

## Two new species of *Neocosmospora* from Japan, with a key to the currently accepted species

S.-I. UDAGAWA

National Institute of Hygienic Sciences, Kamiyoga 1-Chome, Setagaya-ku, Tokyo 158,  
Japan

Y. HORIE

Central Museum of Chiba Prefecture, Aoba-cho, Chiba 280, Japan

&

P. F. CANNON

CAB International Mycological Institute, Ferry Lane, Kew, Surrey TW9 3AF, UK

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Two new species of *Neocosmospora*, isolated from forest soil in Japan, are described and illustrated: *N. boninensis* and *N. arzii*. A key to all accepted species of the genus is provided.

A number of familiar taxa of terricolous Ascomycetes were encountered in connection with studies on the fungi of the Ogasawara Islands (the Bonin Islands) in Japan, but two isolates of *Neocosmospora* appear to be undescribed. The Ogasawara Islands are situated more than 1000 km south of Tokyo in the sub-tropical zone. The mean annual temperature is 22.5°C with only slight seasonality, and the annual rainfall is about 1800 mm. The plants of the Ogasawara research area, due to its isolated geographical position, are characterized by a very high degree of endemism; nearly 53% of vascular plants (excluding introduced species), and more than 67% of arboreal species are confined to the region. The isolation of the islands and the special nature of their flora might suggest that many of the native fungi might also be restricted in their distribution. With the exception of the reports on basidiomycetous fungi (HABE et al., 1978; HONGO, 1977, 1978, 1980) and lichen-forming fungi (KASHIWADANI & NAKANISHI, 1978; KUROKAWA, 1978), however, little is known about the fungal flora of the Ogasawara Islands. DOI (1977, 1978) reported four interesting species of Hypocrealean fungi from the area as follows: *Nectria flavolanata* BERK. & BR., *N. azureo-*

*ostiolata* DOI, *Ophionectria trichospora* (BERK. & BR.) SACC., and *Nectriopsis infusaria* (COOKE & HARKN.) DOI. In this paper, two new species of the genus *Neocosmospora* (Hypocreales) are added to the list of fungi known from the Ogasawara Islands. A key to the known species is included.

### Taxonomy

***Neocosmospora boninensis*** UDAGAWA, HORIE & P. CANNON, sp.nov. – Figs. 1, 3, 4, 7, 8, 10–12.

Coloniae in agar ‚potato-carrot‘ celeriter crescentes, planae, tenues, dilute roseae vel incarnatae; reversum incolor vel dilute flavum.

Mycelium e hyphis hyalinis vel olivaceo-brunneis, ramosis, septatis, levibus, 2–8 µm diam, frequenter in funiculo aggregatis compositum. Perithecia superficialia, dispersa vel aggregata, persicina vel aurantio-rubra, deinde rubro-brunnea, subglobosa vel late ovoidea, 320–385 × 255–310 µm, glabra vel parce pilosa; peritheci collum breve papilliforme, 40–52 µm longum et 80–120 µm diam, glabrum, late ostiolatum; peridium multistratum, membranaceum, persicinum, semitranslucens, textura angularis. Periphysoides filiformes, longae, hyalinae, septatae, deinde inflatae, 6–18 µm diam. Asci plerumque 8-spori, cylindracei, 100–120(–128) × 10–14 µm, sine structura apicali instructi, breviter stipitati. Ascospores uniseriatae, unicellulares, flavo-brunneae vel brunneae, ovoideae vel ellipsoideae, raro fusiformes vel cylindraceae, (13–)14–18 × 10–12 µm, irregulariter incrassatae, sine poro germinali instructae, infirme longitudinaliter striatae.

Stat. Anam. *Acremonium* sp. – Conidiophora erecta, non ramosa vel interdum ramosa, hyalina, basi septata, in cellulis conidiogenis incorporata. Cellulae conidiogenae phialidicae, hyalinae, cylindraceae, (16–)24–80 × 2.5–4.5 µm, leves, superne gradatim attenuatae, collari parvo praeditae. Conidia uni- vel bicellularia, hyalina, cylindracea vel ovoidea, interdum allantoidea, 5–16(–20) × 1.5–4(–5) µm, utrinque rotundata, levia, in massa mucida aggregata.

