

## Fungi on *Juncus roemerianus*

### 3. New Ascomycetes

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*Anthostomella poecila* sp. nov., *A. semitecta* sp. nov., *Phomatospora bellaminuta* sp. nov. and *Physalospora citogerminans* sp. nov. are described from saltmarsh *Juncus roemerianus* in North Carolina. The two *Anthostomella* species are the first records of this genus on *Juncus* in the U. S. A. *Phomatospora bellaminuta* and *A. poecila* are restricted to the lower parts of the culms and are considered to be marine species, whereas *Physalospora citogerminans* appears to be a facultative marine fungus. *Anthostomella semitecta* fruits in the upper, rarely immersed areas of the culms and is probably halotolerant.

#### Introduction

In continuation of a survey of fungi on saltmarsh *Juncus roemerianus* Scheele in North Carolina (Kohlmeyer and Volkmann-Kohlmeyer 1993 a, b, 1995, Kohlmeyer *et al.* 1995, Volkmann-Kohlmeyer and Kohlmeyer 1994) we describe the following four new ascomycetes. Collecting methods and coordinates of collecting sites have been published in a previous paper (Kohlmeyer *et al.* 1995).

#### Results and Discussion

*Anthostomella poecila* Kohlm., Volkm.-Kohlm. *et* O. E. Erikss., sp. nov.

**Etymology:** From the Greek ποικίλος = spotted, in reference to the black clypei and stromata which mottle the surface of the culm.

Ascomata 125–180  $\mu\text{m}$  alta, 165–230  $\mu\text{m}$  diam., subglobosa, omnino immersa, ostiolata, collo longo, coriacea, atrobrunnea, sub stromate nigro membranaceo vel clypeo, singularia vel rariter gregaria; collum 40–70  $\mu\text{m}$  longum, 40–60  $\mu\text{m}$  diam., atrobrunneum, periphysatum, stromate vel clypeo circumdatum; peridium 12–16  $\mu\text{m}$  crassum, 4–5 stratis cellularum brunnearum elongatarum compositum, in sectione longitudinali texturam angularem formans; hamathecium paraphysibus simplicibus, 2.2–3.2  $\mu\text{m}$  diam., matrice gelatinosa circumdatis compositum; asci 70–95  $\times$  11–16  $\mu\text{m}$ , octospori, cylindrici, breviter pedunculati, leptodermi, unitunicati, annulo apicale refractivo, amyloideo, successive ex hyphis ascogenis basalibus exorientes; ascosporae 10.0–14.8  $\times$  4.2–6.9  $\mu\text{m}$  ( $\bar{x}$  = 12.4  $\times$  5.6  $\mu\text{m}$ ; n = 60), uniseriatae, ellipsoideae, unicellulares, brunneae, rima germinativa, tunica gelatinosa tectae.

