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Two new lignicolous species of *Nitschkia* from Argentina

María Virginia Bianchinotti[1]

Laboratorio de Ficología y Micología, Departamento de Biología, Bioquímica y Farmacia, Universidad Nacional del Sur, San Juan 670, 8000 Bahía Blanca, Argentina

Abstract: Two species of *Nitschkia* are described from bark and wood of a legume shrub, native to the semiarid regions of Argentina. *Nitschkia campylospora* is characterized by asci with a variable number of ascospores, mainly 16, and curved ascospores; hairy ascomata and large ascospores are two distinct features of *Nitschkia pilosa*. The new species are compared with most similar species. A key to *Nitschkia* species is provided with the inclusion of comments on those from Argentina and neighboring countries.

Key words: Munk pores, Nitschkiaceae, systematics

INTRODUCTION

During biodiversity studies on micromycetes growing on bark and decorticated wood of a native legume shrub from Argentina, *Geoffroea decorticans* (Gill. ex Hook & Arn.) Burk., two species belonging to *Nitschkia* G.H.Otth ex Karst. were found. *Nitschkia* is characterized by turbinate ascomata that become cupulate upon collapse, a coriaceous peridium composed of brown, thick-walled, angular cells with Munk pores, unitunicate evanescent asci lacking an apical apparatus, and diverse ascospores, both in number and form.

The two species differ from the hitherto published species and here are described as new. A key to species of *Nitschkia* is provided. Some additional information on species from continental southern (semiarid and subtropical) South America is included.

MATERIALS AND METHODS

Ascomata were mounted in water, in 3% KOH, in 1% aqueous phloxine and in lactophenol. Ascomata were hand-sectioned with a razor blade. Measurements (at least 30 of each character) were made of material in water. Asci were observed with 1% Aq. Congo Red, Janus Green, Melzer's Reagent and 5% calcofluor (Romero and Minter 1988). Images were taken using bright field (BF), fluorescence (FL) and phase contrast (PC) with a Zeiss Axiolab microscope. The photographic plates were produced electronically with Adobe Photoshop 7.0.

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[1] E-mail: vbianchi@criba.edu.ar

Nitschkia campylospora Bianchinotti sp. nov. FIGS. 1–10

Ascomata superficialia, dense gregaria vel caespitosa, nigra, subglobosa, sicca cupulato collapsa, tuberculata minutissime rugulosis, tomento castaneo iridescenti preadita, non-ostiolata. Asci clavati, multispori, (4–)16(–25) sporati. Ascosporae allantoideae, curvata vel lunata, (8.5–)9.5–13 × (1.5–)2–2.5 μm, hyalinae, laeves, uniseptatae, guttulatae, in asci irregulariter dispositae. In ligno decorticato emortuis.

Specimens examined. ARGENTINA. BUENOS AIRES: Partido Coronel Rosales, Villa Maio, Ruta Provincial 229 km 9, on decorticated wood of *Geoffroea decorticans,* 30 May 1990, *Bianchinotti 115* (HOLOTYPE: BBB); same locality and substratum, 12 Oct 2002, *Bianchinotti 171, 172* (BBB), *173* (ISOTYPE: F).

