on sambar dung, NTU 467, Jan. 4, 1977, on sheep dung, NTU 468, Dec. 20, 1976, Taipei.

Distribution: America, Brazil, England, France, Mexico, Taiwan.

Chaetomium microcephalum Ames, Mycologia 37: 145, (1945).

Perithecia scattered or gregarious, cylindrical, 500–600 × 150–200 μ , olive-brown to black. Terminal hairs brown, straight below, coiling above, 6–8 coils, septate, finely roughened, 4–5 μ in diameter, sometimes branching. Lateral hairs straight, yellowish brown, septate, finely roughened, 4–5 μ in diameter, with a tapering point. Asci club-shaped, 8-spored. Ascospores ovoid, light colored, 6–7.5 × 5–6 μ , apiculated at both ends.

Habitat: on sheep dung, NTU 482, Jan. 12, 1977, Taipei.

Distribution: America, Taiwan.

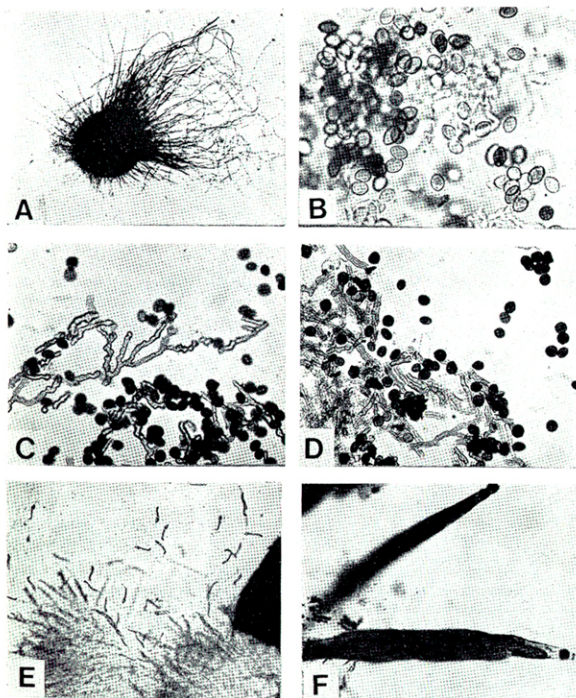


Plate 2. A-B. *Chaetomium globosum*, Perithecia and Ascospores;
C-D. *Chaetomium thermophile*, Hairs and Ascospores;
E-F. *Bombardia coprophila*, Ascospores and Ascus.
(Scales, A, E=5 μ ; B, C, D, F=12 μ)

Chaetomium thermophile La Touch, Trans. Br. Mycol. Soc. 33: 94, (1950). (Plate 2, Fig. C-D)

Perithecia globose to subglobose, covered with loose mass of olive brown hairs, 100-200 μ in diameter, attached to the substratum by brown rhizoids. Terminal hairs branched dichotomously, densely entangled when mature, unequally thickened and constricted along their length, covered with minute granules, branches reflexed with anastomosing, olive brown, 3-4 μ in diameter. Lateral hairs similar to the terminal hairs. Asci cylindrical or club-shaped, 8-spored, 50-60 $\times$ 6-8 μ . Ascospores dark brown, globose or irregularly subglobose, with a single apiculus, 8-10 $\times$ 7-9 μ .

Habitat: on oxen dung, NTU 470, Jan. 6, 1977, on sheep dung, NTU 471, Dec. 20, 1976, on sambar dung, NTU 472, June 6, 1976, Taipei.

Distribution: America, England, Taiwan.

Notes: This species dominantly grow at high temperature. La Touch (1950), isolated it from 45°C, however, the authors find it at 37.5°C.

Podospora absimilis Cain, Can. J. Bot. 40: 448, (1962).

(Plate 3, Fig. A-B)

Perithecia ostiolate, immersed or partially emergent, ovate to subglobose, brownish-black, 500-600 $\times$ 500 μ , hairy at the apex, covering long, scattered, brown hyphae at the other part. Perithecial peridium light-brown, consisting of thin-walled irregularly shaped, brown cells, 5-12 μ in diameter. Hairs adhering in fascicles, straight, septate, brown, 200-500 $\times$ 2-3 μ . Asci clavate, 150-400 $\times$ 50-100 μ , multispored, very thick-walled in youth, 10-30 in thickness, tapering below into stipe, 50-70 μ in length, surrounded by large hyaline swollen cells, up to 50 μ in diameter. Ascospores ellipsoid, multiseriate, arranged somewhat obliquely to longitudinal axis but some irregularly disposed, 17-21 $\times$ 10-12.5 μ , brown black in maturity, with a indistinct gelatinous secondary appendage at the down end, 4-7 $\times$ 2-3 μ , with one or two oil globules when immature, with one germinant pore, circular, hyaline, 1-2 μ in diameter, at apical end.