**Substratum:** Culmi *Junci roemeriani*.

**Distributio:** Littus Oceani Atlantici, America Septentrionalis (U. S. A.: North Carolina).

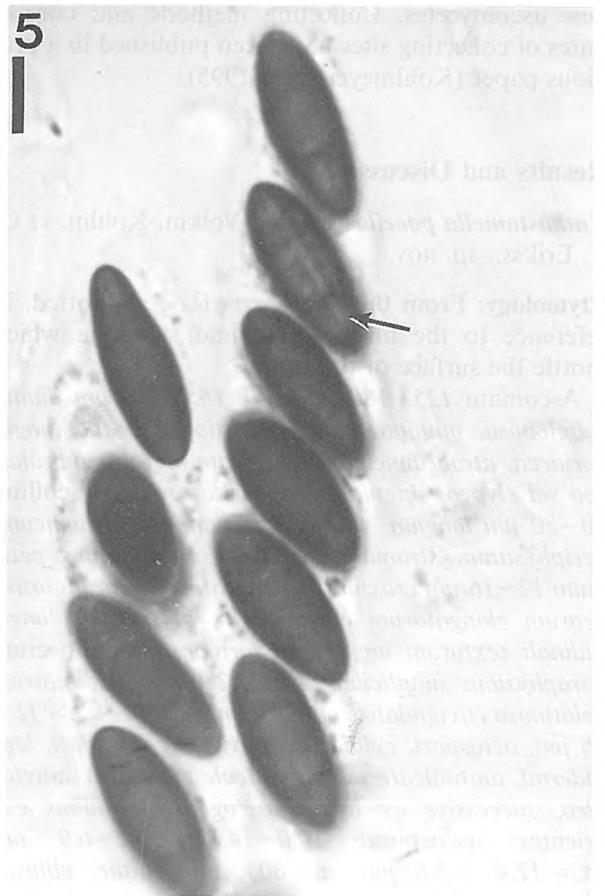
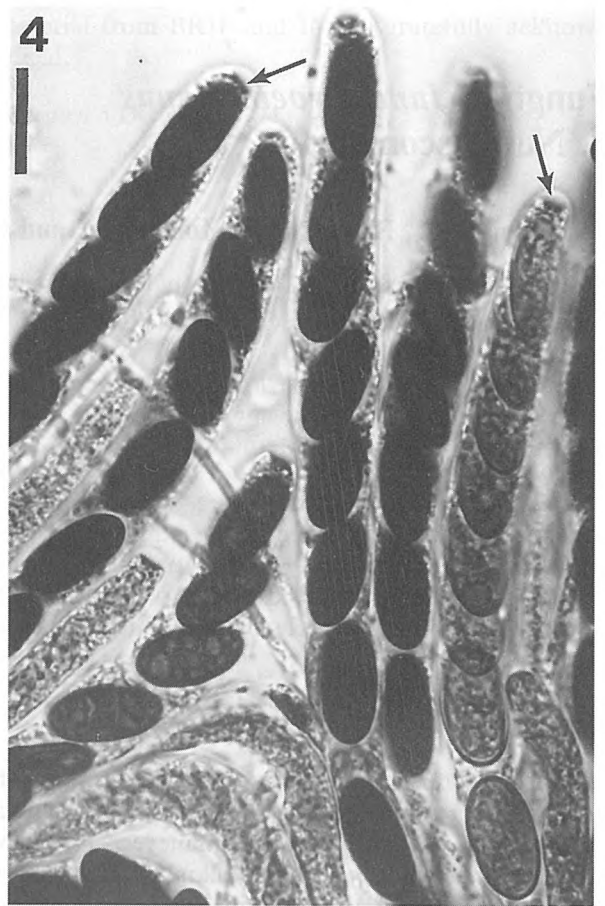
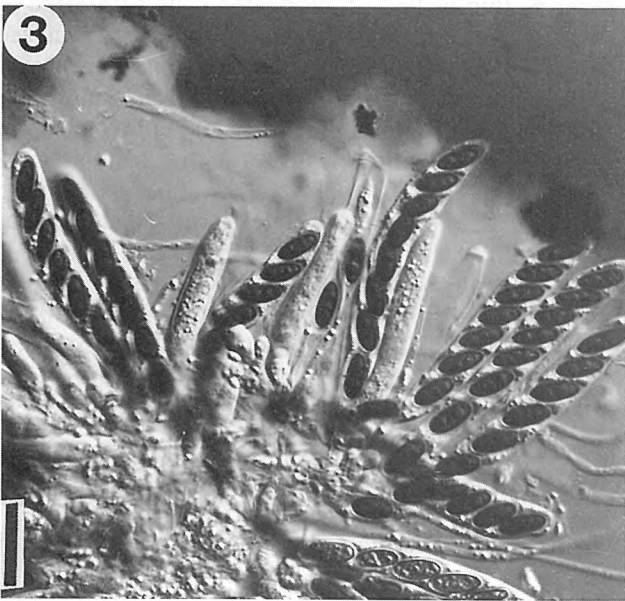
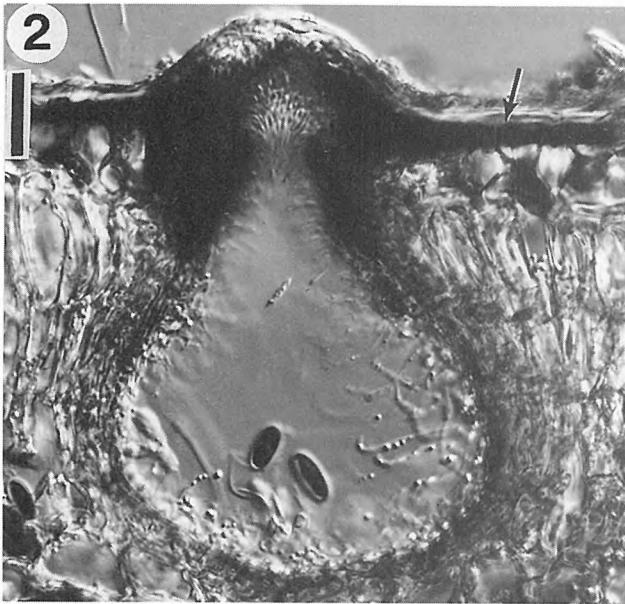
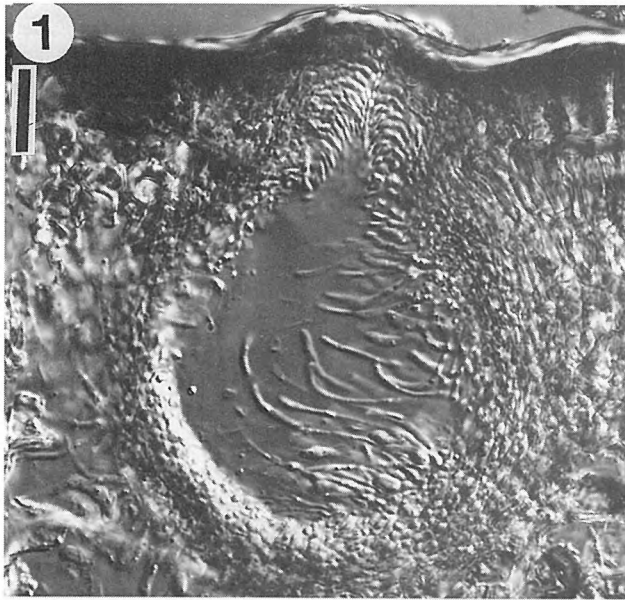
**Holotypus:** J. K. 5520 (IMS); **Isotypus:** J. K. 5520 (UME).