Holotypus: colonia exsiccata, ex solo silva, Ogasawara-mura, Tokyo, in Japonia, 15.vi.1983, a T. SATO, isolata, NHL 2919. In collectione fungorum ‚National Institute of Hygienic Sciences (NHL)‘. Isotypus: IMI 316967.

Etymology: Latin, *boninensis*, pertaining to Bonin Islands (= Ogasawara Islands), the type locality.

Colonies on potato-carrot agar (PCA) spreading broadly, attaining a diameter of 78–80 mm within 14 days at 23°C, plane, thin, with vegetative mycelium largely submerged, producing scattered perithecia and limited numbers of conidiophores, pastel red to pastel pink (M. 10A5–11A4; KÖRNERUP & WANSCHER, 1978); reverse uncoloured to pale yellow (M. 4A3).

Mycelium composed of hyaline to olive-brown, branched, septate, smooth-walled, 2–8 µm diam hyphae, tending to aggregate in bundles, there anastomosing.

Perithecia superficial, scattered or aggregated in small groups, pale pink to orange red, later becoming reddish brown, subglobose to broadly ovoid, 320–385 × 255–310 µm, glabrous or covered with a few, hyaline, straight, simple, septate, smooth-walled, short, hyphal-like hairs measuring 3–5 µm diam near the base; neck short,

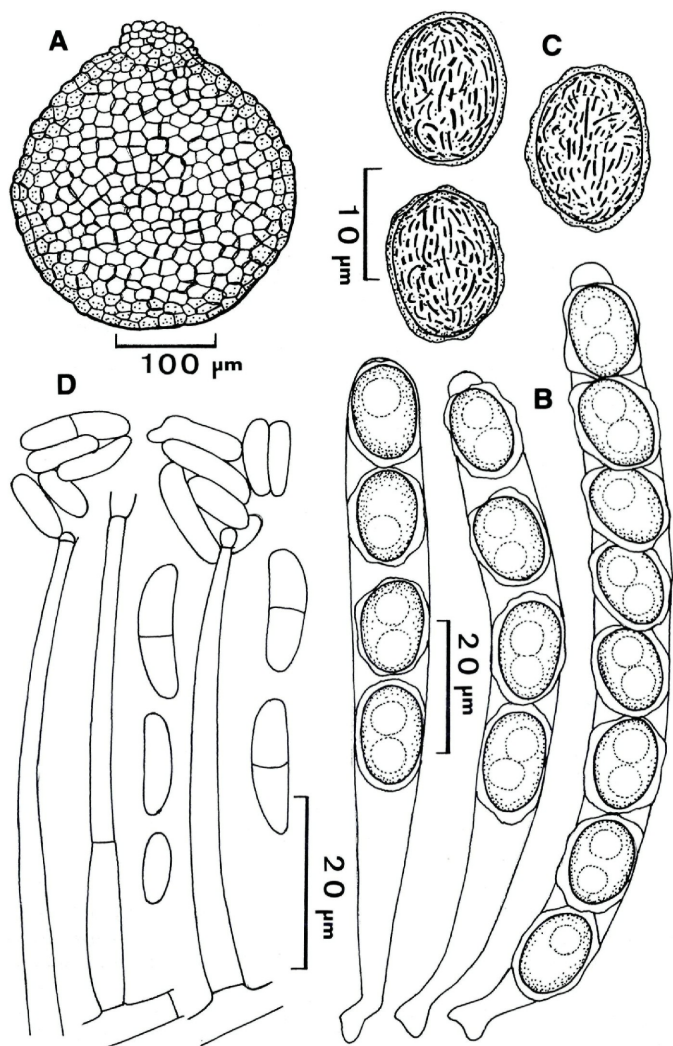


Fig. 1. *Neocosmospora boninensis* (NHL 2919). - A. Perithecium. - B. Asci (two 4-spored and one 8-spored). - C. Ascospores. - D. Conidiogenous cells and conidia.