Habitat: on sheep dung, NTU 459, Dec. 20, 1976; on oxen dung, NTU 474, Jan. 8, 1977, Taipei.

Distribution: Canada, Taiwan.

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

(Plate 3, C-F)

Synonym: *Hypocopa communis* Speg., Anal. Soc. Ci. Argent. 10: 14, (1882). *Sordaria vestita* Zopf, Zeits. Naturw. 56: 556, (1883). *Podospora vestita* (Zopf.) Wint., Rabenh. Krpt. Flora, 1(2): 176, (1885). *Sordaria macrostoma* Speg., Anal. Mus. Nac. Hist. Nat. Buenos Aires, 6: 252, (1899). *Sordaria communis* var. *brachyura* Speg., Anal. Mus. Nac. Hist. Nat. Buenos Aires, 6: 253, (1899). *Pleuraea vestita* (Zopf.) Griff., Mem. Torrey Bot. Club, 11: 76, (1910). *Bombardia vestita* (Zopf.) Migula, Thome's Krypt. Flora, 10(1): 126, (1913). *Sordaria occidentalis* Batista & Pontual, Bol. Agric. Pernam. 15: 38, (1948). *Pleuraea macrostoma* (Speg.) C. Moreau, Encycl. Mycol. 262, (1953).

Perithecia ostiolate, immersed or partially emergent, ovate to subglobose, brownish black, 600-800 $\times$ 300-500 μ , hairy or almost bare. Peridium thin, consisting of brown black cells, 5-7 μ in diameter, opaque near the neck, semitransparent below. Asci clavate, 150-250 $\times$ 20-30 μ , 8-spored, apical ring distinct. Ascospores ellipsoid, biseriate, 25-38 $\times$ 15-20 μ , primary appendage cylindrical, 30-40 $\times$ 4-6 μ , four short or lyre-shaped tuft of secondary appendages at the apex, two or four short appendages at the distal end of the primary appendage, with germ pore apical, 1.5-2.0 μ in diameter.

Habitat: on oxen dung, NTU 445, Dec. 12, 1976; on sheep dung, NTU 455, Dec. 18, 1976, NTU 448, Dec. 16, 1976, Taipei.

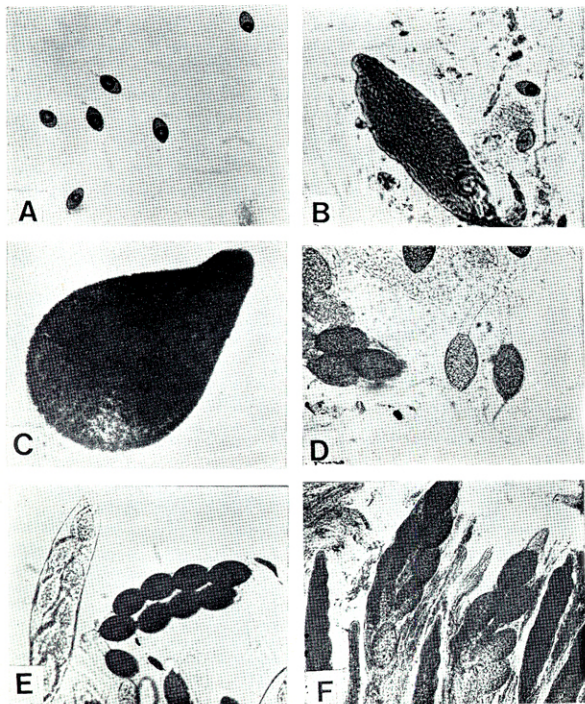


Plate 3. A-B. *Podospora absimilis*, Ascospores and Ascus;
C-F. *Podospora communis*, Perithecium, Ascospores and Ascus.
(Scales, A-F=12 μ)

Distribution: America, Argentina, Brazil, Canada, Germany, Mexico, Taiwan.