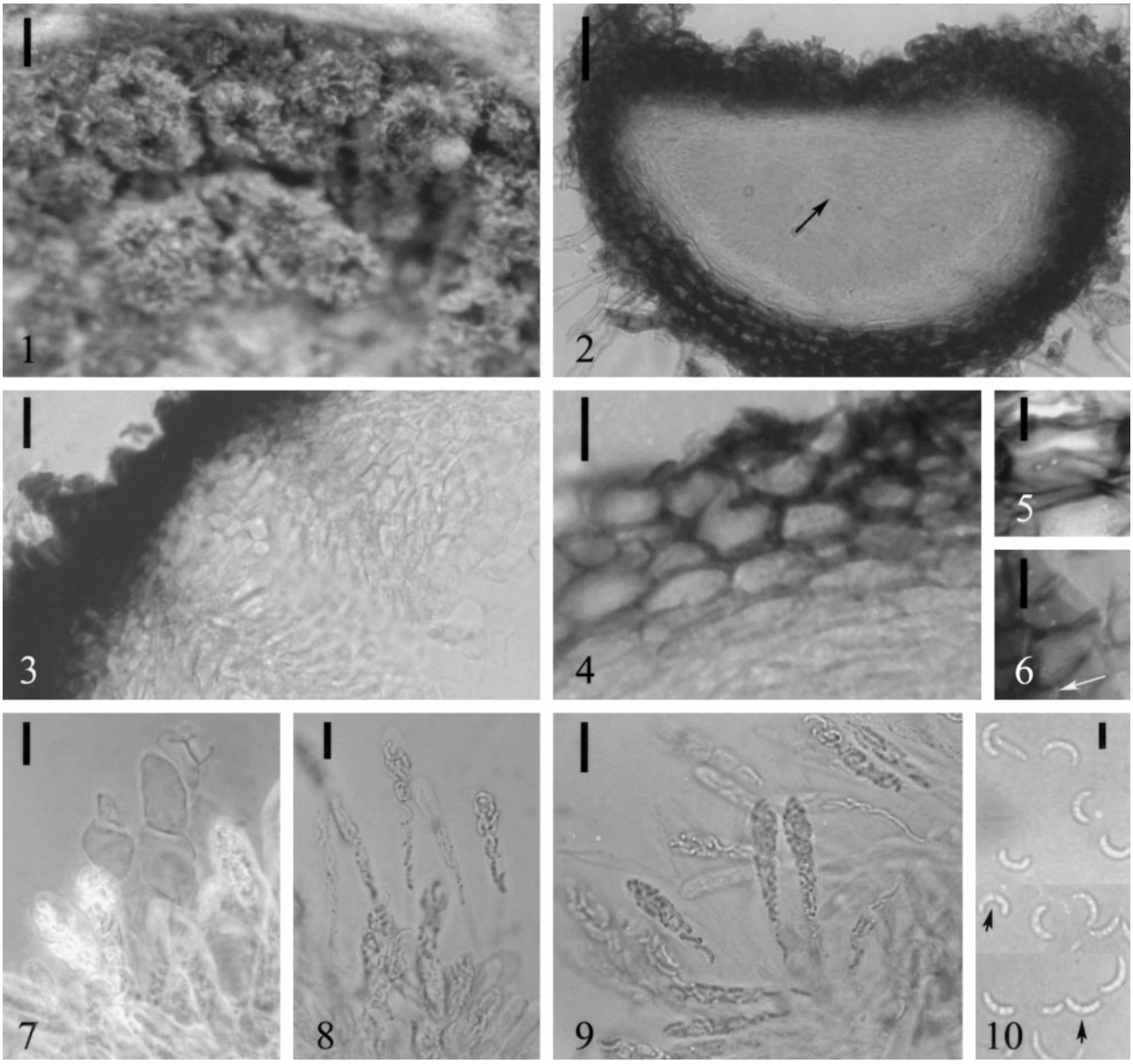
Ascomata superficial on decorticated wood, gregarious, subglobose, cup-shaped when collapsing, 200–400 μm diam, non papillate, non ostiolate, surface minutely warted, black. Ascomata surrounded by an iridescent light brown tomentum, composed of undulating, richly branched, thick-walled, dark hyphae, 7–12 μm diam; subiculum more abundant in immature ascomata. Peridium pseudoparenchymatous comprising two layers; external layer of large, polyhedral, thick-walled, heavily pigmented, dark brown cells possessing Munk pores. Inner layer comprising pale, thin-walled cells; cells surrounding the interior of the locule tangentially compressed, with acute ends. Quëllkorper short and dome-like. Asci clavate, more than 100 μm long, unitunicate, thin-walled, evanescent, with (4–)16(–25) ascospores irregularly disposed in each ascus; apex simple. Ascospores allantoid, strongly curved, (8.5–)9.5–13 × (1.5–)2–2.5 μm, hyaline, smooth, 1-septate, with two large guttules in each cell.

Anamorph. None known.

Etymology. From Greek χαμπνλοζ: curved, referring to shape of ascospores.