papilliform, 40–52  $\mu\text{m}$  in length, 80–120  $\mu\text{m}$  diam, glabrous, widely ostiolate; peridium 30–35  $\mu\text{m}$  thick, 5–6-layered, membranaceous, semitransparent, with an outer layer of pale salmon coloured, thick-walled, angular to more or less rounded cells measuring 12–28  $\times$  10–20  $\mu\text{m}$  and inner layer(s) of hyaline, thin-walled, flattened cells measuring 14–30  $\mu\text{m}$  diam. Periphysoids numerous, filiform, long, hyaline, septate, becoming swollen with age, 6–18  $\mu\text{m}$  diam. – Asci 8-spored (though 3–4 spores may degenerate in some cultural conditions), cylindric, 100–120(–128)  $\times$  10–14  $\mu\text{m}$ , rounded or truncate above, without any distinct subapical structure, short-stalked. – Ascospores uniseriately arranged, one-celled, hyaline and guttulate at first, becoming yellowish brown to brown, ovoid to ellipsoid, rarely fusiform or cylindric, (13–)14–18  $\times$  10–12  $\mu\text{m}$ , thick-walled, without germ pores; ascospore-wall about 1–2  $\mu\text{m}$  thick, eventually becoming very irregular in thickness, with an ornamentation of weakly longitudinally arranged ridges.

Anamorph: *Acremonium* sp. – Conidiophores erect, arising directly from the vegetative hyphae, especially from funiculose strands of hyphae, simple or sometimes branched, hyaline, septate at the base, often acting as conidiogenous cells. – Conidiogenous cells phialidic, hyaline, cylindric, (16–)24–80  $\times$  2.5–4.5  $\mu\text{m}$ , smooth-walled, gradually tapering toward the tip, with a distinct, small collarette. – Conidia 1- or 2-celled, hyaline, cylindric to ovoid, sometimes allantoid, 5–16(–20)  $\times$  1.5–4(–5)  $\mu\text{m}$ , with rounded ends, smooth-walled, aggregating in slimy heads on the apex of conidiogenous cells.

Colonies on potato-dextrose agar as on PCA, funiculose, consisting of a thin basal felt, producing more abundant aerial mycelium and perithecia, pastel red to light brown (M. 9A5–5D4); reverse violet brown (M. 10F4) to light brown (M. 5D4). At 37°C, growth is rather faster than at 23°C, producing abundant conidia but fewer perithecia.

Specimen examined. – A dried culture derived from an isolate of forest soil, Mt. Mikazuki, Chichijima Island, Ogasawara-mura, Tokyo-to, Japan, June 15, 1983, T. SATO, NHL 2919 (holotype), IMI 316967 (isotype). A living subculture from NHL 2919 has been deposited in the culture collection of the CAB International Mycological Institute, Kew (IMI).

*Neocosmospora boninensis* can be recognized by the following combination of features: (1) asci that are cylindrical, and sometimes 4- to 5-spored; (2) ascospores that are usually ovoid to ellipsoid and rather large, with an ornamentation of weakly longitudinally arranged ridges, and a very late-developing, conspicuously irregular epispore ornamentation; (3) the *Acremonium* anamorph with rather large 0- to 1-septate conidia.

In gross morphology, it is somewhat similar to *N. vasinfecta* E.F.



SM. var. *vasinfecta*, but careful comparison of the ascospore ornamentation of the two taxa reveals significant differences. While the ascospore ornamentation of *N. vasinfecta* is composed of a network of wide anastomosing ridges (CANNON & HAWKSWORTH, 1984) which develop relatively early, that of *N. boninensis* has a series of weakly longitudinally arranged ridges, and at a late stage a very irregular episporium. While the ascospores of *N. vasinfecta* var. *vasinfecta* appear rugose under LM, the ascospore wall seems more or less constant in thickness. In those of *N. boninensis*, completely mature ascospores have a conspicuously variable wall thickness.

