60 (58). Ascospores striate 61
60. Ascospores smooth to spinulose 62

61 (60). Ascospores (18–)25–39 × (6.5–)8.5–14 µm, finely striate; anamorph unknown; fungicolous ..... *C. diminuta*
61. Ascospores (19–)25–42(–48) × 6–10(–11) µm, coarsely striate; anamorph *Chaetopsina*; corticolous or on palm fronds ..... *C. chaetopsinae-penicillatae*

62 (60). Corticolous, not conspicuously fungicolous; ascospores 36–41.5 × 6–7 µm, smooth; anamorph *Chaetopsina* ..... *C. macrochaetopsinae*
62. Fungicolous; ascospores smooth or spinulose; anamorph *Fusarium* 63

63 (62). On *Parmulariaceae* on bamboo; ascospores 28–37(–42) × 8–13.5(–16) µm, smooth; anamorph unknown ..... *C. tungurahuana*
63. Not on *Parmulariaceae* on bamboo; ascospores spinulose, < 28 µm long; anamorph *Fusarium* 64

64 (63). On *Rhytismataceae*; ascospores 8–23 × 6–8 µm ..... *C. ganymede*
64. On *Leptosphaeria*; ascospores (14.5–)15–17.5(–26) × (5–)5.5–6.5(–7) µm ..... *C. leptosphaeriae*

Cosmospora wegeliniana (Rehm) Rossman & Samuels, *comb. nov.*

≡ *Nectria episphaeria* (Tode : Fr.) Fr. var. *wegeliniana* Rehm, Hedwigia 30: 260. 1891.
≡ *Dialonectria wegeliniana* (Rehm) Petch, Trans. Brit. Mycol. Soc. 21: 266. 1983 [as '*wegeliana*'].

Anamorph: *Acremonium*-like.

Habitat.— On *Pseudovalsa berkeleyi*.
Distribution.— Europe (type), Neotropics, New Zealand.

Cosmospora xanthostroma (Penz. & Sacc.) Rossman & Samuels, *comb. nov.*

≡ *Nectria xanthostroma* Penz. & Sacc., Malpighia 11: 514. 1897.

Anamorph: None known.

Habitat.— On bark, possibly dematiaceous hyphae.
Distribution.— Indonesia

GIBBERELLA Sacc., Michelia 1: 43. 1877.

Type: *G. pulicaris* (Fr. : Fr.) Sacc. (≡ *Sphaeria pulicaris* Fr. : Fr.).
= *Lisea* (Sacc.) Sacc., Michelia 1: 43. 1877 (≡ *Botryosphaeria* subgenus *Lisea* Sacc., Michelia 1: 42. 1877). — Type: *L. nemorosa* (Sacc.) Sacc. (≡ *Botryosphaeria nemorosa* Sacc.), recognized as *Gibberella nemorosa* (Sacc.) Wollenw.).
= *Lisiella* (Cooke & Massee) Sacc., Syll. Fung. 9: 945. 1891 (≡ *Gibberella* subgenus *Lisiella* Cooke & Massee, *in* Cooke, Grevillea 16: 5. 1887). — Type: *L. passiflorae* (Cooke & Massee) Sacc., Syll. Fung. 9: 945. 1891, recognized as *Gibberella passiflorae* Cooke & Massee, *in* Cooke, Grevillea 16: 5. 1887.

Ascomata solitary or on a thin stroma erumpent through the epidermis, superficial, subglobose to globose, not collapsing, bluish purple, KOH+ dark purple, pigment dissolving in lactic acid, slightly rugose to tuberculate, without hairs or appendages. Ascomatal wall of two regions: outer region of thick-walled, pigmented cells forming a *textura angularis* to *textura globulosa*; inner region of elongate, hyaline, thin-walled cells, becoming thinner toward the centrum. Asci narrowly clavate, often with an apical ring. Ascospores (0–1–)3-septate, ellipsoid, hyaline. Anamorph, where known, *Fusarium*. Saprobic and pathogenic on woody and herbaceous substrata, isolated from soil.