Nitschkia pilosa Bianchinotti sp. nov. FIGS. 11–20

Ascomata superficialia, sparse gregaria, subglobosa vel

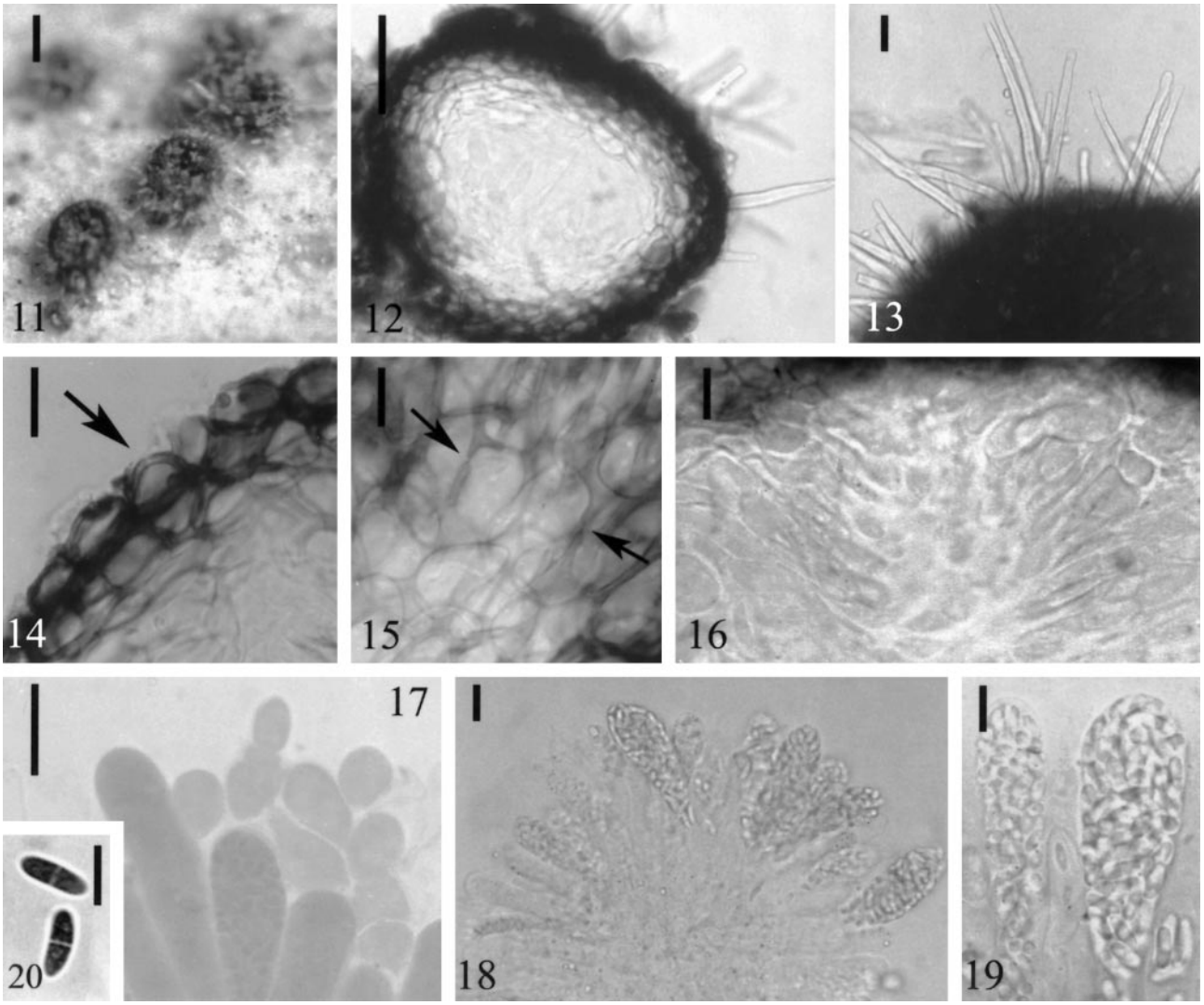


FIGS. 1–10. *Nitschkia campylospora*. 1. Ascomata on the substratum. 2. Longitudinal section through ascoma showing Quëllkorper (arrow). 3. Detail of Quëllkorper zone. 4. Longitudinal section through ascomatal wall. 5, 6. Munk pores. Arrow points to a typical pore surrounded by a ring-shaped thickening of the wall. 7. Cellular remnants among immature asci (PC). 8, 9. Mature asci with irregular number of ascospores. 10. Ascospores. Note the median septum (arrows). Scale bars: 1 = 100 μm, 2–3 = 25 μm, 4–6 = 10 μm, 7–9 = 20 μm, 10 = 10 μm.