*N. vasinfecta* var. *africana* (VON ARX) P. CANNON & D. HAWKSWORTH has rather similar ascospore ornamentation to young spores of *N. boninensis* when examined with LM. However, the ornamentation of the former taxon is composed of narrow cerebriform ridges which are not longitudinally oriented. In addition the former taxon never develops an irregular episporium, and asci are always 8-spored. *N. indica* WADHWANI has a similar episporium ornamentation to *N. boninensis*, but the asci of *N. indica* are clavate and always 8-spored, and the ascospores are slightly narrower, with a punctate episporium which develops at an earlier stage.

***Neocosmospora arxii*** UDAGAWA, HORIE & P. CANNON, sp.nov. – Figs. 2, 5, 6, 9, 13.

Coloniae in agarō ‚potato-carrot‘ potius celeriter crescentes, planae, tenues, dilute aurantiacae; reversum incolor vel salmoneum. Mycelium e hyphis hyalinis vel interdum flavo-pigmentiferis, ramosis, septatis, levibus, 2.5–5 µm diam, frequenter in funiculo aggregatis compositum; chlamydosporae praesentes, catenulatae, intercalares, hyalinae, globosae vel elongatae, 7.5–12 µm diam, leves.

Perithecia semi-immersa vel immersa, dispersa vel aggregata, flavo-aurantiaca vel flavo-brunnea, late ovoidea vel aliquot pyriformia, 220–340 × 160–270 µm, paene glabra; peritheciū collum breve, conicum, 40–60 µm longum et 65–95 µm diam, late ostiolatum; peridium multistratum, membranaceum, dilute flavo-brunneum, semi-translucens, textura angularis. Periphysoides e cellulis catenulatis, hyalinis, inflatis, 12–20 µm diam compositae. Asci 8-spores, late clavati, 70–75 × 27.5–30(–40) µm, sine structura apicali instructi, breviter stipitati, evanescentes. Ascospores biseriatae, unicellulares, hyalinae vel dilute flavae, late ellipsoideae vel ovoideae, saepe inaequilaterales, 16–20(–22) × 14–16(–20) µm, incrassatae, leves, sine poro germinali instructae. Conidia nulla.

Holotypus: colonia exiccta, ex solo in loco ab sylvā *Casuarinae equisetifoliae*, Ogasawara-mura, Tokyo, in Japonia, 3.xii.1977, a Y. HORIE, isolata, NHL 2987. In collectione fungorum ‚National Institute of Hygienic Sciences (NHL)‘. Isotypus: IMI 313854.

**Etymology:** Latinized from the name of the late Dr. J.A. VON ARX in honour of his contribution to the taxonomy of *Neocosmospora*, and to knowledge of the Ascomycetes as a whole.

Colonies on potato-carrot agar (PCA) growing rather rapidly, attaining a diameter of 43–44 mm within 14 days at 23°C, plane, thin, with vegetative mycelium largely submerged and very few aerial