Notes.— *Gibberella* was initially described in a footnote to *Botryosphaeria advena* Ces. & De Not., in which the genus *Botryosphaeria* is discussed as being heterogeneous and was divided into three genera, *Botryosphaeria*, *Giberella* (sic), and *Lisea*. In the original description, this generic name was spelled '*Giberella*'; however, the name is a diminutive of '*Gibbera*' and most authors have spelled it as '*Gibberella*' (Clements & Shear, 1931; Farr *et al.*, 1979b; Hawksworth *et al.*, 1995). The genus *Gibberella* was characterized by Saccardo (1877) as having fleshy, bluish purple ascomata and ovoid–fusoid, 3-septate, subhyaline ascospores. Both *Gibberella* and *Lisea* were placed in the *Hypocreaceae* at that time.

At the same time Saccardo (1877) raised *Botryosphaeria* subgenus *Lisea* to generic rank and considered *Lisea* to be similar to *Gibberella* except in having one-septate ascospores. *Botryosphaeria* subgenus *Lisea* initially included only one species, *B. nemorosa*,

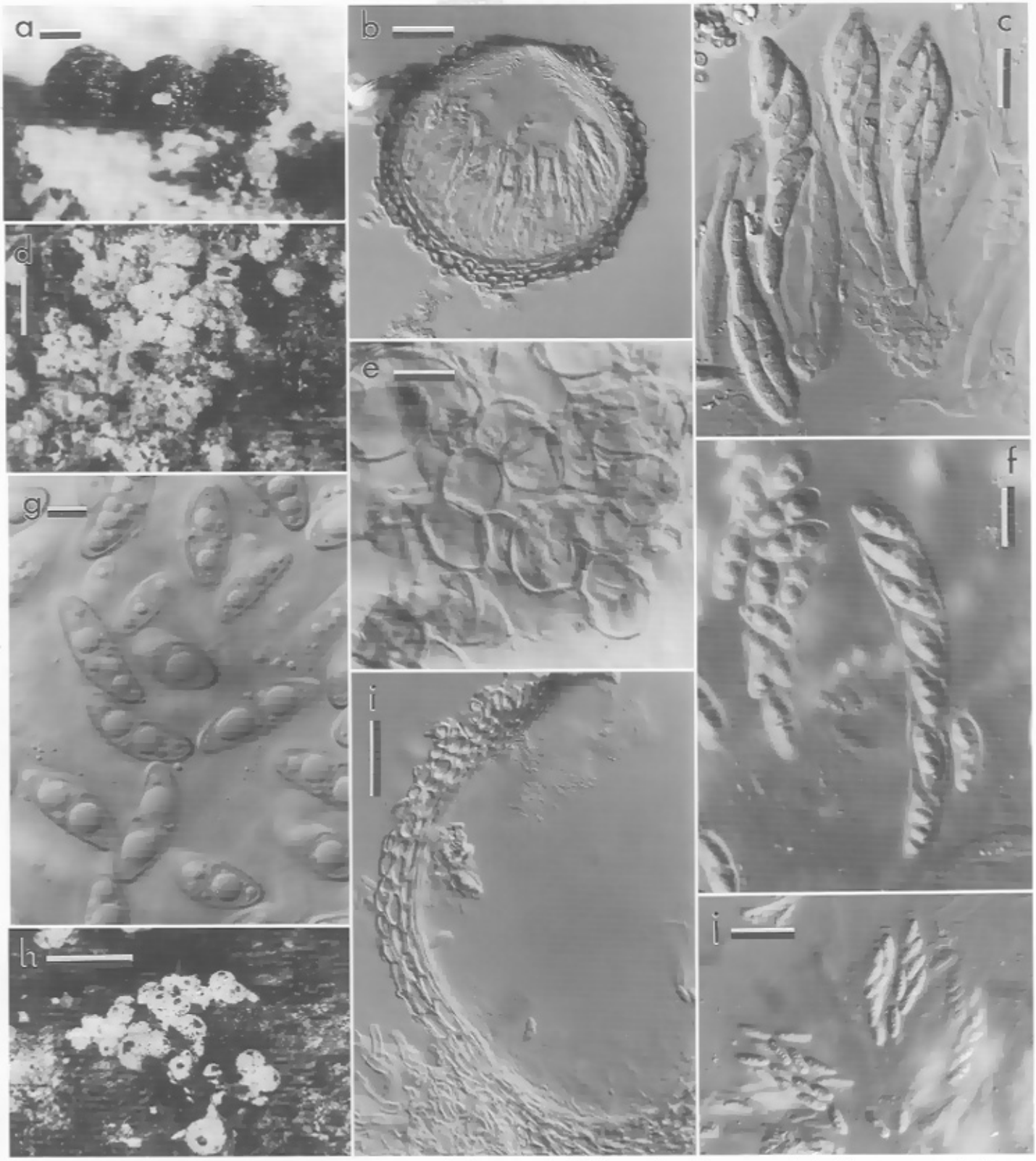

Plate 29. a–c. *Gibberella pulicaris*. a. Ascomata on natural substratum. b. Median section of ascoma. c. Asci with ascospores. **d.** *Haematonectria illudens*. Ascomata on natural substratum. **e–g.** *Haematonectria haematococca*. e. Ascomatal wall cells. f. Asci with ascospores. g. Ascospores. **h.** *Lanatonectria flavolanata*. Ascomata on natural substratum. **i–j.** *Lanatonectria flocculenta*. i. Median section of ascoma. j. Asci with ascospores. a–b. BPI 632303. c. BPI 632301. d. BPI 802461. e–g. BPI G.J.S. 92-140. h. G.J.S. 3584 – NY. i. BPI 552098; j. G.J.S. 1553 – NY. Scale bars: a = 100 μm; b, i = 50 μm; c, e, f, j = 25 μm; d, h = 1 mm; g = 10 μm.

which is therefore the type of the genus *Lisea* as *L. nemorosa* (Sacc.) Sacc. When raising *Lisea* to generic rank, he added a second species, *L. vitis* (Nießl) Sacc. Clements & Shear (1931) mistakenly designated *Lisea buxi* (Fuckel) Sacc. (≡ *Gibbera buxi* Fuckel) as the lectotype and Rogerson (1970) followed this designation. *Lisea buxi* was not included in the original *Botryosphaeria* subgenus *Lisea* nor in the genus *Lisea* as established by Saccardo (1877); it was added to the genus only in a later publication (Saccardo, 1878). Eriksson & Hawksworth (1987b) suggested that *Lisea* Sacc. 1877 was a later homonym of *Licea* Schrader 1797; however, these names, applying to unrelated organisms, are not based on the same root and are not homonyms.

Lisiella was established as a subgenus of *Gibberella* for species with aseptate ascospores. When Saccardo (1891) raised this taxon to generic rank, he included only the original species, *L. passiflorae*. A part of the type specimen of *L. passiflorae* was examined but it is in poor condition [NY, AUSTRALIA. Brisbane, on stems of *Passiflora edulis*, Bailey 535]. It appears to be an immature species of *Gibberella* having bluish purple, rugose ascomata of relatively thick-walled cells, and ascospores 12 × 6 μm, generally 3-septate, also 0–1-septate.

Gibberella teleomorphs are encountered much less frequently than the *Fusarium* anamorphs that have been more thoroughly studied, particularly those in the *Gibberella fujikuroi* species complex (Nirenberg & O'Donnell, 1998; Gams *et al.*, 1999b). Molecular studies suggest that the ubiquitous plant-pathogenic fungus, *F. oxysporum*, is allied with those species of *Fusarium* having *Gibberella* teleomorphs (Bruns *et al.*, 1991; O'Donnell *et al.*, 1998). About 50 names have been included in *Gibberella*; despite their economic importance, the genus *Gibberella* has never been monographed. Although not including some recently described species (Booth & Prior, 1984; Broadhurst & Johnston, 1994; Klaasen & Nelson, 1996; Klittich *et al.*, 1997), the most comprehensive reference remains Booth (1971) who included thirteen taxa of *Gibberella* and their related *Fusarium* anamorphs. Using both teleomorph and *Fusarium* anamorph characteristics, Samuels *et al.* (1998a) recently published a key to the species of *Gibberella* encountered in agricultural settings.

Gibberella pulicaris (Fr. : Fr.) Sacc., Michelia 1:43. 1877. — Plate 29, a–c.

≡ *Sphaeria pulicaris* Fr. : Fr., Syst. Mycol. 2: 417. 1823.

