

Bertia moriformis and its varieties

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Examination of Canadian, United States, and European collections of *Bertia moriformis* in DAOM, TRTC, and other herbaria revealed the existence of two distinct forms distinguished solely by differences in ascospore morphology and dimensions. *Bertia moriformis* var. *moriformis* occurs mostly on deciduous wood in Europe and North America and is characterized by narrow, uniseptate, straight to gently curved ascospores, 4.5–6.5 μm wide. *Bertia moriformis* var. *latispora*, described as new, occurs principally on coniferous wood; the collections with one exception are from North America. Within the ascus, the ascospores of var. *latispora* are indistinguishable from those of var. *moriformis*, but when mature and free of the ascus, they are wider, 6–8.5 μm , and geniculate. Germinating ascospores of var. *latispora* apparently become pluriseptate prior to germination. *Bertia moriformis* var. *multiseptata* Sivanesan, with multiseptate ascospores, is briefly redescribed and illustrated.

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L'examen de spécimens canadiens, américains et européens de *Bertia moriformis* provenant des herbiers DAOM, TRTC, et autres a révélé qu'il existe deux formes distinctes qui se caractérisent uniquement par des différences dans la morphologie et les dimensions des ascospores. *Bertia moriformis* var. *moriformis* se retrouve surtout sur des espèces ligneuses décidues en Europe et en Amérique du Nord; il se caractérise par des ascospores minces, simplement septées, droites à légèrement courbées, mesurant 4.5–6.5 μm en largeur. *Bertia moriformis* var. *latispora*, décrite comme nouvelle variété, se retrouve surtout sur les conifères; sauf une exception, toutes les collections sont d'Amérique du Nord. À l'intérieur de l'asque, les ascospores du var. *latispora* ne peuvent être distinguées de celles du var. *moriformis*, mais lorsqu'elles sont mûres et libres de l'asque, elles sont plus larges, 6.0–8.5 μm , et géniculées. Les spores du var. *latispora* deviennent apparemment pluriseptées avant la germination. On trouvera également une redescription avec illustrations de *Bertia moriformis* var. *multiseptata* Sivanesan.

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Introduction

An examination of Canadian specimens filed as *Bertia moriformis* (Tode: Fr.) de Notaris at the National Mycological Herbarium (DAOM), Agriculture Canada, Ottawa, and at the cryptogamic herbarium of the Department of Botany, University of Toronto (TRTC), revealed that there are two distinct populations that can be readily distinguished by the shape and dimensions of mature ascospores. Differences in ascum morphology could not be discerned, but a minor difference in ascus width was apparent. Immature ascospores of both forms are identical while within the ascus. Only after the asci have disintegrated and the free ascospores have reached maturity within the centrum can the varieties be distinguished. *Bertia moriformis* var. *latispora* var. nov. is described therefore on the basis of its distinct ascospores.

Additional collections of *Bertia moriformis* from the United States and from Europe were examined to determine the range of the new variety. *Bertia moriformis* var. *multiseptata* Sivanesan is briefly redescribed and illustrated from the type collection and one additional gathering.

Taxonomy

- Bertia moriformis* (Tode: Fr.) de Notaris var. *moriformis*,
G. Bot. Ital. 1: 335. 1884 Figs. 1, 2, 6, 7, 11–13
= *Sphaeria moriformis* Tode: Fr., Fungi Mecklenb. Sel.,
Fasc., 2: 22. 1791; Syst. Mycol. 2: 458. 1823
= *Sphaeria claviformis* Sowerby, Col. Fig. Engl. Fungi,
plate 337. 1801
= *Sphaeria rubiformis* Sow., Col. Fig. Engl. Fungi, plate 373,
Fig. 2. 1802
= *Sphaeria rugosa* Greville, Flora edinensis, p. 364. 1824

Ascomata scattered to gregarious, superficial on sound or, occasionally, on partially rotted wood, infrequently erumpent through attached bark of dead wood, subiculum lacking, attached to substrate by a few dark brown hyphal strands, black, short cylindrical, 700–1000(–1200) μm high (including the base), 500–700 μm wide; upper fertile portion of ascoma globose to subglobose, coarsely tuberculate and borne on a well-developed, short cylindrical, nontuberculate base. "Ostiole" not recognizable externally but in median longitudinal section seen as an apical thinning of the ascoma wall; the underlying area filled with thin-walled hyaline cells which disintegrate early, and eventually, the overlying wall cells lysing. Ascoma wall at the top and sides unevenly thickened owing to the presence of the tubercles, composed of dark brown to blackish (at the periphery), thick-walled, angular to tangentially flattened cells up to 30 μm in length, consisting of 8–10 cell layers, 70–100 μm thick, between the tubercles and 10–15 cell layers, 100–125 μm thick, through the tubercles; walls of adjoining cells possessing prominent pores (Munk pores), ca. 1 μm diam., each bordered by a doughnut-shaped thickening; innermost zone bordering the centrum consisting initially of 4–6 layers of pale to hyaline tangentially flattened cells. Asci arising from a basal cushion of thin-walled angular cells, unitunicate, clavate, long stipitate, thin walled, 92–140 \times 10–21 μm (including the stalk), 8 spored, deliquescing early and liberating ascospores into centrum. Ascospores irregularly arranged in upper portion of ascus, hyaline, fusiform, 34.5–52.5 \times 4.5–6.5 μm , straight to curved, ends rounded to acute, 1(–3) septate, guttulate, smooth.

SUBSTRATE: Decorticated sound wood, occasionally on partially rotted wood and dead branches of living trees and shrubs,

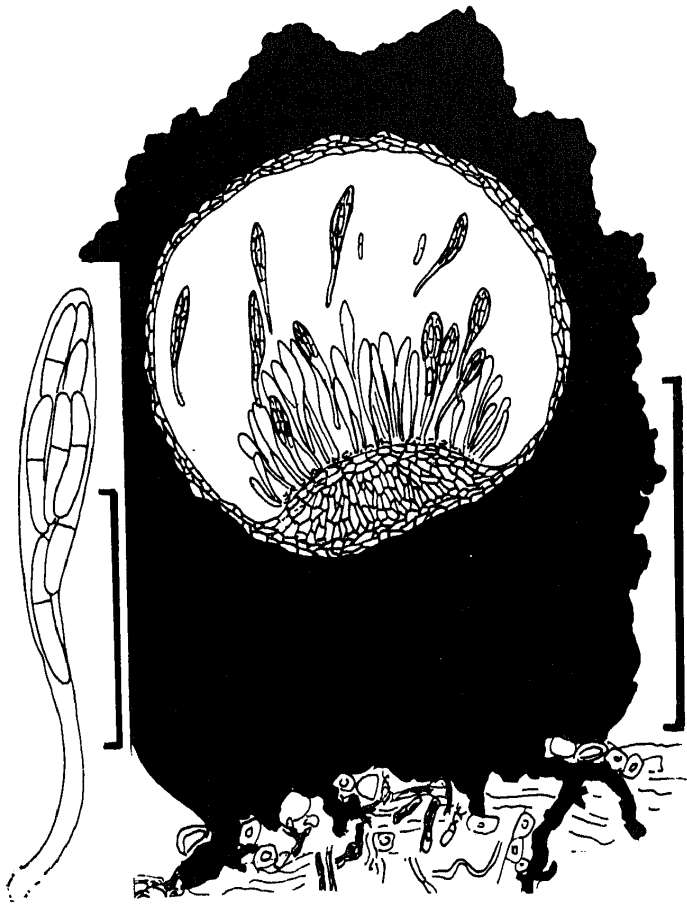


FIG. 1. *Bertia moriformis* var. *moriformis*. Vertical section through ascoma, scale 500 μm ; ascus, scale 50 μm , DAOM 37419.

mostly on deciduous wood (*Acer*, *Alnus*, *Betula*, *Corylus*, *Fagus*, *Fraxinus*, *Populus*, *Quercus*, *Rhododendron*, *Salix*, *Sambucus*, *Tilia*), occasionally on coniferous wood (*Abies*, *Picea*, *Pinus*), and occasionally on old basidiocarps (*Corliolus*, *Hirschioporus*).