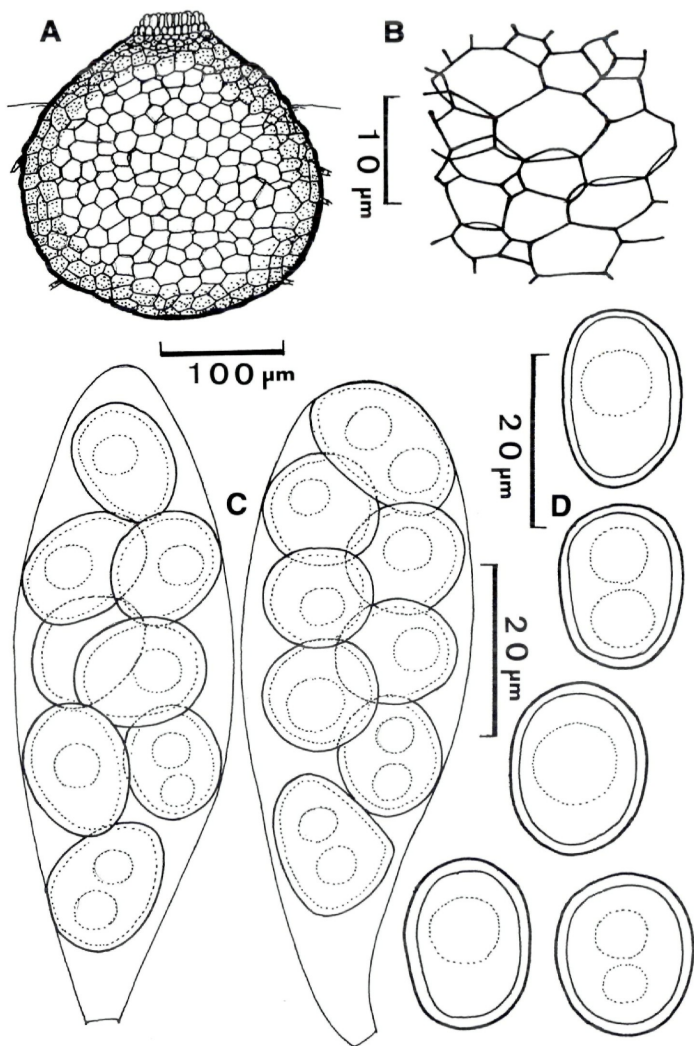


Fig. 2. *Neocosmospora arxii* (NHL 2987). - A. Perithecium. - B. Surface view of peridium. - C. Asci. - D. Ascospores.

hyphae, developing abundant perithecia near the surface of the substratum, light orange (M. 5A5; KORNERUP & WANSCHER, 1978); reverse uncoloured to pale orange (M. 5A3).

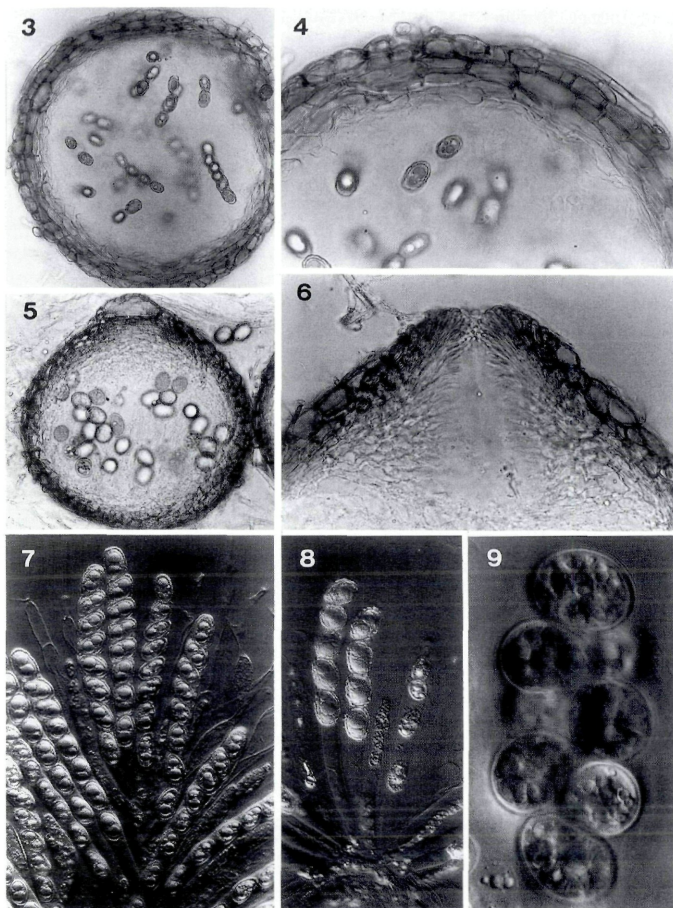
Mycelium composed of hyaline or sometimes yellow-pigmented, branched, septate, smooth-walled, 2.5–5 µm diam hyphae, tending to aggregate in strands; chlamydospores 2–3 in chains, intercalary, hyaline, globose to more or less elongate, 7.5–12 µm diam, smooth-walled.