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

Perithecia ostiolate, immersed or partially emergent, pyriform to subglobose, black, 400–500 $\times$ 200–300 μ . Peridium brownish smooth, thin, semitransparent, consisting of thin-walled, light-brown cells, 12–15 μ in diameter. Hairs 200 $\times$ 2–3 μ , straight, septate, brown, mostly adhering in fascicles. Asci clavate, 200–250 $\times$ 37–45 μ , 8-spored, without thickened ring in apex, surrounded by large, hyaline cells 10–50 μ in diameter. Ascospores ellipsoid, biserial, 25–40 $\times$ 20–23 μ , hyaline when young, black and opaque when mature, primary appendage hyaline, 15–30 $\times$ 5–6 μ , secondary appendages lash-like, 20–35 $\times$ 5–6 μ , with germ pore apical, 1.5–2.0 μ in diameter.

Habitat: on oxen dung, NTU 451, Dec. 6, 1976, Taipei.

Distribution: Canada, Taiwan.

Notes: This species is similar to *Podospora absimilis* but differs in having 8-spored asci and lash-like appendages.

Sordaria fimicola (Rob. ex Desm.) Ces. & De Not., Comm. Soc. crit. ital. 1: 226. (1863).

Synonym: *Sphaeria fimicola* Rob. ex Desm., Ann. Sci. nat. (Bot.) ser. 3, 2: 353. (1849). *Hypocropa fimeti* Fuck., Jb. nassau. Ver. Nat. 23–24: 240. (1870). *Hypocropa fimicola* (Rob. ex Desm.) Sacc., Syll. Fung. 1: 240. (1882). *Sordaria iowana* Ell. & Holw., J. Mycol. 4: 65. (1888). *Hypocropa iowana* (Ell. & Holw.) Sacc., Syll. Fung. 9: 490. (1891). *Sordaria ostiolata* Ell. & Ev., Bull. Torrey bot. Cl. 24: 458. (1897). *Fimetaria fimicola* (Rob. ex Desm.) Griff. & Seaver, North Amer. Fl. 3: 69. (1910).

Perithecia scattered, pear-shaped, more or less immersed in the substrate, smooth, brownish black, up to 0.5–1.0 $\times$ 0.5–0.6 mm. Asci cylindrical, with a apical ring, 200–220 $\times$ 20–25 μ , 8-spored, uniseriate. Ascospores elliptical, with a germ pore at the low end, 17–25 $\times$ 10–13 μ , hyaline in youth, lighter brown to brownish black in maturity, smooth, enclosed with gelatinous sheath, hyaline, 2–2.5 μ in thickness. Paraphyses absent.

Habitat: on ass dung, NTU 304, Apr. 18, 1976, Taipei.

Distribution: cosmopolitan.

Notes: This species is different from *Sordaria humana* in elliptical spores.

Sordaria humana (Fuck.) Wint. Bot. Z. 30: 835. (1872).

(Plate 4, Fig. A-B)

Synonym: *Hypocropa humana* Fuck., Jb. nassau. Ver. Nat. 23–24: 241. (1870). *Hypocropa fermenti* Fuck., Jb. nassau. Ver. Nat. 23–24: 241. (1870). *Hypocropa fimeti* var. *humana* (Fuck.) P. Karst. Bidr. Känn. Finl. Nat. Folk. 23: 50. (1873). *Sordaria fermenti* (Fuck.) Wint. Abh. naturf. Ges. Halle. 13: 21. (1873). *Sordaria sphaerospora* Ell. & Ev., North Amer. Pyren. 128. *Hypocropa sphaerospora* (Ell. & Ev.) Sacc., Syll. Fung. 2: 280. (1895). *Hypocropa fimicola* var. *felina* Speg., An. Mus. nac. Buenos Aires 19: 341. (1909). *Fimetaria humana* (Fuck.) Griff. & Seaver, North Amer. Fl. 3: 67. (1910). *Sordaria papillosa* Bayer, Acta Soc. Sci. nat. Morav. 1. (1924).

Perithecia scattered, pear-shaped, more or less immersed in the substrate, smooth above, with a few anchoring hyphae below, brownish black, up to 0.8 $\times$ 0.6 mm. Asci cylindrical, with a apical ring, up to 250 $\times$ 20 μ , 8-spored, uniseriate. Ascospores broadly obovoid with a small germ pore at the low end, 20–27 $\times$ 12–18 μ , hyaline first, lighter brown to brownish black in maturity, smooth, enclosed with a narrow, 2.5 μ in thickness, hyaline, gelatinous sheath. Paraphyses absent.