Ascomata 125–180  $\mu\text{m}$  high, 165–230  $\mu\text{m}$  in diam., subglobose, completely immersed in the hard outer tissue of the host, ostiolate, with a long neck, coriaceous, dark brown, under a thin black stroma or clypeus, single or rarely gregarious (Figs 1, 2). Neck 40–70  $\mu\text{m}$  long, 40–60  $\mu\text{m}$  in diam., black, breaking through the epidermis and cuticle with a hyaline tip, periphysate, surrounded by the more or less developed stroma which grows between the cuticle and the epidermal cells of the host (Fig. 2). Peridium 12–16  $\mu\text{m}$  thick, composed of 4–5 layers of brown, thin-walled,  $\pm$  elongated cells with large lumina, forming a *textura angularis* in longitudinal section. Hamathecium composed of simple paraphyses, 2.2–3.2  $\mu\text{m}$  in diam., surrounded by a gelatinous matrix (Fig. 3), also lining the sides and epihymenial cupola, merging with paraphyses in the ostiolar canal (Figs 1, 2). Asci 70–95  $\times$  11–16  $\mu\text{m}$ , eight-spored, cylindrical, short pedunculate, thin-walled, unitunicate, with a small refractive apical ring, blueing in IKI, maturing successively on the ascogenous hyphae at the bottom of the locule (Figs 3, 4). Ascospores 10.0–14.8  $\times$  4.2–6.9  $\mu\text{m}$  ( $\bar{x}$  = 12.4  $\times$  5.6  $\mu\text{m}$ ; n = 60), uniseriate, ellipsoidal in side view, terete, one-celled, brown, with a longitudinal germ slit (Fig. 5) and a gelatinous sheath.

**Substratum:** Lower and upper parts of senescent culms of *J. roemerianus*.

**Distribution:** Atlantic Coast (U. S. A.: North Carolina).

**Material examined:** Dead standing culms of *J. roemerianus*, NC-BC: 13 Oct. 1993, J. K. 5520 (Holo-



type: IMS; Isotype: UME); same location: 1 Apr. 1975 (J. K. 3645), 1 Feb. 1977 (J. K. 5515), 5 Feb. 1978 (J. K. 3894), 18 Nov. 1992 (J. K. 5486), 20 Dec. 1992 (J. K. 5491), 31 Jan. 1993 (J. K. 5493, 5494), 7 Feb. 1993 (J. K. 5496), 6 Apr. 1993 (J. K. 5505, 5506), 20 June 1993 (J. K. 5509), 25 July 1993 (J. K. 5516), 8 Aug. 1993 (J. K. 5517), 28 Nov. 1993 (J. K. 5522), 31 Dec. 1993 (J. K. 5523), 30 Jan. 1994 (J. K. 5524), 5 Apr. 1994 (J. K. 5530); NC-B: 19 Nov. 1992 (J. K. 5487); NC-WC: 8 Mar. 1993 (J. K. 5499), 29 Apr. 1993 (J. K. 5507), 3 Sept. 1993 (J. K. 5519), 16 Mar. 1994 (J. K. 5528); NC-SC: 14 May 1994 (J. K. 5534).