Anamorph: *Fusarium sambucinum* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 167. 1869 [1870], *nom. cons. prop.*

Stroma sparse, of densely interwoven hyphae arising from the base of the ascoma; mycelium sparse, bluish purple. Ascomata superficial, gregarious, on a minute, immersed, basal stroma, broadly pyriform, 220–265 μm diam, laterally pinched or not collapsing when dry, bluish purple, darker in KOH, becoming red in lactic acid, non-papillate, with warts to 50 μm high. Ascomatal surface of circular to angular cells, 7–10 μm diam, with 2–2.5 μm thick walls. Ascomatal wall 33–66 μm thick, inclusive of warts, of two regions: outer region, including warts, 15–44 μm thick, cells 7–10 μm diam, walls 2–2.5 μm thick; inner region of cells with more or less ellipsoid lumina, 15–18 × 4–5 μm, with 2 μm thick walls, cells increasingly more compacted and thin-walled toward the centrum. Apex of vertically elongate hyphal elements continuous with the inner region of the ascomatal wall, protruding through the outer region, and merging with the periphyses. Asci clavate, 75–100 × 15–20 μm, apex simple, 8-spored, ascospores biseriate to pluriseriate. Ascospores ellipsoid to cylindrical, (18–)21.5–27 (–29) × 5.5–7(–8) μm, 3(–6)-septate, not constricted at the septum, pale tan, smooth-walled.

Anamorph: Conidiophores abundant in the aerial mycelium, much-branched, 80–100 μm high fascicles, each branch terminating in one or two cylindrical phialides, 10.5–13.5 μm long × 2.5–3.5 μm wide, with visible periclinal thickening at the unflared tip. Conidia cylindrical, straight but with tip cell more or less hooked, with a well-developed, pedicellate foot-cell, (1–)3–5(–6)-septate: 1-septate: 16–20 × 2–3 μm; 2-septate: 16–21 × 3.5 μm; 3-septate: 20.5–31(–34) × (2–)3.5–4.5 μm; 4-septate: (26–)27.5–32(–33.5) × (3.5–)4–5(–5.5) μm; 5-septate: 29–35.5(–42.5) × (3.5–)4–4.5(–6) μm; 6-septate: 45 × 5.5 μm. Chlamydospores usually not abundant.

Habitat.— In soil, causing root and seedling rot of cereals and other crops, and storage rots in potatoes, also reported from hardwood trees causing cankers and collected on a palm trunk in Indonesia (Booth, 1971; Domsch *et al.*, 1980).

Distribution.— Worldwide but more common in temperate than tropical regions.

Type.— GERMANY. 'In rimis corticis *Sambuci*' (type not located).

Illustrations.— Booth (1971, Pl. 18A, Fig. 44); Domsch *et al.* (1980, Fig. 148); Ellis & Ellis (1985, Fig. 708); Ellis & Everhart (1892, Pl. 13, Figs. 1–6); Gerlach & Nirenberg (1982, Fig. 53, anamorph); Nirenberg (1995, Figs. 1–3, anamorph); Samuels *et al.* (1990, Fig. 2).

Specimens illustrated.— UNITED STATES. Massachusetts: Amherst, on *Zea mays*, 1904, G.E. Stone (BPI 632303). — New York, Farmington, on *Zea mays*, Aug 1889, E. Brown (BPI 632301).

Notes.— The type description of *Sphaeria pulicaris* includes reference to a substratum 'in rimis corticis *Sambuci*'. No type specimen exists at UPS; this species needs to be neotypified. The concept of the species *Gibberella pulicaris* is well established particularly as the teleomorph of *Fusarium sambucinum* (Booth, 1971, 1973; Nirenberg, 1995). A large body of literature is associated with this name because of its importance in the production of mycotoxins. Conservation of the anamorph name against the older and often confused *F. roseum* Link was proposed by Gams *et al.* (1997).

Gibberella nemorosa (Sacc.) Wollenw., Z. Parasitenk. (Berlin) 3: 489. 1931.

≡ *Botryosphaeria nemorosa* Sacc., Michelia 1: 42. 1877.
≡ *Lisea nemorosa* (Sacc.) Sacc., Michelia 1: 43. 1877.

Ascomata solitary to aggregated in groups of 2–5, on a sparse pseudoparenchymatous stroma, superficial, subglobose, 125–240 μm diam, becoming cupulate on drying, appearing black, microscopically dark purple, KOH+ black with purple pigments dissolving, fleshy, rugose. Ascomatal wall 12-18 μm thick, of one region of globose cells forming a *textura angularis*, cells 8–15 μm diam, walls slightly thickened to about 1.5 μm. Apical paraphyses visible as deliquescing strands. Asci narrowly clavate, 52–90 × 8–12 μm, apex simple. Ascospores ellipsoid, 12–16 × 4.5–7.5 μm, 1-septate, hyaline, smooth-walled.