turbinata, 125–380 μm diametro, sicca cupulato collapsa, pilis hyalinis septatis ornata, fusco-atra vel atra. Asci oblongo clavati, 75–120 × 15–35 μm, stipitati, apice simplici, ca 64-spori. Ascosporae suballantoidea vel allantoidea, (6.5–)9.4–11(–12) × (2.5–)3–4(–5) μm, hyalinae, laeves, uniseptatae. In cortice Geoffroea decorticans (Hook. & Arn) Burk. Argentina.

Specimens examined. ARGENTINA. BUENOS AIRES: Partido Coronel Rosales, crossroads between Ruta Nacional 3 and Ruta Provincial 229, bark of *Geoffroea decorticans,* 22 May 1991, *Bianchinotti 118* (HOLOTYPE: BBB); same collecting information, *Bianchinotti 116, 117* (ISOTYPES: F); Partido Bahía Blanca, Campo Tarantino, 38°40′S, 62°18′, bark of *Geoffroea decorticans,* 1 Sep 1986, *Bianchinotti 7, 50, 52* (BBB); same locality and substratum, 25 Dec 1986, *Bianchinotti 109, 110* (BBB); 10 April 1987, *Bianchinotti 86* (BBB); 7 Jul 1987, *Bianchinotti 83, 96, 97, 98, 99* (BBB).

Ascomata superficial on inner bark, scattered to gregarious, subglobose to turbinate, collabent on drying, 125–380 μm diam, with a short papilla and a well developed sterile base, non ostiolate, surface minutely warted, hairy, dark brown to black. Hairs subcylindric, septate, to 150 μm long, 4–10 μm at base,



FIGS. 11–20. *Nitschkia pilosa*. 11. Ascomata on the substratum. 12. Longitudinal section through ascoma. 13. Ascomatal hairs. 14. Longitudinal section through ascomatal wall. Arrow indicates a Munk pore in the exterior wall. 15. Tangential section through ascomatal wall showing Munk pores connecting cells (arrows). 16. Detail of Quëllkorper zone. 17. Immature asci. Note cellular remnants among them. 18. Young and mature asci. 19. Detail of mature asci. 20. Mature ascospores stained with Aq. Phloxine. Scale bars: 11 = 200 μm, 12 = 50 μm, 13 = 20 μm, 14–20 = 10 μm.

thick-walled, subhyaline to pale brown; thinner and paler towards the acute or rounded ends, base cylindrical to subglobose. Peridium ca 30 μm wide except up to 80 μm wide in the basal portion; composed of two regions, external region composed of 5–7 layers of large, 7–15 μm diam, polyhedral, thick-walled, heavily pigmented, dark brown cells; cells paler and thinner-walled toward the interior, organized in more or less vertical rows in the basal portion, with simple Munk pores. Internal region composed of 3–4 layers of thin-walled, hyaline, tangentially compressed cells with acute ends, 2–3 μm wide. Quëllkorper short and dome-like. Asci oblong to clavate, 75–120 × 15–35 μm, unitunicate, thin-walled, evanescent, 64-spored, apex simple lacking any visible apparatus. Ascospores suballantoid to allantoid, (6.5–)9.5–11(–12) × (2.5–)3–4(–5) μm, hyaline, smooth, 1-septate.

Etymology. From Latin *pilus* (hair), referring to those that cover the ascomata.

Anamorph. None known.

DISCUSSION

Several researchers (Fitzpatrick 1923, 1924, Nannfeldt 1975a, b, Sivanesan 1974, Subramanian and Sekar 1990) have studied members of Nitschkiaceae. A close relationship between this family and Lasiosphaeriaceae has been postulated several times (Arx 1981, Barr 1990, Carroll and Munk 1964, Sivanesan 1974, 1975, 1978). The number of genera in the fam-

ily and the criteria for their separation greatly vary, but the broader generic concept adopted by Nannfeldt (1975b) is preferred until molecular studies allow more accurate decisions.