COLLECTIONS EXAMINED: CANADA: NEW BRUNSWICK: Kent Co.: Cape St. Louis, Kouchibouguac National Pk., DAOM 169451, 10 Aug. 1978, K. Egger, *Populus tremuloides* Michx.; QUÉBEC: Gatineau Co.: near Cantley, DAOM 28634, 22 July 1952, S.J. Hughes, on *Fagus grandifolia* Ehrh.; Kingsmere, DAOM 29262, 6 Oct. 1952, D.E. Wells, *Fagus grandifolia* Ehrh.; near Kingsmere, DAOM 37419, 9 July 1953, S.J.H., *Fagus grandifolia* Ehrh.; ONTARIO: Leeds Co.: St. Lawrence Islands National Pk., Thwartway I., DAOM 159428, 26 Aug. 1976, J. Bond, unidentified wood; Muskoka Dist.: S. of Dorset, University of Toronto Forest, TRTC 50214, 14 Sept. 1967, R.F. Cain, *Fagus* and TRTC 49118, 12 Sept. 1961, R.F.C., unidentified branch; Nipissing Dist.: Algonquin Provincial Pk., Hardwood Hills picnic ground, TRTC 44990, 3 July 1966, B. Malloch, decorticated hardwood; Algonquin Provincial Pk., Costello L., TRTC 15894, 22 Aug. 1939, R.F.C., on *Alnus incana* Am.; Timagami Forest Reserve, Gull L. portage, TRTC 26049, DAOM 85154, 13 July 1931, R.F.C., *Acer spicatum* Lam; L. Timagami, Bear I., DAOM 85155, 29 June 1932, R.F.C., *Corylus cornuta* Marsh.; L. Timagami, Bear I., TRTC 10709 & G, 25 July 1936, H.S. Jackson, *Corylus* or *Acer*; L. Timagami, Bear I., TRTC 5054, 6 Sept. 1933, R.F.C., *Acer spicatum* Lam.; L. Timagami, Bear I., TRTC 11846, 2 Aug. 1937, R.F.C., *Populus*; L. Timagami, Bear I., TRTC 3884, 2 June 1932, S.M. Pady & J.W. Groves, dead branches of *Corylus cornuta* Marsh.; Diamond Lake, TRTC 10698, 3 Sept. 1935, H.S.J.,

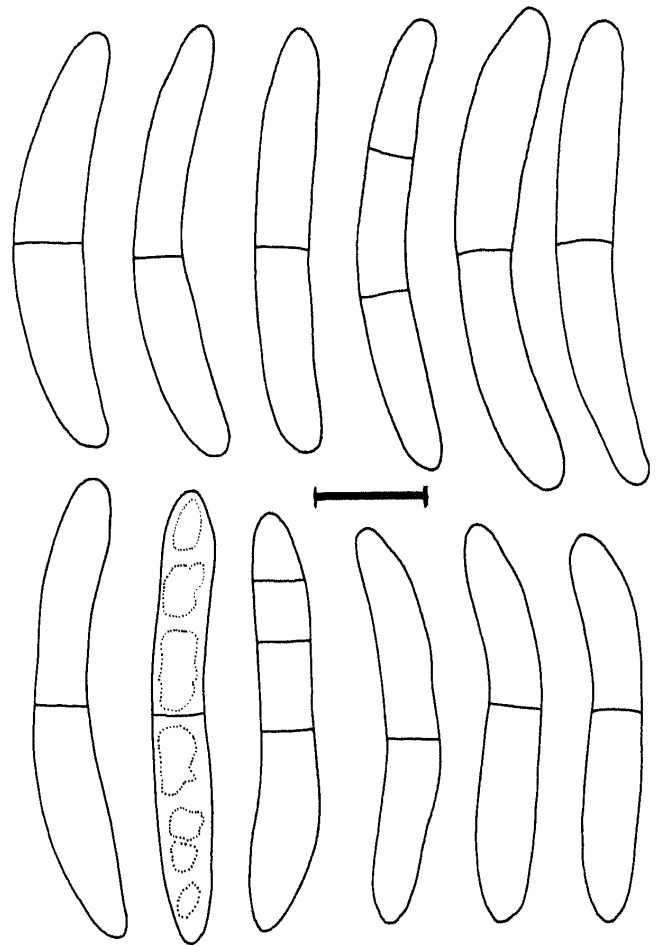


FIG. 2. *Bertia moriformis* var. *moriformis*. Ascospores, scale 10 μm ; upper row DAOM 29262, lower row DAOM 37419.

Corliolus pargamensis (Klotzsch) Pat.; Sudbury Dist.: Hassard Twp., 32 km s. of Hwy 101, along Hwy 144, TRTC 47713, 14 June 1973, D. Malloch, dead branches of *Acer spicatum* Lam; Thunder Bay Dist.: Sibley Provincial Pk., Sleeping Giant, TRTC 43432, 24 Aug. 1965, B. Parchim, *Betula*; Upsala, TRTC 48487, 13 Sept. 1957, R.F.C., *Picea*; Peel Co.: Niagara escarpment near Belfountain, DAOM 136411, 16 April 1967, D.M., unidentified wood; ALBERTA: Waterton Lakes Nat. Pk., DAOM 176808b, 4 Aug. 1980, G.P. White, *Picea* log; BRITISH COLUMBIA: Glacier, 1760 m, DAOM 112939, 4 Aug. 1963, R.A. Shoemaker, *Abies*; Vancouver, University of British Columbia endowment lands, DAOM 114387, 29 April 1962, R.J. Bandoni, *Salix*; Vancouver I., Courtenay, DAOM 45196, 3 Dec. 1953, A.T. Foster, *Abies*; Vancouver I., DAOM 35643, 10 Feb. 1915, J. Macoun, *Alnus*; Vancouver I., Exp. Stat., Mesachie Lake village, s.e. end of Cowichan L., DAOM 56404, 22 Aug. 1957, S.J.H., *Alnus* and DAOM 139286, 6 July 1972, S.J.H., undetermined wood; Vancouver I., Cowichan L., DAOM 141710, 30 June 1955, R. Horner & W. Ziller, *Alnus*; Vancouver I., Shawinigan L., DAOM 141708 N. Engelhardt and DAOM 141709, K. Taylor, D. Chu & E. Haskins, 29 June 1955, *Alnus*. U.S.A.: MAINE: Penobscot Co.: Orono, BPI ex herb. J.B. Ellis, F.L. Harvey, on wood; York Co.: Kittery Point, FH, 7 Sept. 1891, R. Thaxter, bark (probably *Corylus*); Abol field, near Baxter State Pk., MASS, 6 July 1962, H.E. & M.E. Bigelow, beech; NEW HAMPSHIRE: Cheshire Co.: Jaffrey, FH ex herb. E. Tuckerman, July 1919, L. Riddle, dead stick (probably *Betula*); Chocorua, C, Sept. 1906, W.G. Farlow, decorticated wood; VERMONT: Dummerston, ex F.P. 69537, TRTC, 21 June 1935, H.G. Eno, *Populus*; Mt. Mansfield State Forest, woods near ski tow,