*Anthostomella poecila* is one of the most frequent species on senescent culms of *J. roemerianus* and does not show a seasonality; we collected it in every month of the year in North Carolina. It occurs in the lower parts of the culm of *J. roemerianus*, from 6 to 42 cm above the rhizome, therefore, overlapping in its distribution with other obligate marine fungi, such as *Aniptodera juncicola* Volk.-Kohlm. et Kohlm., *Aro-psichus junci* (Kohlm. et Volk.-Kohlm.) Kohlm. et Volk.-Kohlm., and *Papulosa amerospora* Kohlm. et Volk.-Kohlm. Apparently, *A. poecila* is a marine species which can develop also in the upper, less frequently inundated parts of the culm.

The key to the species of *Anthostomella* by Francis (1975) leads to *A. leptospora* (Sacc.) Francis or *A. caricis* Francis. *Anthostomella caricis* differs from *A. poecila* by higher ascomata (238–300  $\mu\text{m}$  versus 125–180  $\mu\text{m}$ ) with a larger diameter, by a thicker peridium (18  $\mu\text{m}$  versus 12–16  $\mu\text{m}$ ), by thinner asci (8–10  $\mu\text{m}$  versus 11–16  $\mu\text{m}$ ) and paraphyses (1.5–2  $\mu\text{m}$  versus 2.2–3.2  $\mu\text{m}$ ). Also, the mean ascospore sizes are slightly different (13.6  $\times$  6.3  $\mu\text{m}$  in the type of *A. caricis* [IMI 183760],  $n = 50$ ; 12.4  $\times$  5.6  $\mu\text{m}$  in *A. poecila*,  $n = 60$ ). In *A. leptospora*, known only from *Cladium*, the ascomata are higher, the peridium is thicker, the asci are longer and thinner and the ascospores are greenish-brown and above all slightly inequilateral, *i. e.*, more or less straight on one side.

*Anthostomella semitecta* Kohlm., Volk.-Kohlm. et O. E. Erikss., sp. nov.

**Etymology:** From the Latin *semi* = half, and *tectus* = covered, in reference to the gelatinous sheath which covers one half of the ascospore.

Ascomata 240–350  $\mu\text{m}$  alta, 320–430  $\mu\text{m}$  diam., subglobosa, omnino immersa, ostiolata, coriacea, atro-

brunnea, sub clypeo nigro, singularia; collum ca. 110  $\mu\text{m}$  longum, 110–135  $\mu\text{m}$  diam., conicum ad cylindricum, periphysatum; peridium 23.5–27.5  $\mu\text{m}$  crasum, 5–6 stratis cellularum brunnearum, in pseudoparenchymate hyalino transiens, texturam angularem formans; hamathecium paraphysibus 2–4  $\mu\text{m}$  diam., furcatis, in pseudoparenchymate exorientibus; asci 105–125  $\times$  9.5–12.5  $\mu\text{m}$ , octospori, fusiformes, leptodermi, unitunicati, annulo apicali refractivo, amyloideo, breve pedunculati, successive ex hyphis ascogenis basalibus exorientes; ascosporae 15.9–18.8  $\times$  6.6–8.1  $\mu\text{m}$  ( $\bar{x} = 17.1 \times 7.4 \mu\text{m}$ ;  $n = 25$ ), uniseriatae, ellipsoideae, tunica gelatinosa laterali semitectae, bicellulares, cellula grandi brunnea, rima germinativa, et cellula parva hyalina basali (1.2–2.2  $\mu\text{m}$  diam.).