Most *Nitschkia* species are saprobic on branches or decorticated wood, and a few are hyperparasitic on fungi. Typically their small nonostiolate ascomata look like sessile apothecia when dry, and are commonly surrounded by a subiculum. The tomentum in *N. campylospora* is typical of the genus, but ascomatal hairs as those found in *N. pilosa* have not been reported. These hairs are similar to those described in some species of *Lasiosphaeria* Ces. & De Not. (e.g., *L. strigosa* [Albert. & Schw.] Sacc. and *L. stuppea* Ellis. & Ev., as illustrated by Seaver 1912) and resemble those described in *Nitschkiopsis* Nann. & R.Sant., a lichenicolous member of Nitschkiaceae (Nannfeldt 1975b).

The ascomatal peridium is pseudoparenchymatous, composed of two distinct layers. One striking feature is the presence of Munk pores in the cells of the outer layer. Typically one per cell, they are ca 1 μm diam and surrounded by a ring-shaped thickening of the wall. They are not always obvious, and their number varies depending upon the species and developmental stage (Nannfeldt 1975b). In *N. campylospora,* the conspicuous pores are typical of the genus and two per cell frequently can be observed. In *N. pilosa,* ascomata of different ages show pores that are simpler, appearing merely as circular thinning of the wall. One or more pores could be observed both in the common wall between adjacent cells and in the exterior wall as well. They resemble the simple pores described in *Lasiobertia* Sivan., a genus similar to *Oxydothis* Penz. & Sacc., with a rather uncertain taxonomic position in the opinion of Eriksson and Santesson (1986), that was considered a member of the Lasiosphaeriaceae by Barr (1990) and later transferred to the Hyponectriaceae by Hyde (1993).

Peridial pores were considered for a long time unique to members of ''Coronophorales '', but Cannon (1995) clearly showed that they are more widespread among ascomycetes than previously thought. A few more examples can be added to those mentioned by Cannon (1995)—*Lasiobertia africana* Sivan., *Lasiosphaeriella dennisii* Sivan. (Sivanesan 1975), *Lasiosphaeriopsis salisburyi* D. Hawksw. & Sivan. (Hawksworth 1980), *L. stereocaulicola* (Lindsay) O. E. Erikss. & R. Sant. (Eriksson and Santesson 1986), and *Melanospora sphaerodermoides* Grove (Shoemaker and Smith 1970).

The function of Munk pores is unknown. A hypothetical explanation is that they could help in transporting moisture to the interior of the ascoma, which is diminished by the heavily pigmented and thickened walls, thus enhancing the discharge of ascospores from the entirely closed ascomata. Observations made after wetting ascomata of the two species described here were similar to those reported by Nannfeldt (1975b) for *N. parasitans,* in which spores were extruded in a slimy mass from the top of ascomata that had been kept in a moist chamber. It is thought that the cell mass known as Quëllkorper, which may become swollen, plays an important role in ascomata discharge. In addition, Vujanovic (2002) recently has reported the important increase of Quëllkorper cells size in water.

Asci in the two species described here are typical of the family, being long claviform, unitunicate, thinwalled and evanescent. No evidence of any thickening or apical structures could be found in bright field or phase contrast observations made with Congo Red, Janus Green or fluorescence microscopy using calcofluor. True paraphyses are lacking. Instead, cellular remnants corresponding to the ''restes des cellules nourricières'' described by Parguey-Leduc (1966)) were observed among immature asci.

Asci in most *Nitschkia* species are octosporous; rarely they are 4-spored and in a few they are polysporous. The mostly 16-spored asci of *Nitschkia campylospora* and the particular shape of the ascospores distinguish it from other species. Although variation in number of ascospores in asci of the same ascomata has been reported previously in *Nitschkia affinis* (H.& P. Syd.) Nannf. and in *N. leonensis* (Sivan.) Nannf., the most frequently observed numbers of ascospores in both species are 32 and 25. The ascospores strongly resemble those of *Acanthonitschkea argentinensis* Speg., which is characterized by dark bristles on the subiculum and ascomata, 8-spored asci, and smaller ascospores (6–8 × 2 μm) (Spegazzini 1908).