MASS, 29 June 1964, H.E. & M.E.B., rotting wood; NEW YORK: Tompkins Co.: near Danby, Michigan Hollow, FH ex NY, 3 Oct. 1947, C.T. Rogerson, dead branches; Franklin Co.: ca. 1.6 km w. of Saranac L., DAOM 136599 & TRTC 44989, 11 Sept. 1965, B.M. 137, hardwood log; Ontario Co.: Canandaigua, Ellis & Everhart, N.A. Fungi, 2nd ser. no. 2752, DAOM, TRTC, BPI & G, April 1891, Edgar Brown, old *Corliolus pargamenus* (Klotzsch) Pat.; PENNSYLVANIA: Chester Co.: West Chester, FH ex herb. Ellis, Aug. 1881, E.H.J. & G. 215, decorticated wood; MASSACHUSETTS: Middlesex Co.: Shirley, TRTC & C ex FH, 12 Nov. 1935, D.H. Linder, fruiting body of *Corliolus pargamenus* (Klotzsch) Pat.; Magnolia, FH, Aug. 1903, W.G.F., decorticated wood; CONNECTICUT: New Haven Co.: Milford, FH, May 1891, R.T. 64 and May 1890, R.T. 66, dead sticks (probably *Fagus*); MARYLAND: Frederick Co.: Cunningham State Park, MASS, 13 Aug. 1966; INDIANA: Munroe Co.: w. of Bloomington, McCormick Creek Pk., TRTC 34282, 22 Aug. 1958, R.F.C., hardwood; Shades, BPI, May 1937, A.R. Bechtel, decorticated wood; OHIO: Pieston, in FH, 1895, A.P. Morgan 9, *Acer saccharinum* L.; IDAHO: Bonner Co.: n. slope Nickelplate Mt., 915 m, MASS, 7 Aug. 1939, A.W. Slipp 394, *Populus tremuloides* Michx. var. *aurea*; COLORADO: Delta Co.: Grand Mesa near Barron L., BPI, 21 July 1929, R.W. Davidson, *Picea*; Grand Mesa Mt., BPI, 16 June 1930, R.W.D. 254, wood (apparently coniferous); Grand Mesa Mt., BPI, 17 June 1930, R.W.D. 288, spruce or fir wood; Grand Mesa Mt., BPI, 19 July 1930, R.W.D., spruce or fir wood; WASHINGTON: Snohomish Co.: s. of Lee forest, BPI, 20 May 1963, J.L. Maas 907, fallen stick; Clearwater River, DAOM 121545, 9 May 1939, A.H. Smith, *Alnus* sp.; CALIFORNIA: Humboldt Co.: Trinidad, Spruce Grove, California Fungi, TRTC & G ex UC, April 1935, H.E. Parks 5499, *Hirschioporus abietinus* (Fr.) Donk, *Pinus muricata* D. Don.; Trinidad, G ex UC, May 1941, H.E.P. 6641, *Salix scouleriana* Barratt. AUSTRIA: Niederösterreich: prope Lilienfeld, Schachernwald in monte Reaisalpe, Krypt, exs. vindobonensis 615, TRTC, C & G, F.v. Höhnel, *Fagus sylvatica* L.; Wiesenbachthal-Reaisalpe, FH, 24 June 1905, v. Höhnel, *Fagus*; Schneeberggebiet, FH, 27 July 1902, v. Höhnel, an *Fagus*-Holz; Wiener Wald, FH, 21 May 1903, v. Höhnel, *Fagus*; Weg zur Wienerwaldwarte, FH, 20 May 1899, *Fagus*; Wiener Wald, Sattleberg bei Fresheim, FH, 3 Sept. 1909, v. Höhnel, *Fagus*; Wiener Wald, Jochgrabenberg bei Rekat, FH, 28 Sept. 1902, v. Höhnel, auf Büchenholz; Wiener Wald, Georgenberg bei Purkersdorf, FH, 27 Feb. 1903, v. Höhnel, *Fagus*-Zweig; Wiener Wald, Zigeunersteig bei Purkersdorf, FH, 1 June 1902, v. Höhnel, an *Fagus*-Holz; Wiener Wald, Rehgrabenberg, FH, 23 June 1900, v. Höhnel, auf durren Buchenzweig (*Fagus*); Wiener Wald, Sauerbrunnbitten bei Rekat, FH, 13 Aug. 1906, v. Höhnel, *Fagus*-Holz; Wiener Wald, Grosser Steinbachgraben, FH, 30 March 1905, v. Höhnel, *Fagus*. BELGIUM: Vlanderen, près d'Ypres, Westendrop et Wallays coll. no. 25, FH ex BR, dans les vieux saules creux. DENMARK: Fyn, Skaarup, C, March 1869, E. Rostrup, decorticated wood; Jylland, Frederikshavn, C, 10 July 1903, J. Lind, *Fagus sylvatica* L.; Jylland, Mattrup, C., 25 April 1926, J.L., *Fagus*; Jylland, Mols, C, 29 April, 1943, A. Munk, *Quercus*; Sjaelland, Distr. 44, Krabbesholm, C, 17 April 1904, J.L., decorticated wood; Sjaelland, Distr. 44, Krabbesholm, Hornsherred, C, 23 April 1905, J.L., *Corylus avellana*; Sjaelland, Distr. 45, Amager, Kongelunden, C, 24 Feb. 1974, H. Knudsen, *Fraxinus*; Sjaelland, Distr. 45a, Frederikdal, C, ex herb. Rostrup, as *Lasiosphaeria spermoides* (Hoffm.) Ces. & de Not., C, 8 Sept. 1883, E.R., dead stick (*Fagus*); Sjaelland, Distr. 45a, Dyrehaven, ved Kobenhavn, C, marts 1903, O. Galloe, pa nedfalden gren; Sjaelland, Sollerup inde-lukke, DAOM 109439 and C, 9 April 1950, O. Winge, *Euonymus*; Sjaelland, Distr. 45b, Sjaelsolund, ved Sjaelso, C, 16 April 1908, J.L., *Picea excelsa* Link. ESTONIA: Rapla, Keava, TAA 26415, C, 25 May 1959, P. Poldmaa, decaying wood of *Picea excelsa* Link. FRANCE: Stirpes cryptogamae Vogeso-Rhenanae, 1810–1840, no. 382, G. 1813, J.B. Mougeot et C. Nestler, in ramis arborum emortuus; C. Roumeguere, Fungi Gallici Exsiccati 1847, 1891, T. Therry, le bois de sapin dénudé; two collections, but no localities, collection dates or substrates given, DAOM 187378 (slide only), Fautrey n. 869 and DAOM 187377 (slide only), Fautrey. GERMAN DEMOCRATIC REPUBLIC: Brandenburg, bei Uetzdorf, Kreis Nieder-Barnim, Sydow, Mycotheca germanica no. 1575, DAOM, TRTC, C & FH, 2 Aug. 1920, H. & P. Sydow, auf Asten von *Fagus sylvatica* L. FEDERAL REPUBLIC OF GERMANY: Hessen, Nassau, Oestrich, Nassau's Flora, as *Sphaeria moriformis a fasciculata*, G. L. Fuckel, auf *Diatrype ferruginaea* Fr.; Hessen, Nassau, Oestrich, Fungi Rhenani 999 and herb. Barbey-Boissier 648, BPI, FH & G, L. Fuckel, ad ramos varios putridos ad terram prostratos; Hessen, Nassau, Oestrich, herb. Barbey-Boissier 649 as *Bombardia fasciculata* Fr., G, L. Fuckel, sur un tronc. ITALY: Valsesia, Erbar. Crittogam. ital., Ser. II, nr. 291, G, 1869, sul Rododendro; Venetia, Treviso, Consiglio, Saccardo, Mycoth. italica no. 291, DAOM, TRTC & BPI, Aug. 1898, Saccardo, in ligno fagineo. ROMANIA: Bacau-Slanic, Moldova, ex herb. Mycol. Romanicum Dr. Prof. Tr. Savulescu, TRTC, 28 Aug. 1933, Tr. Savulescu & C. Sandu, *Fagus sylvatica* L. SWEDEN: Storongeen, BPI & UPS, 19 July 1929, C.L. Shear, *Pinus*?; Uppland, Uppsala (Bonkyrka), Nosten, Flora Suecica 4379, UPS, 1 June 1925, J.A. Nannfeldt, *Picea abies* (L.) Karst. rami dejecti decorticati; Uppland, Vaksala parish, 1.5 km nne. of Jalla, Flora Suecica 11721, UPS, 9 June 1957, R. Santesson, dead twigs of *Tilia* (?); Dalarna, Hedemora, c. 200 m ne. of the bird watching place near L. Hovran, Flora Suecica, UPS, 16 April 1979, K. & L. Holm, *Alnus incana* Am.? SWITZERLAND: Kt. Vaud: St. Cergue, elev. 1128 m, DAOM 88014, 26 May 1932, G.D. Darker (4028), stump of *Abies*; Kt. Aargau: Barmelweid, TRTC ex ZT, 21 May 1958, E. Müller, *Fagus sylvatica* L.; Kt. Zurich: Sihlwald, DAOM 91935, 29 Aug. 1961, E.M. & R.A. Shoemaker, on decorticated wood; Kt. Aargau: Lensburg, ex herb. E. Burnat, G, Schluisseberger, sur *Fagus*; Kt. Baselland: Dornach, G, 29 April 1951, E. M., auf durren Zweigen von *Fagus sylvatica* L. UNITED KINGDOM: SCOTLAND: Loch of Skene, Dunecht, IMI 197772, J. Webster, *Fagus*; Inverness: Aviemore, IMI 12822, Sept. 1927, *Acer*; ENGLAND: Yorkshire: Howldale, DAOM 48438 & TRTC, ex IMI 13820, 13 April 1927, S.J.H., *Sambucus nigra* L.; Kingthorpe Wood, IMI 12815, 18 Sept. 1930, *Ulmus*; Kingthorpe Wood, IMI 12825, 18 Sept. 1930, *Fraxinus*; IMI 19229, 11 Oct. 1947, W.G. Bramley, *Sambucus*; Middleton-in-Teesdale, FH ex K, 5 April 1945, on fallen pine branches; Surrey: IMI 78039, 3 Oct. 1959, C. Hayward, *Alnus*; Gloucestershire: Saintsbury, IMI 217904, 7 Sept. 1935, *Corylus*; IMI 151795, 29 Aug. 1970, decayed wood; Norfolk, King's Lynn, ex herb. W.G. Grove, FH ex BM, 1882, C.B. Plowright, old branches of *Fagus*; Shropshire, Forden, Micro-Fungi Britannici no. 175, G, J.E. Vize, decorticated wood; WALES: Monmouth, Grosmont,

