

THE GENERA OF THE *NECTRIACEAE*

ALBONECTRIA Rossman & Samuels, gen. nov.

Type: *Albonectria rigidiuscula* (Berk. & Broome) Rossman & Samuels (= *Nectria rigidiuscula* Berk. & Broome).

Ascomata superficialia, vulgo aggregata in stromate parce vel bene expresso, subglobosa vel globosa vel ellipsoidea, alba vel luteola, KOH-, parietes > 25 µm crassi, saepe verrucatae, cellulae parietis valde incrassatae. Asci 4–8-sporei. Ascosporeae ellipsoideae vel longe-ellipsoideae, 3- vel pluriseptatae, hyalinae vel fusco-luteae, laeves vel striatae.

Ascomata superficial, solitary to gregarious on a sparse to well-developed stroma. Ascomata subglobose, globose to ellipsoid, white to pale yellow, KOH-, walls relatively thick, more than 25 µm, often warty, walls unevenly thickened, particularly the outermost cell walls. Asci 4–8-spored. Ascospores ellipsoid to long-ellipsoid, 3- to multiseptate, hyaline to yellow-brown, smooth to striate. Anamorph, where known, *Fusarium decemcellulare* or related species of fast-growing *Fusarium*. Saprobic and pathogenic on dicotyledonous and monocotyledonous hosts, often fruiting on decaying woody substrata.

NOTES.— The genus *Albonectria* is established for those species that are distinguished by having white to pale yellow, strongly warted ascomata with the outermost cells having greatly thickened outer walls that appear capitate. In *A. rigidiuscula* and *A. albosuccinea* the ascomata are aggregated on well-developed, pseudoparenchymatous stromata. Although the stromata in *A. verrucosa* are not well-developed, the ascomatal wall and *Fusarium* anamorph are characteristic of this genus. The anamorphs known for *A. rigidiuscula* and *A. albosuccinea* are species of *Fusarium* that form a monophyletic group within this large anamorph genus (Guadet *et al.*, 1989; O'Donnell, 1993). *Albonectria* is unusual in the *Nectriaceae* in having pallid, KOH- ascomata; however, the anamorph of fast-growing *Fusarium* and biological relationship to *Gibberella* place this genus in the *Nectriaceae*. This hypothesis is corroborated by sequence analyses of 28S rDNA as reported both by Guadet *et al.* (1989), O'Donnell (1993), and Rehner & Samuels (1995).

Albonectria rigidiuscula (Berk. & Broome) Rossman & Samuels, *comb. nov.* — Plate 25, a–j.

= *Nectria rigidiuscula* Berk. & Broome, J. Linn. Soc., Bot. 14: 116. 1873.

= *Calonectria rigidiuscula* (Berk. & Broome) Sacc., *Michelia* 1: 313. 1878.

= *Calonectria lichenigena* Speg., Bol. Acad. Nac. Ci. 11: 530. 1889.

= *Calonectria eburnea* Rehm, *Hedwigia* 37: 196. 1898.

= *Calonectria sulcata* Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25: 29. 1899.

= *Calonectria meliae* Zimm., *Centralbl. Bakteriolog., Abth. 2.* 7: 106. 1901.

= *Calonectria cremea* Zimm., *Centralbl. Bakteriolog., Abth. 2.* 7: 140. 1901.

= *Calonectria hibiscicola* Henn., *Hedwigia* 48: 105. 1908.

= *Scoleconectria tetraspora* Seaver, *North Amer. Flora* 3: 27. 1910.

= *Calonectria tetraspora* (Seaver) Sacc. & Trotter, *Syll. Fung.* 22: 487. 1913.

[= *Calonectria flavida* Masee, in Petch, *Ann. Roy. Bot. Gard. (Peradeniya)* 7: 117. 1920, nom. nud.].

[= *Calonectria squamulosa* Rehm, in Weese, *Mitt. Bot. Lab. Techn. Hochsch. Wien* 2: 53, nom. nud.].

Anamorph: *Fusarium decemcellulare* Brick, *Jahresber. Vereinigung Angew. Bot.* 6: 277. 1908.