Asci in *N. pilosa* and *N. molnarii* Funk are both 64-spored, but the latter has glabrous ascomata and smaller ascospores (Funk 1979). In addition, ascospores of *N. pilosa* are much wider (up to 5 μm) than those in all other polysporous species described to date.

An unidentified stromatic coelomycete producing hyaline microconidia in phialidic conidiogenous cells occasionally was observed growing close to the ascomata of *N. campylospora.* Funk (1979) considered a pycnidial fungus with Munk pores in the outer wall cells to be the anamorphic state of *N. molnarii.* Vujanovic (2002) found similar pycnidia in the same pustule as *N. parasitans* var. *mijuskovicii* Vujanovic. This circumstantial evidence would suggest the pycnidial states belong in the respective life cycles. However, because no *Nitschkia* species has been grown in

pure culture, no correlation with any anamorphic state can be established with certainty.

Although *Nitschkia* species are well known in some regions of Europe and India, they have not been widely collected and studied in other parts of the world. Nannfeldt (1975b) predicted that a number of undescribed species as well as others described in the most unexpected genera reside in South Temperate Zones. More collectors and collaborative research is urgently needed to increase our knowledge of these minute but extremely interesting fungi.

KEY TO NITSCHKIA SPECIES

1. Asci 4–8 spored 2
1′. Asci polysporous 23
2. Asci 4-spored 3
2′. Asci 8-spored 4
3. Ascospores fusiform, curved, hyaline to brown, (25–)30–40 × 5–6 μm . . . . . *N. malabarica* Subram. & Sekar
3′. Ascospores fusiform, almost straight, hyaline to gray, 15–22 × 2.5–3 μm . . . . . *N. tetraspora* Nannf.
4. Ascomata up to 0.3 mm diam. Hyperparasitic on *Nectria cinnabarina* stomata . . . . . *N. parasitans* (Schw.) Nannf.
4′. Ascomata more than 0.3 mm diam. Mostly saprobic 5
5. Ascomata bearing spines (up to 20 μm long) . . . . . *N. brevispina* (Munk) Nannf.
5′. Ascomata without spines 6
6. Ascomata surrounded by a hyphal subiculum 7
6′. Ascomata seated on a pseudoparenchymatous subiculum 22
7. Subiculum composed of dichotomously branched hyphae 8
7′. Subiculum composed of irregularly branched hyphae 10
8. Subicular hyphae with spiny endings . . . . . *N. acanthostroma* (Mont.) Nannf. Considered a widespread species in subtropical regions, was first cited for South America as *Scortechinia culcitella* (Berk. & Rav.) Speg. (Spegazzini 1888). Recorded in Bolivia, Brazil and Paraguay.
8′. Subicular hyphae with blunt endings 9
9. Ascospores ellipsoidal to subcylindrical, with terminal appendages, 19–30 × 4.5–7 μm . . . . . *N. chaetomioides* (Penz. & Sacc.) Nannf.
9′. Ascospores suballantoid to reniform, without appendages, 6–8 × 2–3 μm *N. velutina* (Petr.) Nannf.
10. Ascospores rough, ellipsoidal to ovoid, 7–9 × 4.5–5.5 μm . . . . . *N. uniseriata* (Fitzp.) Nannf.
10′. Ascospores smooth 11
11. Ascospores always hyaline 12
11′. Ascospores colored with age 16
12. Ascospores fusiform 13
12′. Ascospores otherwise 14
13. Ascomata tuberculate, with large warts. Ascospores 6–9 × 1.5–2.5 μm . . . . . *N. grevillii* (Rehm in Starb.) Nannf.
13′. Ascomata not tuberculate. Ascospores 7–11 × 2–3 μm . . . . . *N. pezizoidea* (Pat. & Gaill.) O.Kze
14. Ascospores ellipsoidal, 5–7 × 1.5–2 μm . . . . . *N. calyculus* (Mont.) O.Kze
14′. Ascospores subcylindrical to cylindrical, larger . . 15
15. Ascospores 10–18 × 2–2.5 μm . . . . . *N. cupularis* (Fr. ex Fr.) Karst.
15′. Ascospores 36–45 × 12–14 μm . . . . . *N. gigantospora* Nannf.
16. Ascospores septate, variously shaped 17
16′. Ascospores aseptate, ovoid to ellipsoidal, subreniform, 7–11 × 3.5–5 μm . . . . . *N. confertula* (Schw.) Nannf.
17. Ascomata setose. Setae dark brown, to 150 μm long. Ascospores ovoid, 13–18 × 4–6 μm . . . . . *N. phaeospora* W.H. Hsieh, C.Y. Chen & Sivan.
17′. Ascomata glabrous 18
18. Ascospores broadly ellipsoidal 19
18′. Ascospores fusiform 20
19. Ascospores 21–30 × 7–10 μm . . . . . *N. thekkadyensis* Subram. & Sekar
19′. Ascospores 28–38 × 13–18 μm . . . . . *N. pulneyensis* Subram. & Sekar
20. Ascospores 12–18 × 3.5–7 μm . . . . . *N. collapsa* (Rom.) Chentantais
20′. Ascospores longer 21
21. Ascospores 26–40 × 3–4 μm . . . . . *N. silentvalleyensis* Subram. & Sekar
21′. Ascospores 35–45 × 4.5–6 μm . . . . . *N. sundara* Subram. & Sekar
22. Ascospores 15–20 × 3–4.5 μm . . . . . *N. floridana* Fitzp. A North American species recorded in Brazil by Rick as *Bertia submoriformis* (fide Nannfeldt 1975b).
22′. Ascospores 26–45 × 6–6.5 μm . . . . . *N. macrospora* Teng
23. More than 200 spores/asci . . . . . *N. broomeiana* (Berk.) Nannf. Argentina, Brazil. A cosmopolitan species, first cited for Argentina by Spegazzini (1880) as *Fracchiaea heterogenea* Sacc., recorded more recently by Romero (1987) and Romero and Carmarán (1997).
23′. Less than 200 spores/asci 24
24. Ascomata surrounded by a hyphal subiculum . . . 25
24′. Subiculum pseudoparenchymatous or absent . . . 30
25. Subiculum composed of dichotomously branched hyphae. 26
25′. Subiculum composed of irregularly branched hyphae 27
26. Ascospores reniform, often spiral, with terminal appendages, 6–9 × 3 μm . . . . . *N. similis* (Bres.) Nannf.
26′. Ascospores subreniform, allantoid to ovoid, without appendages, 5–7 × 2–3 μm . . . . . *N. leonensis* (Sivan.) Nannf.