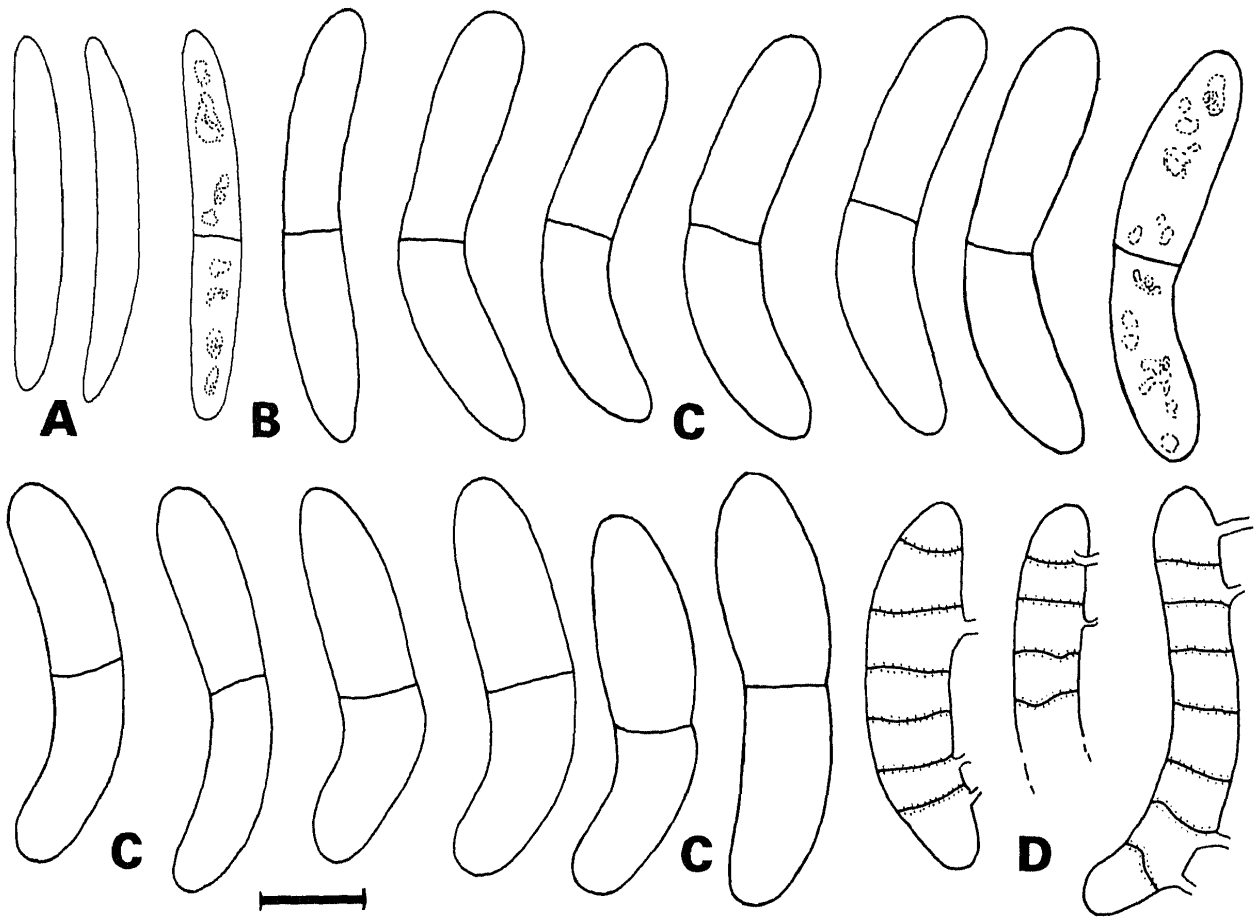


FIG. 3. *Bertia moriformis* var. *latispora*. Ascospores: (A) immature from ascus; (B) immature, free in centrum; (C) mature, one septate; (D) multisepate with phialidic germination; scale 10 μm , DAOM 59880 (holotype).

Pen-y-clawdd Woods, BPI ex IMI (9933), 13 April 1945, S.J.H., dead wood.

Approximately one-half of the Canadian collections of *Bertia moriformis* examined and about two-thirds of the smaller sampling of U.S. collections (mostly from the northeast) are variety *moriformis*. The type variety is distributed from the east coast to the west coast in Canada and probably occurs in all provinces, although a few are not represented by collections in DAOM and TRTC. All but three of the over 40 European collections examined are variety *moriformis*.