**Substratum:** Culmi *Junci roemeriani*.

**Distributio:** Littus Oceani Atlantici, America Septentrionalis (U. S. A.: North Carolina).

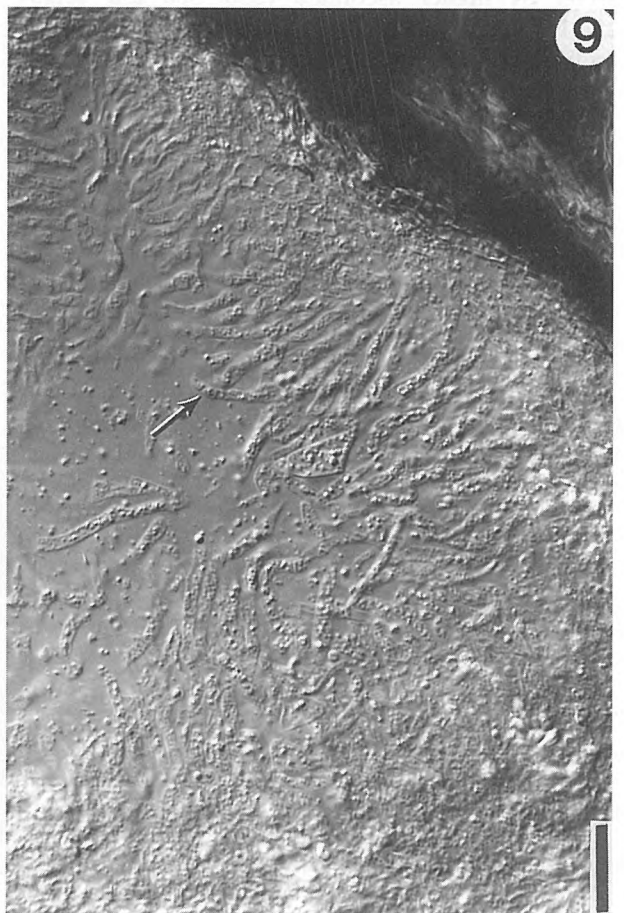