Perithecia semi-immersed to immersed, scattered or aggregated in small groups, yellowish orange to yellowish brown, broadly ovoid to somewhat pyriform, 220–340 × 160–270 µm, almost glabrous; neck short, conical, 40–60 µm long, 65–95 µm diam, widely ostiolate, at the ostiolar region composed of short, papillate cells; peridium 20–30 µm thick, 4–5-layered, membranaceous, semi-transparent, with an outer layer of light yellow, thick-walled, angular to more or less rounded cells measuring 7.5–20 × 6.5–17.5 µm and inner layer(s) of hyaline to pale yellow, thin-walled, flattened, angular cells measuring 6–18 µm diam. Periphysoids composed of a chain of hyaline, large, cylindrical to swollen cells, 12–20 µm diam. – Asc borne in a basal fascicle, 8-spored, broadly clavate, 70–75 × 27.5–30(–40) µm, rounded above, without distinct apical structure, short-stalked, evanescent. – Ascospores biserially arranged, one-celled, hyaline and guttulate at first, becoming pale yellow in age, broadly ellipsoid to ovoid, often inequilateral, 16–20(–22) × 14–16(–20) µm, uniformly thick-walled (wall: 1.5 µm thick), smooth (appearing very faintly verrucose with SEM, though this may be an artefact caused by shrinkage of mucilage), without germ pores, extruded at maturity in the form of a yellowish orange slimy mass. Conidia not observed.

Colonies on oatmeal agar essentially as described on PCA but developing perithecia in localized V-shaped sectors, brown to dark brown (M. 7D7–7F7); reverse brown (M. 7E6). At 37°C, colony diameter is about one-quarter that at 23°C, with reduced mycelial growth.

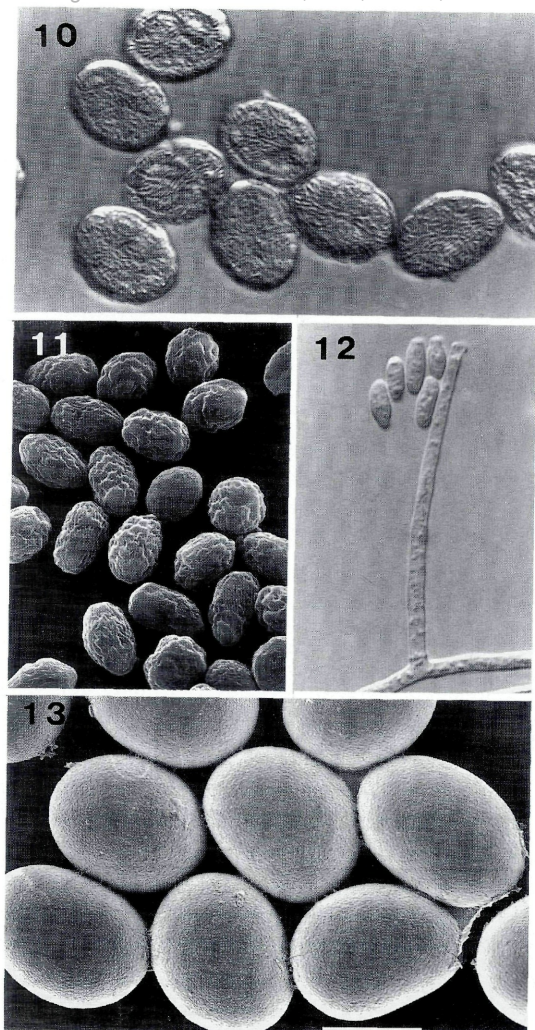
Specimen examined. – A dried culture derived from an isolate of soil in beefwood forest (*Casuarina equisetifolia* FORST.), Omotohama, Hahajima Island, Ogasawara-mura, Tokyo-to, Japan, Dec. 3, 1977, Y. HORIE, NHL 2987 (holotype), IMI 313854 (isotype). A living subculture from NHL 2987 has been deposited in the culture collection of the CAB International Mycological Institute, Kew (IMI).