Ascomata solitary to gregarious, in groups of up to 30, usually seated on a well-developed, pseudoparenchymatous stroma; stromata up to 400 µm high, of hyaline, angular cells, 5–10(–20) µm diam, with walls unthickened or up to 2 µm thick. Ascomata white to pale yellow, globose to subglobose, 220–320 µm high × 190–300 µm diam, slightly laterally pinched or not collapsing when dry, with small, pointed papilla, ascomatal surface with large, concolorous warts up to 50 µm high. Ascomatal wall 25–100 µm thick, of three regions: outer region including warts 10–80 µm thick, of angular to globose cells 10–18 µm diam, with walls up to 1.5 µm thick, outer region usually delimited from the middle region by one layer of large, globose cells 15–20 µm diam; middle region 12–15 µm thick, of elongate cells, 7–10 × 5–7 µm, with up to 1 µm thick walls, toward the base angular and larger, intergrading with the stroma; inner region 7–12 µm thick, of hyaline, thin-walled, elongate cells 14–20 × 4–7 µm. Asci narrowly clavate, 77–100 × 12–14 µm, simple, usually 4-spored, but 8-spored or variable in heterothallic strains, ascospores obliquely uniseriate to biseriate. Ascospores ellipsoid with broadly rounded ends, 24–35 × 7–10 µm, smaller in 8-spored asci, then 19–22 × 6–7 µm, 3-septate, hyaline, smooth or faintly striate at maturity.

ANAMORPH IN CULTURE: Producing a rose pigmentation on PSA. Macroconidiophores loosely branched with terminal phialides, 30–40 × 5–6 µm; macroconidia curved, cylindrical to broadly fusiform, with curved, pointed tip and foot-cell, 55–130 × 6–10 µm, 7–10-septate, hyaline, smooth. Microconidiophores develop as simple or sparsely bifurcated lateral branches; phialides more or less densely verticillate, 28–36 × 4–5 µm; microconidia formed in chains, oval with small, flattened,