27. Asci (4–) 16 (–25) spored. Ascospores allantoid, strongly curved, (8.5–)9.5–13 × (1.5–)2–2.5 μm 1. *N. campylospora*
27′. Asci mostly 32-spored. Ascospores otherwise 28
28. Ascospores suballantoid, hyaline, 7–9 × 1.5 μm *N. callista* (Berk. & Curt.) Nannf.
28′. Ascospores ovoid, fusiform to ellipsoidal, hyaline or colored, wider 29
29. Ascospores ovoid, hyaline, 5–6 × 3 μm .... *N. multiasca* (Pat. & Gaill.) Nannf.
29′. Ascospores ellipsoidal, fusiform or ovoid, hyaline becoming light brown, 6–10 × 3–4 μm .... *N. variabilis* Romero & Samuels Argentina. Described from decorticated wood of *Eucalyptus viminalis*. Known only from type locality (Romero and Samuels 1991).
30. Ascomata glabrous, seated on a pseudoparenchymatous subiculum 31
30′. Ascomata hairy, subiculum absent. Ascospores suballantoid to allantoid, (6.5–) 9.5–11(–12) × (2.5–)3–4(–5) μm ..... 2. *N. pilosa*
31. Asci (25-) 32-spored. Ascospores subcylindrical to ellipsoidal, 5.5–7 × 1–1.5 μm .... *N. affinis* (H. & P. Syd.) Nannf.
31′. Asci 64-spored. Ascospores allantoid, 6–8 × 1.5–2 μm ..... *N. molnarii* Funk

Excluded: *Nitschkia archeri* (Berk.) Subram. & Sekar and *N. didyma* (Speg.) Subramanian & Sekar. Type material of both species were first examined by Fitzpatrick (1923) and then by Nannfeldt (1975b) who considered them as belonging to *Thaxteria* Sacc. because of their large ostiolate ascomata, which not become characteristically cupulate, the asci with truncate tips with thickened walls and small rings and the broadly subcylindrical, geniculate rather allantoid, 3-septate, dark brown ascospores.