Habitat.— On dead twigs and stems of *Clematis* and *Cytisus*.
Distribution.— Italy.

Type.— ITALY. Montello, on dead twigs of *Cytisus nigricans*, Oct. 1876 (PAD, holotype); Montello (Treviso), on dead stems of *Clematis vitalba*, Aug. 1902, P.A. Saccardo, D. Saccardo, Mycotheca italica no. 1305 (BPI, authentic, unbound).

Illustrations.— Wollenweber (1930, No. 821).

Note.— The holotype specimen at PAD of *Botryosphaeria nemorosa* has only a few remaining ascomata of a fungus resembling the original description. A later specimen identified as *Lisea nemorosa* by P.A. Saccardo was issued as Mycotheca Italica no. 1305. This specimen at BPI agrees with the original description; however, the specimen of that number at NY has larger, 3-septate ascospores of a species of *Gibberella* suggesting that Mycotheca Italica no. 1305 was a mixed collection and may have been the source of misunderstanding about this genus. Weese (1919), Petrak (1923) and later Müller & von Arx (1962) considered *Lisea* Sacc. to be a synonym of *Gibberella*. They noted that *Lisea nemorosa* occasionally has three-septate as well as one-septate ascospores but in all other respects is typical of the genus *Gibberella*. In the holotype specimen of *Lisea nemorosa*, only one-septate ascospores were observed; it is possible that these ascomata are immature.

HAEMATONECTRIA Samuels & Nirenberg, *gen. nov.*

Type: *Haematonectria haematococca* (Berk. & Broome) Samuels & Nirenberg.

Ascomata non stromatica, solitaria vel gregaria, superificialia, globosa vel pyriformia, flava vel rubra, KOH+ parum fuscata, grosse verrucata, verrucae sursum acutatae e cellulis angularibus, crassitunicatis constantes, 15–30 μm diam. Asci clavati, apice simplici. Ascosporae ellipsoideae, saepe utrinque leviter truncatae, fusco-luteae, striatae vel spinulosae.

Ascomata non-stromatic or with a basal stroma, solitary to gregarious, superficial, globose to pyriform, yellow to red, KOH+ slightly darkening, collapsing laterally when dry; coarsely warted, warts formed of angular cells, 15–30 μm diam, walls thickened; apex acute, of clavate hyphal elements. Asci clavate, apex simple, rarely with a ring, ascospores biseriate above, uniseriate below. Ascospores ellipsoid, often with ends slightly truncate, translucent yellow-brown, striate or spinulose. Anamorph *Fusarium* sect. *Martiella* or unknown. Saprobic and pathogenic on woody and herbaceous substrata.

Notes.— *Haematonectria* corresponds to the *Nectria haematococca*-group defined by Samuels (1976a) based on both teleomorph and anamorph characteristics. The *Fusarium* anamorphs of species of *Haematonectria* are common soil inhabitants, often causing root diseases of cultivated plants, unlike species of *Nectria sensu stricto* that occur as weak parasites of trees and shrubs and are not commonly isolated from soil. *Haematonectria haematococca* is not congeneric with *Nectria sensu stricto* as defined by Rossman (1989) either on morphological or molecular grounds. The results of the analysis of sequence data presented by both Guadet *et al.* (1989) and O'Donnell (1993) as well as differing mycotoxin profiles (Marasas *et al.*, 1984) indicate that *H. haematococca* is distinct from *Nectria sensu stricto*. Just as there is little similarity between species of *Haematonectria* and species of *Nectria sensu stricto*, there is little similarity between *Haematonectria* and other teleomorphs that have *Fusarium* anamorphs, viz. *Albonectria*, *Cosmospora*, and *Gibberella*. Based on rDNA sequences, Guadet *et al.* (1989) and O'Donnell (1993) have clearly demonstrated genetic differences between *Albonectria*, *Gibberella*, and *Haematonectria*. The accumulated data support the recognition of a separate genus for '*Nectria*' *haematococca* and its relatives.