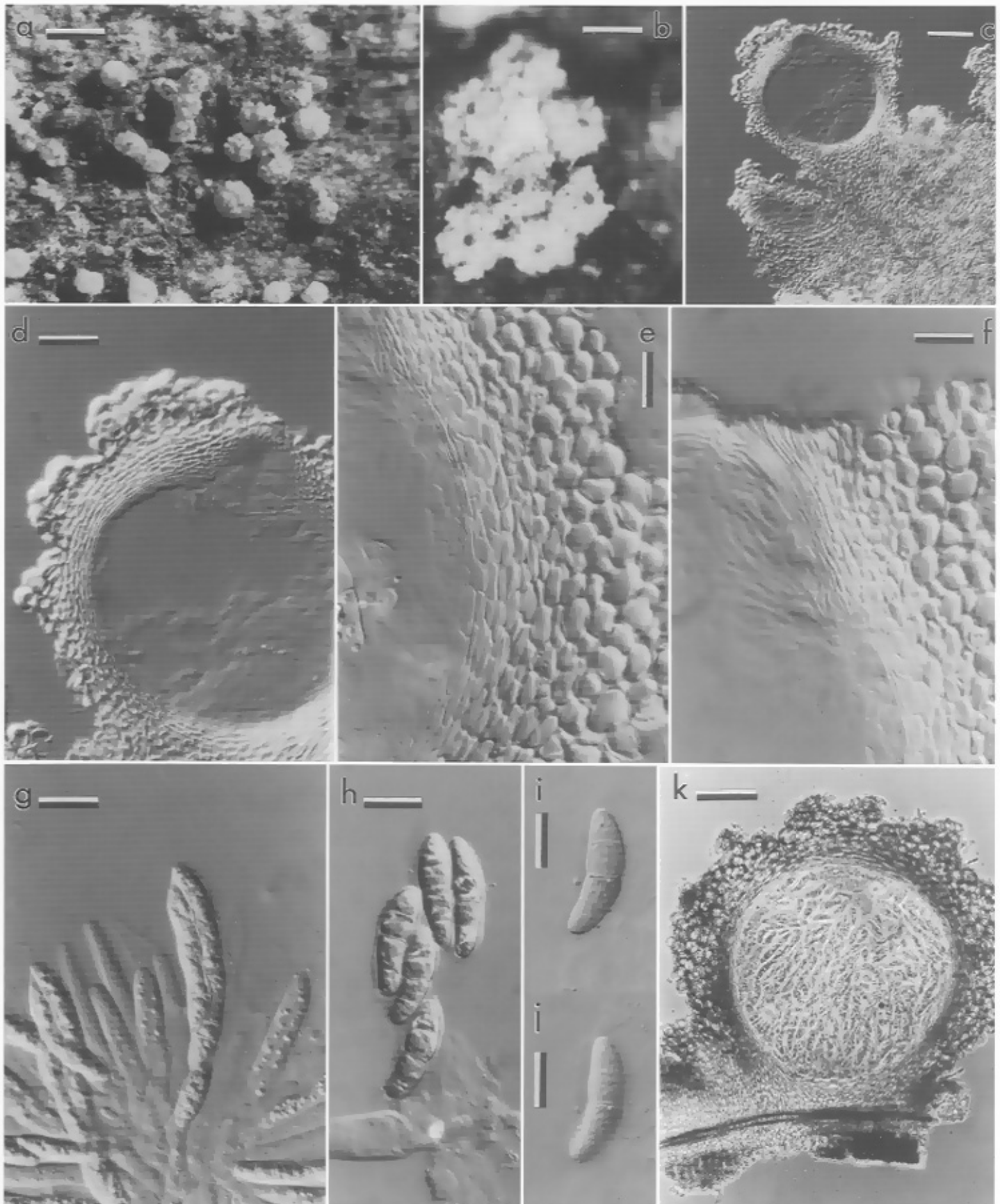


Plate 25. a–j. *Albonectria rigidiuscula*. a, b. Ascomata on natural substratum. c. Median section of ascomata on well-developed stroma. d. Median section of ascoma showing outer wall cells with capitate thickening. e. Section of ascomatal wall. f. Median section of ascomatal apex. g. Asci with developing ascospores. h. Ascus with mature ascospores. i. Ascospore in median focus. j. Ascospore in off-median focus to show fine ornamentation. **k.** *Allonectella guaranitica*, median section of ascoma. a, g. BPI 737674. b, e, f, h–j. BPI 745809A/B. c, d. BPI 553054. k. Holotype of *A. rubescens* – W. Scale bars: a = 500 μm ; b = 250 μm ; c = 100 μm ; d = 50 μm ; e–j = 25 μm ; k = 75 μm .

basal papilla, 10–15 × 3–5 µm, non-septate, occasionally 1-septate, hyaline, smooth. Chlamydospores lacking. Anamorph description based on Booth (1971).

HABITAT.— Saprotrophic and pathogenic on dicotyledonous plants, known on hosts in the *Anacardiaceae*, *Annonaceae*, *Apocynaceae*, *Bignoniaceae*, *Bombacaceae*, *Euphorbiaceae*, *Fabaceae*, *Malvaceae*, *Meliaceae*, *Moraceae*, *Myrtaceae*, *Poaceae*, *Sterculiaceae*, *Tiliaceae*, *Ulmaceae* (Booth, 1971; Booth & Waterston, 1964; Gerlach & Nirenberg, 1982).

DISTRIBUTION.— Pantropical and subtropical (Booth, 1971).

HOLOTYPE.— SRI LANKA (Ceylon). On bark, No. 173c (K). The holotype specimen is in poor condition and was examined only macroscopically. The few remaining ascospores agree with the descriptions and illustrations written and drawn by authors who have examined it microscopically (Booth, 1971; Petch, 1920).

ILLUSTRATIONS.— Booth (1960, Figs. 4a–c, as *C. rigidiuscula*), Booth & Waterston (1964, Figs. a–c, as *C. rigidiuscula*), Rossman (1983, Fig. 30, Pl. 10a–d, as *N. rigidiuscula*), Samuels *et al.* (1990, Fig. 31, as *N. rigidiuscula*).

SPECIMENS ILLUSTRATED.— JAMAICA. St. Mary's Parish, between Buff Bay & Annotte Bay, on wood, 19 Jan 1971, A.Y. Rossman (BPI 553054). NEW ZEALAND. North Island, Gisborne District, Urewera National Park, track to Lake Rupanui, 31 May 1983, coll. G.J. Samuels *et al.*, cult. G.J.S. 83-175 (BPI 745098). PUERTO RICO. Luquillo Mountains, El Verde Research Area, on bark, May 1995, S.M. Huhndorf 1388, PR 2276, G.J. Samuels, cult. 95-50 (BPI 737674). Additional specimens examined listed in Rossman (1983) and Samuels *et al.* (1990), as *Nectria rigidiuscula*.

NOTES.— *Albonectria rigidiuscula* is a common tropical species that is often not directly associated with diseased trees; however, the anamorph, *Fusarium decemcellulare*, is found as a pathogen of various tropical crops, causing die-back and canker of branches associated with capsid injury, 'green-point' cushion gall of buds, and pod rot of cacao; panel decay of *Hevea* rubber, associated with *Phytophthora* spp.; stem canker of 'robusta' coffee associated with *Xyleborous morstatta*; stem rot of durian; and blight of rice plants, as listed by Booth & Waterston (1964). The cytology of *Albonectria rigidiuscula* (as *Calonectria rigidiuscula*) has been studied by Alexander & Carmichael (1973). The synonyms of *A. rigidiuscula* are discussed in Rossman (1979b; 1983, as *N. rigidiuscula*).