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LITERATURE CITED

Barr ME. 1990. Prodromus to nonlichenized, pyrenomycetous members of Class Hymenoascomycetes. Mycotaxon 39:43–184.

Cannon PF. 1995. Studies on fungi with isthmoid ascospores: the genus *Vialaea,* with the description of the new family Vialaeaceae. Mycol Res 99:367–373.

Carroll GC, Munk A. 1964. Studies on lignicolous Sordariaceae. Mycologia 56:77–98.

Eriksson O, Santesson R. 1986. *Lasiosphaeriopsis stereocaulicola*. Mycotaxon 25:569–580.

Fitzpatrick HM. 1923. Monograph of the Nitschkieae. Mycologia 15:23–65.

———. 1924. The genus *Fracchiaea*. Mycologia 16:101–114.

Funk A. 1979. A new Nitschkia on western conifers and its probable microconidial state. Can J Bot 57:2113–2115.

Hyde KD. 1993. Fungi from palms. VI. Reflections on *Oxydothis* and related genera. Sydowia 45:204–225.

Nannfeldt JA. 1975a. Stray studies in the Coronophorales (Pyrenomycetes) 1–3. Svensk Bot Tidskr 69:49–66.

———. 1975b. Stray studies in the Coronophorales (Pyrenomycetes) 4–8. Svensk Bot Tidskr 69:289–335.

Parguey-Leduc A. 1966. Recherches sur l'ontogenie et l'anatomie des ascocarpes des Pyrénomycètes ascoloculaires. 2. Les ascocarpes des Pyrénomycètes unituniqués. Ann Sci Nat Bot 12:19–30.

Romero AI. 1987. Contribución al estudio de los hongos xilófilos de la Argentina. II. Ascomycotina en *Eucalyptus viminalis* (Myrtaceae). Darwiniana 28:251–270.

———, Carmarán CC. 1997. Algunos micromicetes xilófilos de la región subtropical Argentina. I. Misiones. Bol Soc Argent Bot 33:59–67.

———, Minter DW. 1988. Fluorescence microscopy fungi: an aid to the elucidation of ascomycete structures. Trans Brit Mycol Soc 90:457–470.

———, Samuels GJ. 1991. Studies on xylophilous fungi from Argentina. VI. Ascomycotina on *Eucalyptus viminalis* (Myrtaceae). Sydowia 43:228–248.

Seaver FJ. 1912. The genus *Lasiosphaeria*. Mycologia 4:115–124.

Shoemaker RA, Smith JD. 1970. *Melanospora sphaerodermoides* on seed of *Agrostis palustris*. Can J Bot 48:1657–1658.

Sivanesan A. 1974. Two new genera of Coronophorales with description and key. Trans Br Mycol Soc 62:35–43.

———. 1975. *Lasiosphaeriella,* a new genus of the family Lasiosphaeriaceae. Trans Br Mycol Soc 64:441–445.

———. 1978. *Lasiobertia africana* gen. et sp. nov. and a new variety of *Bertia moriformis*. Trans Br Mycol Soc 70:383–387.

Spegazzini C. 1880. Fungi Argentini Pug 2. Anal Soc Cient Argentina 10:122–142.

———. 1888. Fungi Guaranitici. Pugillus II. Anal Soc Cient Argentina 26:5–74.

———. 1908. Hongos de la Yerba mate. Anal Mus Nac Buenos Aires (ser 3 t 10) 17:111–141.

Subramanian CV, Sekar G. 1990. Coronophorales from India—a monograph. Kavaka 18:19–90.

von Arx JA. 1981. On *Monilia sitophila* and some Families of Ascomycetes. Sydowia 34:13–19.

Vujanovic V. 2002. A new variety of *Nitschkia parasitans* hyperparasitic on *Nectria cinnabarina* from American beech. Mycologia 82:121–126.