Normally the ascospores of variety *moriformis* are one septate, occasionally up to three septate. However, two collections, TRTC 10709 (at G, but not the part at TRTC) and a Farlow collection from Chester, PA (ex herb. Ellis, coll. 1891), had a few pluriseptate ascospores indistinguishable from the three- to eight-septate ascospores of *Bertia moriformis* var. *multiseptata* Sivanesan.

Bertia moriformis (Tode: Fr.) de Not. var. *latispora* var. nov.

Figs. 3, 4, 8, 9, 14

Ascomata dispersa aut aggregata, superficialia aut interdum partim immersa, nigra, breviter cylindracea, 750–1000 \times 525–750 μm magna, summa in parte globosa vel subglobosa, tuberculata, basin versus breviter cylindracea; peridium e cellulis angularis, porosis compositum. Asci unitunicati, clavati, basin versus in stipitem longum attenuati, cum parietibus tenuibus, (100–)120–150 \times 15–25 μm magni, octospori, evanescenti. Ascosporae hyalinae, primum fusiformes, maturitate confirmata, 30–49 \times 6–8.5(–10.5) μm magnae, inferne in parte geniculatae, 1(–3) septatae.

HOLOTYPE: In ligno pini lectus est, in loco Gatineau Park vocato, in Gatineau comitatu, in Québec provincia Canadensis

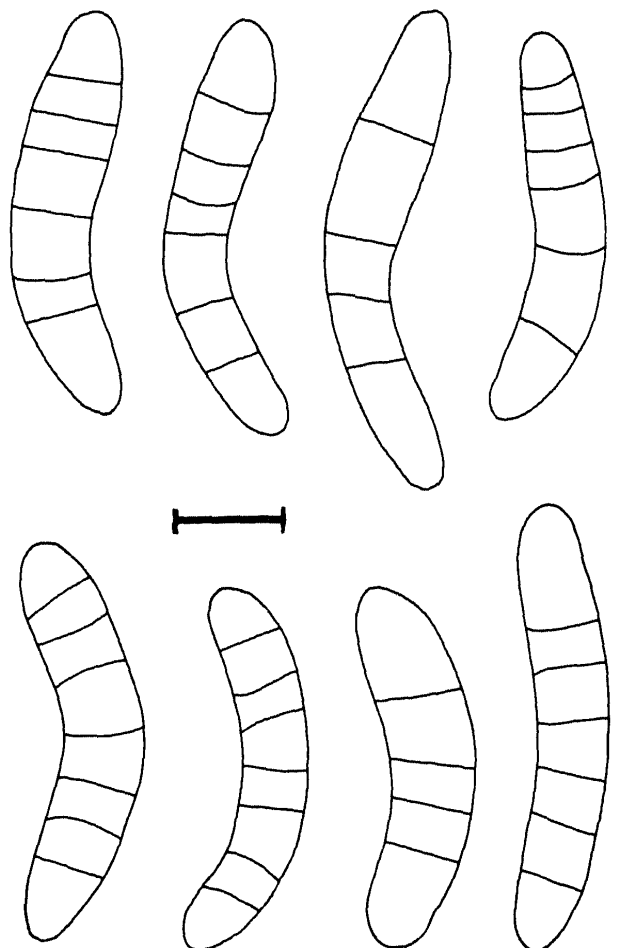


FIG. 4. *Bertia moriformis* var. *latispora* (multiseptate form). Ascospores, scale 10 μm , TRTC 22926 (DAOM 187155).

regni, 9 Sept. 1958, J. Shorten, DAOM 59880.

ETYMOLOGY: Latin, *latus* = broad and *spora* = seed, referring to the wider ascospores.

Ascomata scattered or gregarious, superficial or occasionally erumpent, on hard or partially rotted wood, black, short cylindrical, large, 700–1000 × 500–700 μm, in the upper portion globose to subglobose, tuberculate, borne on a short cylindrical base. Ascoma wall composed of angular to tangentially flattened cells, with prominent pores in adjacent walls. Asci unitunicate, clavate, long stipitate, thin walled, (100–)120–150 × 15–25 μm, 8 spored, deliquescing early and liberating ascospores into centrum. Ascospores irregularly arranged in upper portion of ascus, hyaline, initially fusiform, at maturity 30–49 × 6–8.5(–10.5) μm, usually geniculate in the lower half, 1(–3) septate, guttulate, wall smooth.

SUBSTRATE: Decorticated sound wood, occasionally partially rotted wood and dead branches of living trees, mostly on coniferous wood (*Abies*, *Picea*, *Pinus*, *Tsuga*), occasionally on deciduous wood (*Acer*, *Alnus*, *Salix*), and occasionally on old basidiocarps (*Hymenochaete*).

COLLECTIONS EXAMINED: CANADA: NEW BRUNSWICK: Kent Co.: 0.4 km from entrance of Kouchibouguac National Pk., DAOM 172038, 6 July 1977, S.J. Hughes, unidentified wood; Charlotte Co.: Campobello, FH, July 1902, W.G. Farlow, decorticated wood; QUÉBEC: Gaspé Prov. Pk., Mt. Albert, DAOM 121544, 26 Aug. 1947, L.E. Wehmeyer, unidentified wood; Gatineau Co.: Gatineau Pk., nature trail, DAOM 59880 (holotype), TRTC, BPI & G, 9 Sept. 1958, J. Shorten, *Pinus* sp.; Abitibi Co.: Hwy 167 at Lac Dufresne, TRTC 48480, 2 Sept. 1976, D. Malloch, *Hymenochaete tabacina* (Sow.: Fr.) Lév.; ONTARIO: Frontenac Co.: Silver L., TRTC 39193, 1 Sept. 1941, R.F. Cain, decorticated log of conifer; York Co.: s. of Bond L., TRTC 7114, DAOM 85156 & G, 28 Sept. 1934, R.F.C., *Tsuga canadensis* (L.) Carr.; Peel Co.: nw. of Palgrave, TRTC 32235, IMI 73277, 4 Nov. 1956, R.F.C., *Picea*; Simcoe Co.: Alliston, TRTC 37873, 12 June 1955, R.F.C., *Pinus*; s. of Alliston, TRTC 32283, 3 Nov. 1956, R.F.C., *Pinus strobus* L.; Bruce Co.: s. of Glamis, TRTC 37891, 8 Oct. 1961, *Fraxinus*; Muskoka Dist.: 1.6 km w. of Forest Ranger School, s. of Dorset, DAOM 96881 & BPI, 9 Sept. 1962, M. Pantidou, unidentified wood; Haliburton Co.: 9.6 km n. of Forest Ranger School, TRTC 44987 & DAOM 136600, 1 Oct. 1966, B. Malloch, *Picea* sp.; Nipissing Dist. L., Timagami, Cattle I., DAOM 85159, TRTC 2613, 10 Aug. 1931, S.M. Pady & R.F.C., coniferous wood; Timagami Forest Reserve, L. Timagami, Bear I., DAOM 85157, 19 June 1931, R.F.C., *Acer spicatum* Lam.; Algonquin Provincial Pk., Pinetree L., TRTC 22926 & C, 31 Aug. 1940, R.F.C., *Picea*; Timagami Forest Reserve, L. Timagami, Bear I., TRTC 2603 & DAOM 85153, 1 July 1931, R.F.C., dead sticks; Timagami Forest Reserve, L. Timagami, Bear I., TRTC 2705, 1 July 1931, G.E. Thompson, dead stick; Timagami Forest Reserve, L. Timagami, Gull L. Portage, TRTC 2602, 13 July, 1931, R.F.C. & G.E. Thompson, coniferous wood; Timagami Forest Reserve, Diamond L., Long Portage, TRTC 10697, 31 Aug. 1935, H.S. Jackson, *Pinus*; Thunder Bay Dist.: Black Sturgeon L., TRTC 44988, 1 Aug. 1965, R.F.C., conifer wood; Kenora Dist.: 29 km n. of Vermillion Bay, Hwy 105, TRTC 33951, 31 May 1956, R.F.C., *Picea*; BRITISH COLUMBIA: Exp. Stat., Mesachie Lake village, s.e. end of Cowichan L., DAOM 56391, 22 Aug. 1957, S.J.H., *Alnus* sp.; Natural Bridge, DAOM 71231b, 3 Aug. 1960, S.J.H., coniferous