***Albonectria albosuccinea* (Pat.) Rossman & Samuels, comb. nov.**

≡ *Calonectria albosuccinea* Pat., Bull. Soc. Mycol. France 8: 132. 1892.

≡ *Nectria albosuccinea* (Pat.) Rossman, Mycotaxon 8: 487. 1979.

= *Calonectria ecuadorica* Petrak, Sydowia 4: 463. 1950.

Anamorph: *Fusarium* sp.

Ascomata solitary or aggregated, each on a small, pseudoparenchymatous stroma 40–75 µm thick, stromata of hyaline, angular cells 7–18 µm diam with up to 2 µm thick walls. Ascomata globose to ovoid, 300–430 high × 300–410 µm diam, slightly laterally pinched or not collapsing when dry, white to pale yellow, with small, pointed papilla 40–65 µm high, ascromatal surface with large, concolorous warts up to 70 µm high, warts sometimes in longitudinal rows. Ascromatal wall 35–120 µm thick, of three intergrading regions: outer region including warts 10–80 µm thick, of angular to globose cells, cells variable in size, 10–30 µm diam, with up to 2 µm thick walls; walls of the outermost cells thickened up to 5 µm, outer region proliferating to form warts; middle region 20–25 µm thick, of elongate cells 12–20 × 4–5 µm with walls up to 1.5 µm thick; inner region 5–10 µm thick, of hyaline, thin-walled, elongate cells 7–12 × 4–7 µm. Asci narrowly clavate, 75–95 × 16–20 µm, simple, 8-spored, ascospores obliquely uniseriate. Ascospores fusiform, tapering to narrowly rounded ends, (31–)40–48 × (8.5–)10–12.5 µm, 3(–4)-septate, sometimes slightly constricted at each septum, hyaline, smooth or faintly striate.

ANAMORPH IN CULTURE: Conidiophores solitary to aggregated, cylindrical, 25–70 × 2.5–3.5 µm, straight, simple or multiply branched, hyaline, smooth, sparsely septate, bearing phialides at the apices. Conidiogenous cells phialidic, monoblastic, integrated, solitary, terminal 15–35 × 2.5–3.5 µm, cylindrical or expanding slightly toward the unflared apex, without conspicuous collarette. Macroconidia long-fusiform to clavate, tapering to curved, beaked ends, foot-cell distinctly beaked, (2–4)5–6-septate: 2-septate, 32–40 × 5–6 µm; 4-septate, 46–62 × 5–6 µm; 5-septate, 52–80 × 5–6 µm; 6-septate, 68–80 × 5–6 µm. Microconidia ellipsoid to slightly clavate with truncate base, variable in size and shape, hyaline, smooth, 0–1-septate: 0-septate, 11–13 × 3.5–4 µm; 1-septate, 15–16 × 3.5–4 µm.

HABITAT.— On dead bark of dicotyledonous trees, often occurring on lenticels.

DISTRIBUTION.— Ecuador and Venezuela.

TYPE.— ECUADOR. Puente de Cimbo, "sur écorce pourrie, Août", Lagerheim (FH – Patouillard, holotype of *Calonectria albosuccinea*); Prov. Tungurahua, Hacienda San Antonio de Baños, "auf berindeten, am Boden liegenden, faulen Ästen," 10 Jan 1938, H. Sydow, Nr. 712b (W, holotype of *Calonectria ecuadorica*; ZT, isotype).

ADDITIONAL SPECIMENS EXAMINED.— VENEZUELA. Edo. Aragua, path between hotel and water source, Rancho Grande, Parque Nac. Henry Pittier, on wood, Dumont *et al.*, VE 1149, 3 July 1971, culture C.T. Rogerson 71-188, ATCC 44544 (NY); Edo. Monagas, vicinity of Cueva del Guácharo, Caripe, on bark, Dumont *et al.*, VE 5296, 18 July 1972 (NY); as above, Dumont *et al.*, VE 5349 (NY); as above, Dumont *et*

al., VE 5424 (NY); as above, Dumont *et al.*, VE 6060 (NY).
ILLUSTRATIONS.— Rossman (1983, Fig. 31, Pl. 9a, as *N. albosuccinea*).

NOTES.— *Albonectria albosuccinea* has a *Fusarium* anamorph similar to *F. decemcellulare*; however, the anamorph of *A. albosuccinea* does not produce rose-red pigments in culture, the microconidia are not formed in chains, and the macroconidia are shorter and have fewer septa.