*Neocosmospora arxii* is readily distinguished from other known species of the genus by its large, sometimes inequilateral, ellipsoid-ovoid, almost hyaline, smooth-walled ascospores. In ascus morphology, it is similar to *N. indica* WADHWANI but the ascospores of the latter species are 12.5–16 × 9–10 µm, reticulate and covered with markedly irregular epispore (CANNON & HAWKSWORTH, 1984).



Figs. 3-9. *Neocosmospora* spp. - 3, 4. *N. boninensis* (NHL 2919). 3. - Vertical section of perithecium, x 180. - 4. A part of the perithecium, x 360. - 5, 6. *N. arxii* (NHL 2987). - 5. Vertical section of perithecium, x 180. - 6. Vertical section of the neck, x 360. - 7, 8. *N. boninensis* (NHL 2919). - 7. 8-spored asci, x 400. - 8. 4-5-spored asci, x 400. - 9. *N. arxii* (NHL 2987). - Ascus, x 900.





Figs. 10–13. *Neocosmospora* spp. – 10–12. *N. boninensis* (NHL 2919). – 10. Ascospores (Nomarski D.I.C.), x 1250. – 11. Ascospores (SEM), x 800. – 12. Conidiogenous cell and conidia, x 1000. – 13. *N. arxii* (NHL 2987), Ascospores (SEM), x 1600.  
SEM: Spores were fixed with 2% buffered  $\text{OsO}_4$ , washed and dried on cover slip pieces and then mounted on stubs with colloidal silver paste. The samples were coated with gold-palladium and examined with a Hitachi HFS-2 SEM.



The almost hyaline and smooth ascospores of *N. arxii* invite comparison with the genus *Pseudonectria* SEEVER. However, the type species of this genus, *P. rousseliana* (MONT) WOLLENW. has truncate asci with narrowly ellipsoid to fusoid ascospores, ascomata with conspicuous knob-like hairs, and a *Volutella* anamorph. In addition, it is a pathogen of *Buxus* in Europe and North America (PEACE, 1962).

### Key to species of *Neocosmospora*

1. Asci clavate; ascospores biserially arranged ..... 2
1. Asci cylindrical; ascospores uniseriately arranged ..... 3
  2. Ascospores yellow-brown, strongly ornamented, the wall markedly irregular in thickness ..... *N. indica* WADHWANI
  2. Ascospores hyaline or pale yellow, ± smooth, the wall regular in thickness ..... *N. arxii* UDAGAWA & al.
3. Ascospores with a transversely striate ornamentation ..... 4
3. Ascospores otherwise ornamented ..... 5
  4. Ascospores 7.5–12 × 5–6.5 µm, with 6–10 transverse hyaline flanges; ascomata dark brown ..... *N. parva* MAHONEY
  4. Ascospores 13.5–17 × 10–11.5 µm, with many inconspicuous transverse ridges; ascomata orange to red ..... *N. tenuicristata* UEDA & UDAGAWA
5. Ascospores 8–10 × 5–5.5 µm; ascomata less than 200 µm diam ..... *N. parva* MAHONEY
5. Ascospores almost always more than 10 µm long, and always at least 7 µm diam; ascomata more than 200 µm diam ..... 6
  6. Ascospores with weakly developed longitudinal ridges and developing a markedly irregular epispore; asci sometimes less than 8-spored ..... *N. boninensis* UDAGAWA & al.
  6. Ascospores with a rugose or cerebriform ornamentation; asci always 8-spored ..... 7
7. Ascospores with a conspicuous rugose ornamentation  
*N. vasinfecta* E.F. SM. var. *vasinfecta*
7. Ascospores with a cerebriform ornamentation  
*N. vasinfecta* var. *africana* (VON ARX) P. CANNON & D. HAWKSW.

### Acknowledgments

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Autor(en)/Author(s): Udagawa S. I., Horie Y., Cannon P. F.

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