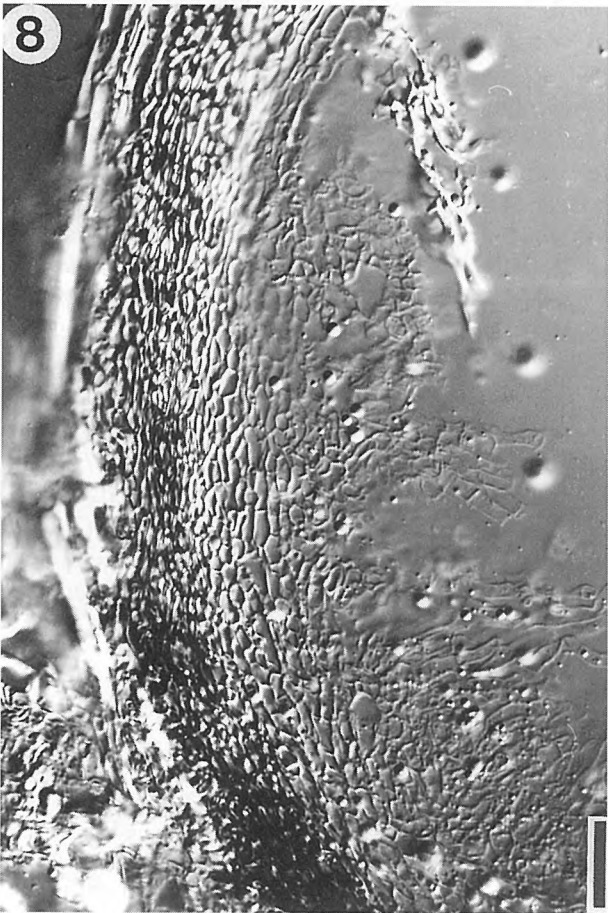
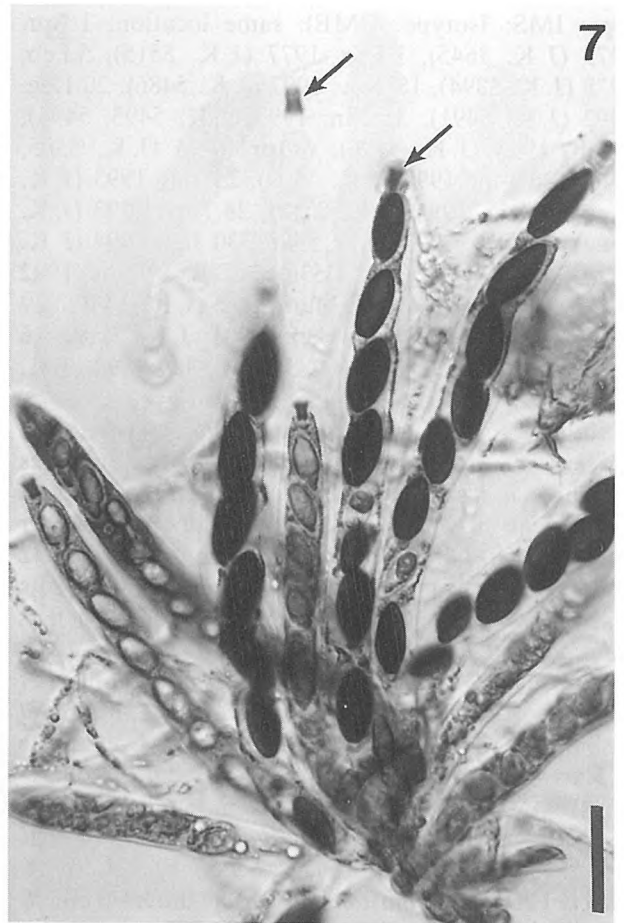
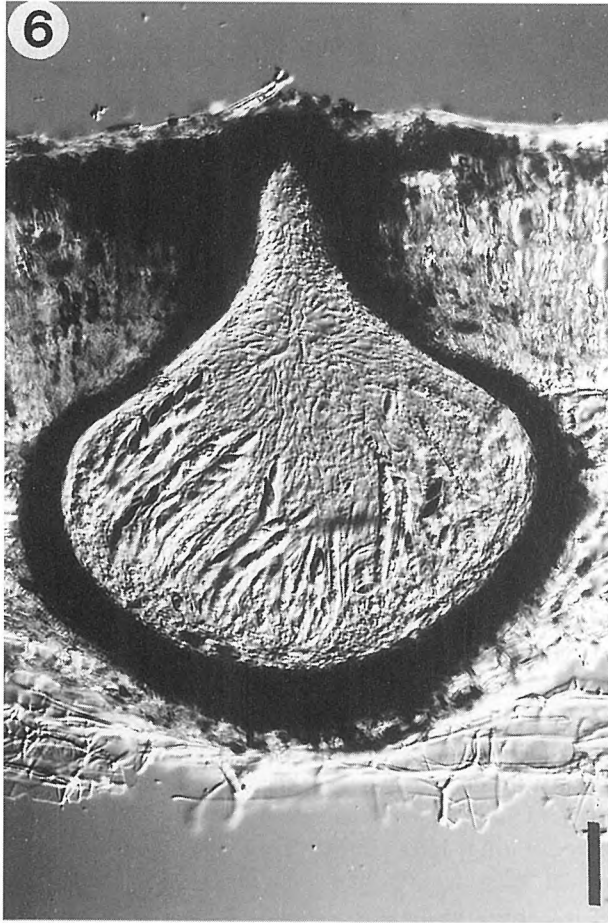
**Holotypus:** J. K. 5524 (IMS); **Isotypus:** J. K. 5524 (UME).