Albonectria verrucosa (Pat.) Rossman & Samuels, *comb. nov.*

≡ *Calonectria verrucosa* Pat., Bull. Soc. Mycol. France 11: 228. 1895.

≡ *Nectria astromata* Rossman, Mycotaxon 8: 550. 1979 [non *N. verrucosa* (Schwein.) Sacc., 1883].

Anamorph: *Fusarium* sp.

Ascomata solitary to densely gregarious, superficial on the substratum, without a stroma. Ascomata ovoid to obovoid, 350–400 µm high × 300–350 µm diam, slightly laterally pinched or not collapsing when dry, pale ochraceous, becoming ochraceous to cinnamon when dry, with large warts up to 50 µm high and paler than ascomata, area around the ostiole appearing darker due to lack of warts. Ascomatal wall 40–90 µm thick, of two intergrading regions: outer region 20–70 µm thick, of hyaline, angular cells 7–12 µm diam with walls up to 2 µm thick, walls of the outermost cells thickened up to 8 µm, outer region proliferating to form warts; inner region 15–20 µm thick, of hyaline, thin-walled, elongate cells, 10–15 × 5–7 µm, walls slightly thickened toward the outer region. Asci broadly clavate to fusiform, 100–180 × 17–23 µm, simple, 8-spored, ascospores pluriseriate. Ascospores long-fusiform, tapering to rounded ends, (40–)42–62 × 7–9 µm, 5–9(–13)-septate, each cell filled with small droplets, hyaline, smooth.

KEY TO THE SPECIES OF *ALBONECTRIA*

1. On dead culms of bamboo; stroma lacking; ascomata seated directly on the substratum; ascospores narrowly fusiform, 42–62 × 7–9 µm, 5–9-septate *A. verrucosa*
1. On dead wood and bark of dicotyledonous plants; ascomata on well-developed, pseudo-parenchymatous stroma; ascospores 3-septate, ellipsoid or fusiform, generally less than 50 µm long 2
2. Ascospores ellipsoid, 24–35 × 7–10 µm; ascomata usually aggregated on a well-developed stroma; in tropical regions, common *A. rigidiuscula*
2. Ascospores fusiform, 40–48 × 10–12.5 µm; ascomata solitary or aggregated on a scant, pseudo-parenchymatous stroma that immediately subtends each ascoma; in tropical regions, rare *A. albosuccinea*

ANAMORPH IN CULTURE: Producing pale pink to salmon-colored pigmentation on PDA. Macroconidiophores arising directly from hyphae or more extensively, irregularly branched. Conidiogenous cells phialidic, monoblastic, integrated, solitary, terminal, cylindrical or expanding slightly toward the unflared apex, with slight periclinal thickening, 18–25 × 2.5–3.5 µm. Macroconidia long-fusiform to clavate, gently curved, uniform or more strongly curved at the apical end, basal cell pedicellate, thin-walled, hyaline, 3–5(–6)-septate: 3-septate, 24–39 × 2.5–4 µm; 4-septate, 31–45 × 3–4.5 µm; 5-septate, 39–48 × 3–4.5 µm; 6-septate, 38.5–50 × 4–5 µm. Microconidia oblong, sometimes with a poorly developed foot-cell, variable in size and shape, hyaline, smooth, 0–1-septate: 0-septate 7–10 × 1–2 µm; 1-septate 10–33 × 2–3 µm.

HABITAT.— On dead culms of *Chusquea* sp. and other unidentified bamboo.

DISTRIBUTION.— Brazil, Colombia, Ecuador and Venezuela.

TYPE.— ECUADOR. San Jorge, tiges mortes de *Chusquea*, leg. Lagerheim (FH – Patouillard, holotype).

ADDITIONAL SPECIMEN EXAMINED and listed in Rossman (1983, as *N. astromata*): BRAZIL. Igapo, vic. "meeting of water", opposite Manaus City, on dead bamboo culm, 14 Dec. 1977, G.J. Samuels, BR 1022, culture G.J.S. 91-48, 91-49, det. A. Rossman (BPI 745920); on bamboo culm, Buck 20571A (BPI 1112822, NY); VENEZUELA. Territorio Federal Amazonas, Neblina Base Camp on Rio Baria, on bamboo, 17 Feb 1985, A. Rossman (BPI 550134).

ILLUSTRATIONS.— Rossman (1983, Fig. 29, Pl. 9 c, d).

NOTES.— The warts on the ascomata of *Albonectria verrucosa* are often not as prominent as those of *A. rigidiuscula* and *A. albosuccinea*. A fast-growing *Fusarium* was produced by single ascospores of the Brazilian specimen.