wood. U.S.A.: NEW HAMPSHIRE: Shelburne, Reliq. Farlowianae no. 3, TRTC & G, Sept. 1893, W.G. Farlow, coniferous bark; Shelburne, FH, Sept. 1891, W.G.F., decorticated wood; Chocorua, TRTC ex FH, Sept. 1913, W.G.F., decorticated wood; Chocorua, BPI & FH, Aug. 1904, W.G.F., decorticated wood; Chocorua, FH, Sept. 1916, W.G.F., hemlock; Chocorua, FH, 23 July 1917, W.G.F., decorticated wood (probably coniferous); Grafton Co.: Enfield, ex Timber & Forest Survey 69439, BPI, 13 May 1934, H.G. Eno, *Abies balsamea* (L.) Mill.; Gilmanton, FH, 12 Oct. 1942, D.H. Linder, decayed spruce limb; Intervale, C & FH, July 1901, R.T. 3947, *Pinus strobus* L.; NEW YORK: Essex Co.: Twin Valley Camp, e. of Lewis, DAOM 136413, 9 Sept. 1967, B. Malloch, *Tsuga* log and DAOM 136412, 10 Sept. 1967, B.M., dead stump; Delaware Co.: s. of Oneonta, Vlei Bog, TRTC 49133, 22 Sept. 1963, J.H. Mirza, decorticated wood; Tompkins Co.: Ithaca, Coy Glen, Fungi of the Cayuga L. Basin, New York, ex herb. H.S. Jackson, TRTC, 26 April 1904, R.S. Woglum, *Tsuga canadensis* (L.) Carr.; Erie Co.: Buffalo, FH, G.W. Clinton, decorticated (probably coniferous) wood; MICHIGAN: Chippewa Co.: Lower Tahquamenon Falls, MASS, 23 June 1953, M.E. Bigelow, rotten wood; VIRGINIA: Occoquam, BPI, 3 Dec. 1923, C.L. Shear, *Pinus*; NORTH CAROLINA: Avery Co.: Cranberry, FH, 1896, R. Thaxter 3946, decorticated wood; COLORADO: Delta Co.: Grand Mesa Mt., BPI, 2 July 1930, R.W. Davidson 502, spruce or fir. SWITZERLAND: Kt. Genève, près Vandoeuvres, G, 5 mars 1882, J. Rome 164, sur du bois pourri dans un vieux Saule (*Salix*).

Approximately one-half of the Canadian collections of *Bertia moriformis* and about one-third of the smaller sample of United States collections examined are variety *latispora*. Most of the *latispora* collections are from the eastern half of North America with the exception of two (out of 11) collections from British Columbia, Canada, and one from Colorado, U.S.A. The apparent scarcity of variety *latispora* from the west may in part be due to the smaller numbers of western North American collections available for study. Only 1 of the more than 40 European collections examined was variety *latispora*. European material was predominantly variety *moriformis*. Two collections from herb. IMI, one of these the type collections, were *Bertia moriformis* var. *multiseptata*.

Bertia moriformis var. *latispora* is characterized by its noticeably broader (6–8.5 μm) and geniculate ascospores in contrast to the narrower (4.5–6.5 μm) and straight to gently curved ascospores of the type variety. Differences in ascomatal morphology at the varietal level could not be discerned. The asci of variety *latispora* may be a little wider, although ascospores in the asci are not noticeably broader than comparable ascospores of variety *moriformis*. It is only after the ascospores of variety *latispora* have been liberated into the centrum that they mature and taken on their wider geniculate appearance. Immature ascospores of variety *latispora* (Figs. 3, A and B, and 14) are indistinguishable from mature ascospores of the type variety. When crush mounts containing mature ascospores are examined, it is immediately possible to recognize to which of the two varieties a collection belongs.

While variety *latispora* normally has 1-septate ascospores with occasionally up to 3 septa, one collection (TRTC 22926) has pluriseptate but otherwise *latispora*-like ascospores (Fig. 4). Initially we had intended to erect a new variety of *Bertia moriformis* for this collection, considering it to be the pluriseptate form of variety *latispora* just as *Bertia moriformis*

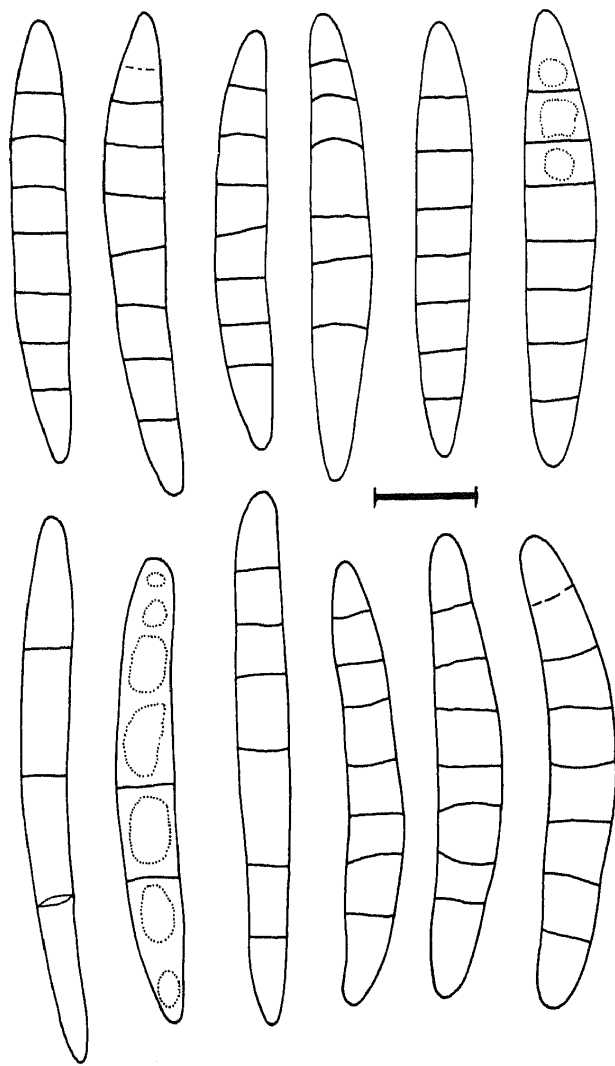


FIG. 5. *Bertia moriformis* var. *multiseptata*. Ascospores, scale 10 μm , IMI 214142 (holotype).

var. *multiseptata* Sivanesan (described below, Fig. 5) is the pluriseptate equivalent of the type variety. However, it was subsequently noted that the type collection of variety *latispora* (DAOM 59880) possessed some germinating pluriseptate ascospores with 3–7(–8) pale brown septa. Individual ascospore cells had undergone phialidic germination (Fig. 3, D); no phialoconidia were seen. Although only a few pluriseptate ascospores were observed in DAOM 59880, the association of pluriseptation and germination suggested that ascospore germination might be preceded by the formation of some additional septa (up to 7 or 8 per ascospore) and that pluriseptation might be the mature condition for *Bertia moriformis* var. *latispora*. Although we did not observe germination of the extremely abundant pluriseptate ascospores of TRTC 22926, we are nevertheless reluctant at this time to erect a new taxon for this collection until an investigation of ascospore germination is undertaken.