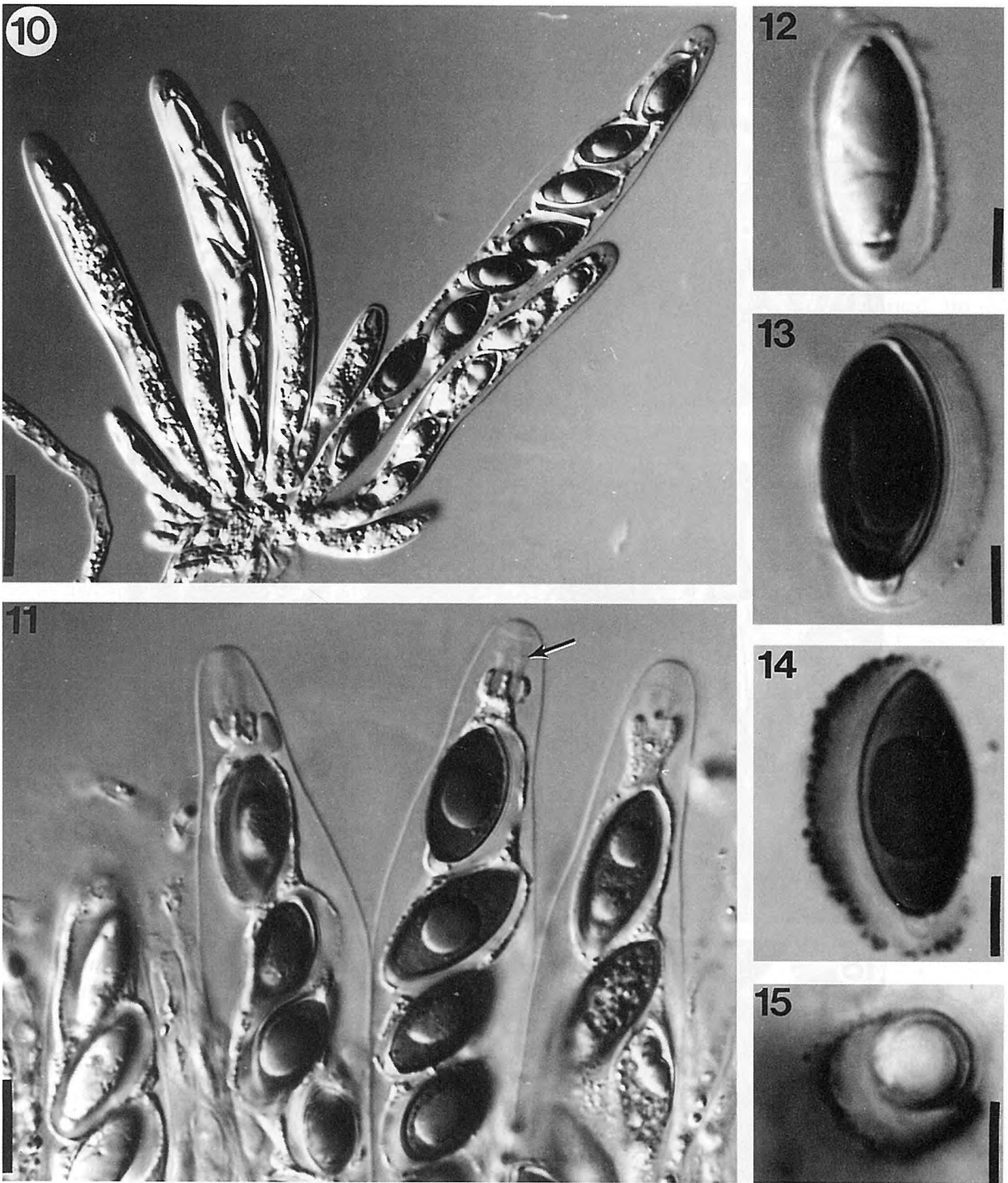
Ascomata 240–350  $\mu\text{m}$  high, 320–430  $\mu\text{m}$  in diam., subglobose, immersed in the soft tissue under the outer crust-like tissue of the culm, ostiolate, coriaceous, dark brown, with a small black clypeus around the tip of the neck, single (Fig. 6). Neck ca. 110  $\mu\text{m}$  long, 110–135  $\mu\text{m}$  in diam., conical to cylindrical, piercing the epidermis and cuticle, periphyses in a gelatinous matrix; the periphyses continue downwards as periphysoids in the epihymenial cupola (Fig. 9). Peridium 23.5–27.5  $\mu\text{m}$  thick, composed of 5–6 layers of large, thin-walled brown cells with large lumina, merging towards the locule into hyaline pseudoparenchymatous cells, forming a *textura angularis* (Fig. 8). Hamathecium composed of more or less branched paraphyses, 2–4  $\mu\text{m}$  in diam., around the asci and along the inner peridium, arising from the hyaline, thin-walled pseudoparenchyma. Asci 105–125  $\times$  9.5–12.5  $\mu\text{m}$ , eight-spored, fusiform, thin-walled, unitunicate, with an apical ring which appears to project into the lumen of the ascus, blueing in IKI, with a short stalk, maturing successively at the bottom of the locule (Figs 7, 10, 11). Ascospores 15.9–18.8  $\times$  6.6–8.1  $\mu\text{m}$  ( $\bar{x} = 17.1 \times 7.4 \mu\text{m}$ ;  $n = 25$ ), uniseriate, ellipsoidal, two-celled, with a large brown and a small hyaline basal cell (1.2–2.2  $\mu\text{m}$  in diam.), with a gelatinous sheath which covers one lateral half of the spore, with a longitudinal germ slit in the large cell (Figs 11–15).