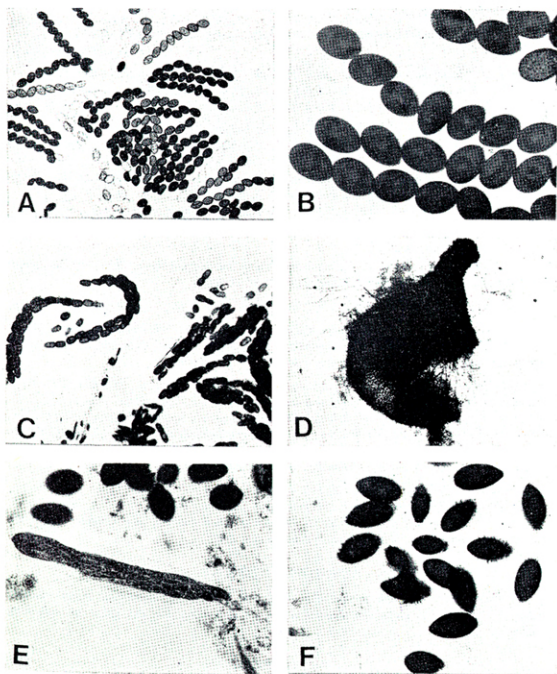


Plate 4. A-B. *Sordaria humana*, Ascospores and Ascus;
C. *Sporormiella minima*, 3-septated ascospores;
D-F. *Zygopleurage zygospora*, Perithecium, unmaturing Ascus and
separated Ascospores.
(Scales, A = 5 μ ; B-F = 12 μ)

Habitat: on rabbit dung, NTU 334, July 18, 1976, NTU 405, Dec. 8, 1976.

Distribution: cosmopolitan.

Sporormiella minima (Auersw.) Ahmed & Cain, Can. Jan. Bot. 50: 449. (1972).

(Plate 4, Fig. C)

Synonym: *Sporormia minima* Auersw., Hedwigia, 7: 66. (1868). *Sporormia evallata* Pass., nuovo Giorn. Bot. Ital. 7: 190. (1875). *Sphaeria multifera* Berk. & Rav., Grevillea, 4: 143. (1876). *Philocopra multifera* (Berk. & Rav.) Sacc., Syll. Fung. 1: 251. (1882).

Pseudothecia scattered, small, ostiolate, more or less immersed in dung, $150-200 \times 100-150 \mu$, ostiole round, $50-100 \mu$ long, brown black. Asci cylindrical, short stalk, bitunicate, intermingled with pseudoparaphyses, up to $150 \times 12 \mu$, 8-spored. Ascospores arranged in two or three rows, cylindrical, straight or slightly curved, $28-30 \times 3.5-4.5 \mu$, 3-septate, easily separating into unicellular segments, each enclosed with a hyaline mucilaginous sheath.

Habitat: on sheep dung, NTU 354, Apr. 12, 1976, NTU 441, Dec. 20, 1976; on ostrich dung, NTU 396, May 18, 1976, Taipei.

Distribution: cosmopolitan.

Notes: This species is easily distinguished from other coprophilous fungi by its spores with 3-septate, separating into unicellular segments in maturity.

Zygopleura zygospora (Speg.) Boedijn, Persoonia 2: 316. (1962). (Plate 4, Fig. D-F)

Synonym: *Sordaria zygospora* Speg. Michelia 1: 227. (1878). *Philocopra zygospora* (Speg.) Sacc., Syll. Fung. 1: 251. (1882). *Podospora zygospora* (Speg.) Niessl, Hedwigia 22: 156. (1883). *Pleura zygospora* (Speg.) O. Kuntze, Rev. Gen. Pl. 3: 505. (1898).

Perithecia ostiolate, immersed or partially emergent, pyriform, black, $500-600 \times 250-300 \mu$, peridium brownish, smooth, thin, semitransparent, consisting of thin-walled, light-brown cells, $10-15 \mu$ in diameter. Asci clavate, $250-300 \times 32-50 \mu$, 8-spored, without thickened ring in apex, thick-walled in youth, $10-20 \mu$ in thickness. Ascospores 2-celled, multiseriate, hyaline, clavate in youth, $100-120 \times 5-6 \mu$, brownish black in maturity, $27-42 \times 15-20 \mu$, connected by a narrow hyaline central cord, separating in maturity, with 2-4 appendages.

Habitat: on oxen dung NTU 452, Jan. 12, 1977, Taipei.

Distribution: America, Bulgaria, Hungary, Italy, Sweden, Taiwan.

Notes: This species is very similar to *Podospora* when mature, but different from the latter in spores connected by a narrow hyaline central cord.

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