Bertia moriformis (Tode: Fr.) de Not. var. *multiseptata* Sivanesan, Trans. Br. Mycol. Soc. 70: 387. 1978

Figs. 5, 10

Ascomata as described for variety *moriformis*. Asci unitunicate, clavate, long stipitate, thin walled, 90–150 \times 9–20 μm , 8 spored, deliquescent early and liberating ascospores into centrum. Ascospores irregularly arranged in upper portion of ascus, hyaline, fusiform, 37–48 \times 5–6 μm , straight to curved, ends rounded to acute, 1(–3) septate in the ascus, becoming 3–8 septate in the centrum, guttulate, wall smooth.

COLLECTIONS EXAMINED: ENGLAND: Norfolk, Foxley Woods, IMI 214143 (type), 23 May 1977, M.B. Ellis & J.P. Ellis, on dead wood; IMI 230732, 25 June 1972, D.W. Minter, on *Pinus*.

Our ascus measurements exceed those given by Sivanesan (1978) (70–105 \times 6–13 μm). This discrepancy may be due to the difficulty of attaining ascus measurements because of the early deliquescence of ascus stalks and eventually of entire asci while the ascospores are still immature.

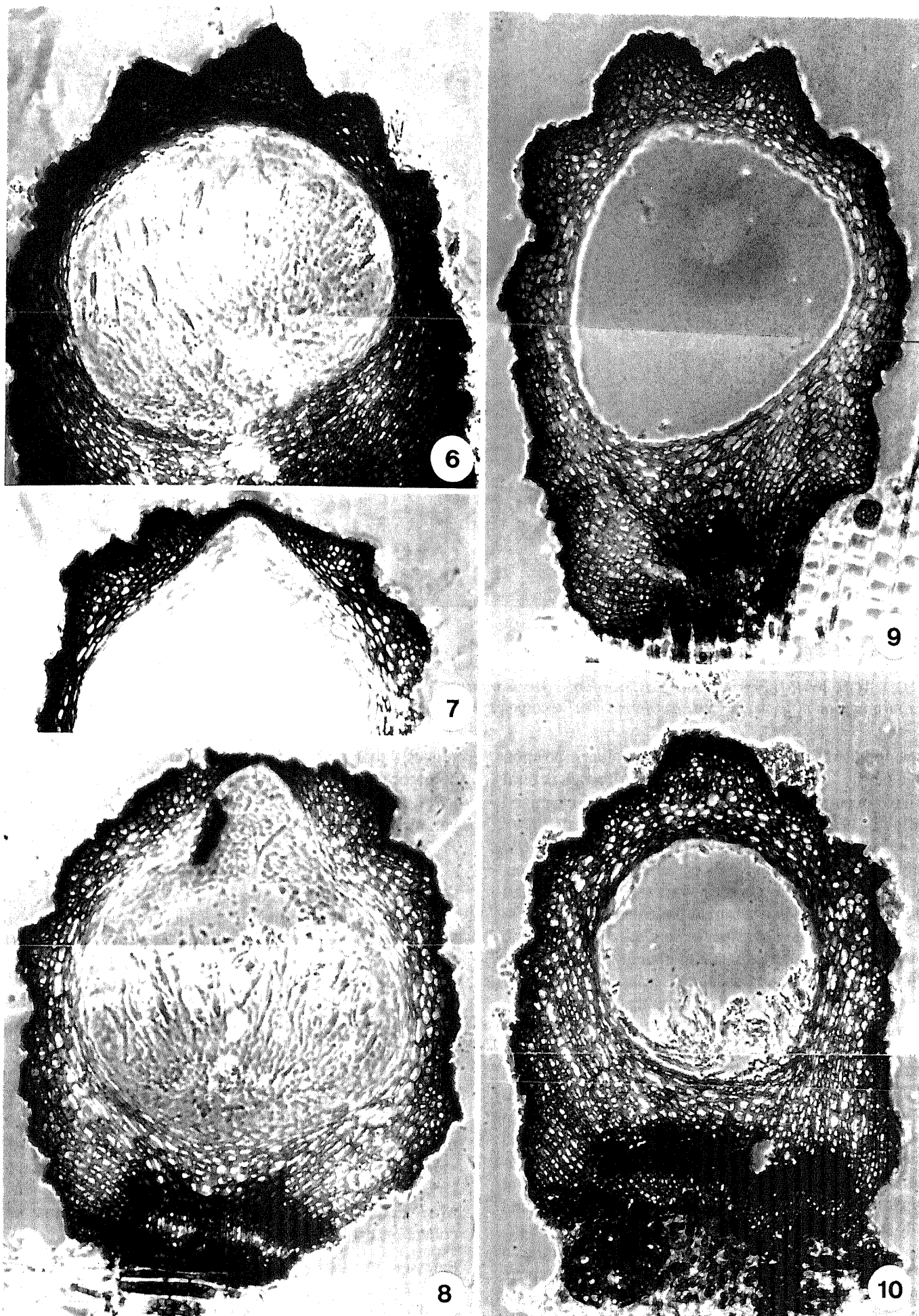
Bertia moriformis var. *multiseptata* was described by Sivanesan for IMI 214143, a collection bearing initially 1-septate (rarely 3-septate) ascospores which at maturity became 3 to 8 septate and germinated either by phialides or by germ tubes (hyphal primordia). It appears (Sivanesan 1978, Fig. 14) that most or all of the cells of the pluriseptate ascospores have the potential to germinate. In Fig. 14, a 1-septate ascospore is also seen to have germinated from one cell. Previously Hawley (1923) reported on collections of *B. moriformis* from Mulgrave Woods, Yorkshire, England, which likewise were initially 1-septate, eventually became 3 to 7 septate at maturity and measured 48–52 \times 5–6 μm . Some ascospores from the Mulgrave Woods specimens germinated from every cell. Hawley noted that the multiseptate ascospores tended to be larger (up to 52 μm long) than the typical 1-septate ascospores (up to 46 μm long) and he believed that multiseptate spores probably represent the mature condition of *B. moriformis*. Sivanesan on the other hand emphasized that multiseptation had been observed in no more than several mature collections and because of its rare occurrence he considered the multiseptate condition to represent a distinct variety of *B. moriformis*.

Discussion

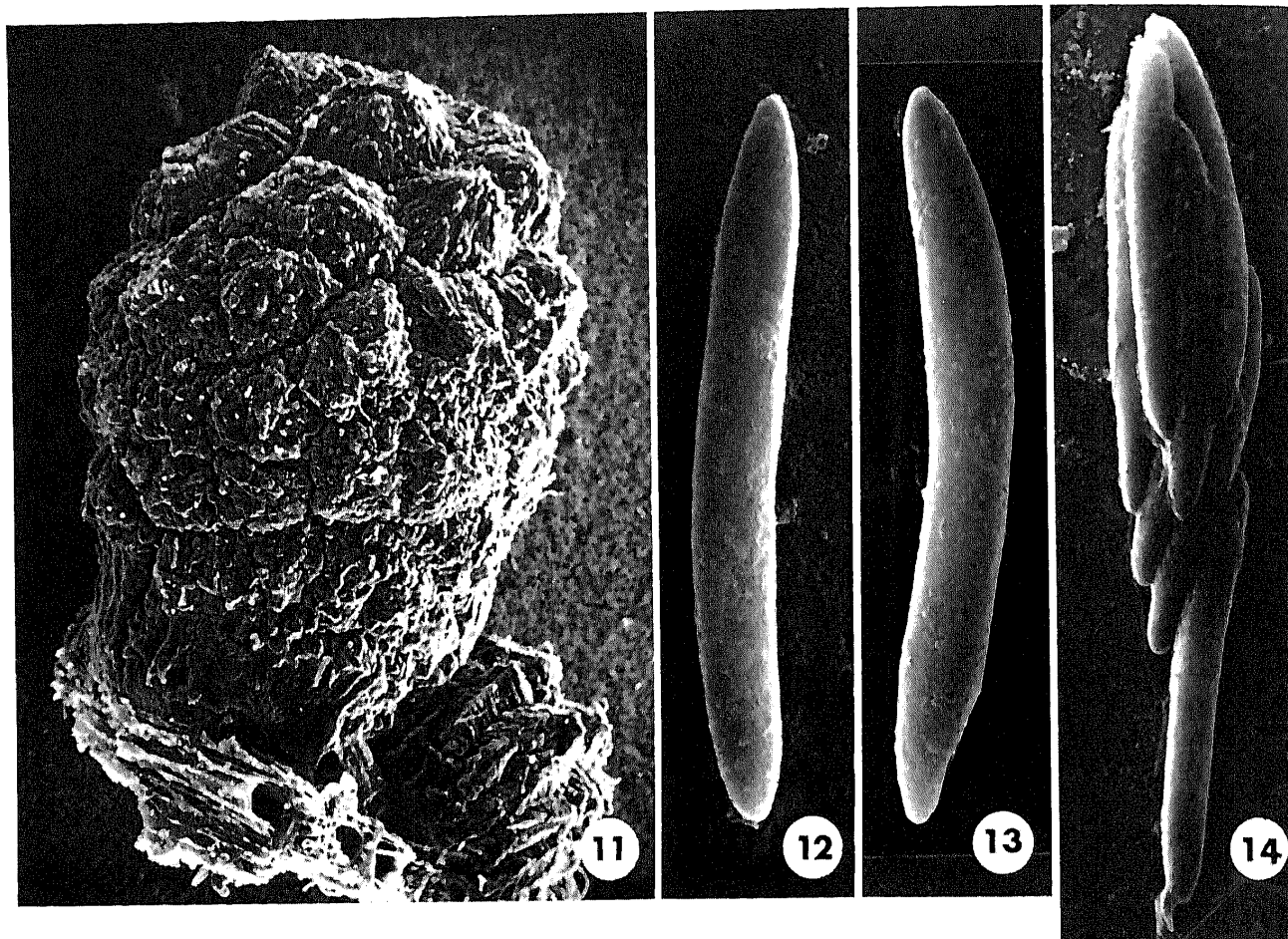
Bertia moriformis is the type of the genus *Bertia* and is included in the Coronophorales, an order erected by Nanfeldt (1932, p. 54) for certain wood-inhabiting and mycoparasitic Ascomycetes possessing dark coriaceous ascomata and long-stalked, deliquescent asci. Nanfeldt's Coronophorales included two families, the Coronophoraceae v. Hohn. (1907) and the Nitschkiaceae (Fitzp.) Nannf. (1932), and was originally considered by him to be far removed from other major taxa of unitunicate Ascomycetes. Müller and von Arx (1973) grouped the genera in a single family, the Coronophoraceae. Nanfeldt's recent reevaluation of the order (1975) concluded that a revised Coronophorales is a distinctive but homogeneous group derived from the Lasiosphaeriaceae Nannf. sensu Lundq. (1972). Nanfeldt (1975) recommended that the Coronophorales be abandoned as a separate order and the genera be united in the single family Nitschkiaceae near the Lasiosphaeriaceae. He also referred to the problem of the correct family name (p. 304). The name Coronophoraceae has priority if the "Familie der Coronophoreen" v. Höhnel (1907) is to be accepted. Eriksson (1982), however, considers the name to be illegitimate (International Code of Botanical Nomenclature, article 18). von Arx (1981) likewise considers this group to be closely related to the Lasiosphaeriaceae but has continued until quite recently to accept Coronophoraceae as the family name.

Recognizing the distinctiveness of *Bertia* within the Coronophorales, Smyk (1981) erected the family Bertiaceae for *Bertia moriformis*. Curiously, Smyk's illustrations of the perithecia and ascospores of *B. moriformis* are not of this species.

Bertia moriformis is a true member of the Nitschkiaceae



FIGS. 6–10. Vertical sections through ascomata. $\times 120$. Figs. 6 and 7. *Bertia moriformis* var. *moriformis*, DAOM 37419. Fig. 8. *B. moriformis* var. *latispora*, DAOM 59880 (holotype). Fig. 9. *B. moriformis* var. *latispora* (multiseptate form), TRTC 22926 (DAOM 187155). Fig. 10. *B. moriformis* var. *multiseptata*, IMI 214143 (holotype).



FIGS. 11–14. Scanning electron microscope. Fig. 11. *Bertia moriformis* var. *moriformis*, coarsely tuberculate ascoma with nontuberculate base. $\times 80$, DAOM 169451. Figs. 12 and 13. *B. moriformis* var. *moriformis*, ascospores, $\times 2300$, DAOM 37419. Fig. 14. *B. moriformis* var. *latispora*, aggregation of immature “var. *moriformis*-like” ascospores (as in Fig. 3, A and B), $\times 1150$, DAOM 85153.

(sensu Nannfeldt 1975), but it occupies a solitary position within the family. *Bertia* may be monotypic. Although several species have been placed in the genus *Bertia*, three examined by Nannfeldt (1975) were found not to be congeneric.

We conclude that the subspecific taxa described in *Bertia moriformis* are distinguishable only by differences in the morphology of their mature ascospores. Varieties *moriformis* and *latispora* do exhibit host or substrate preference, but this distinction is not sufficiently constant to be a reliable taxonomic character. In all other aspects of their morphology, the varieties of *B. moriformis* are indistinguishable. Because of the paucity of distinguishing characters, we believe that these taxa do not warrant recognition at the specific level.

Bertia moriformis var. *moriformis* occurs principally on deciduous wood, although sometimes it is on coniferous wood. It is characterized by hyaline, narrow, 1-septate, straight to gently curved ascospores, $4.5\text{--}6.5\ \mu\text{m}$ wide. *Bertia moriformis* var. *latispora* is found mainly on coniferous wood and sometimes on deciduous wood. The young ascospores of variety *latispora* are like variety *moriformis* in the ascus, but at maturity (free in the centrum) they are wider, $6\text{--}8.5\ \mu\text{m}$, and geniculate usually below the middle.

With some reservation, we accept variety *multiseptata* as a distinct variety. As Sivanesan (1978) pointed out, pluriseptate ascospores have been observed in only a few collections. He may be quite correct in his assumption that the pluriseptate condition of the ascospores, because of its rarity, is a reliable taxonomic character at the varietal level. However, our observation of some pluriseptate ascospores in two collections of variety *latispora*, which like the type variety are 1-septate,

suggests that pluriseptation may be the natural condition at ascospore maturity just prior to ascospore germination. An investigation of ascospore germination *in vitro* of 1-septate variety *moriformis* ascospores might clarify the situation.

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