Figs 1–5. *Anthostomella poecila*.

Fig. 1. Longitudinal section through immature ascoma, with paraphyses and periphyses, early stage of stroma development. Fig. 2. Longitudinal section through mature ascoma, embedded in host tissue, clypeus arrowed. Fig. 3. Group of asci and paraphyses in gelatinous matrix, made visible with India ink. Fig. 4. Asci treated with IKI, showing small apical rings (arrows); ascospores in side and front view. Fig. 5. Ascospores in side view with longitudinal germ slit (arrow). Figs 1–4 from Herb. J. K. 5520; Fig. 5 J. K. 5517. Bar lines, 1 to 3 = 20  $\mu\text{m}$ , 4 = 10  $\mu\text{m}$ , 5 = 5  $\mu\text{m}$ . Figs 4 and 5 brightfield, all others Nomarski interference contrast.





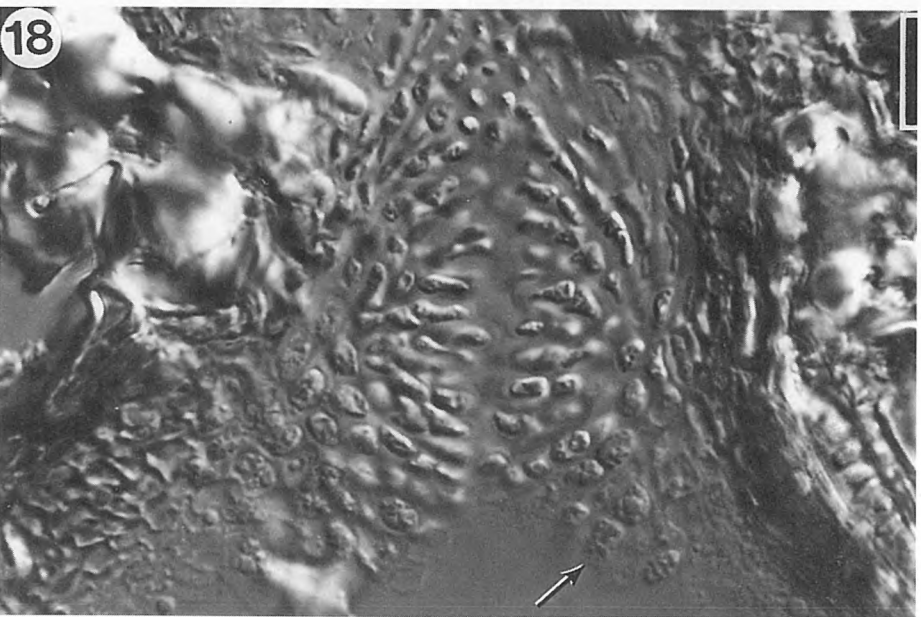
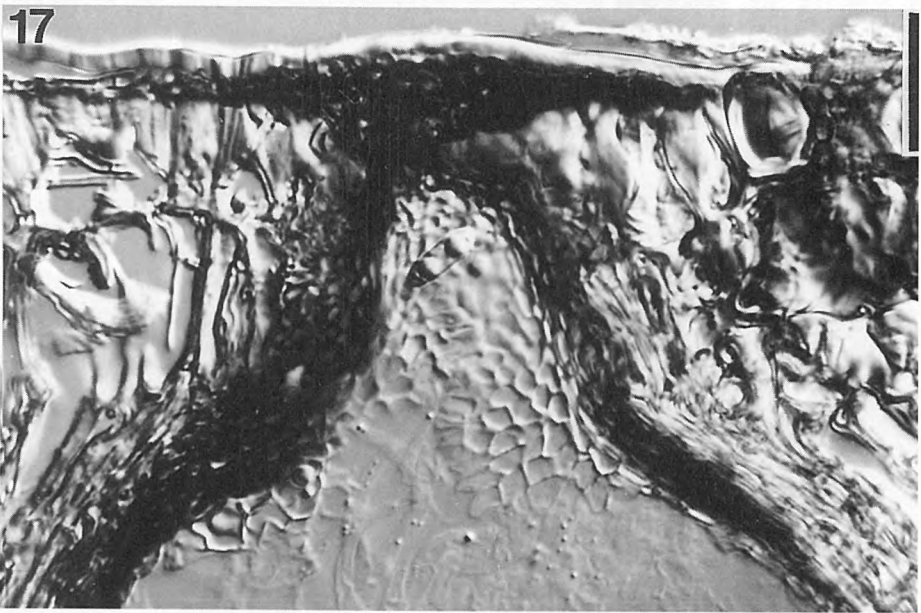
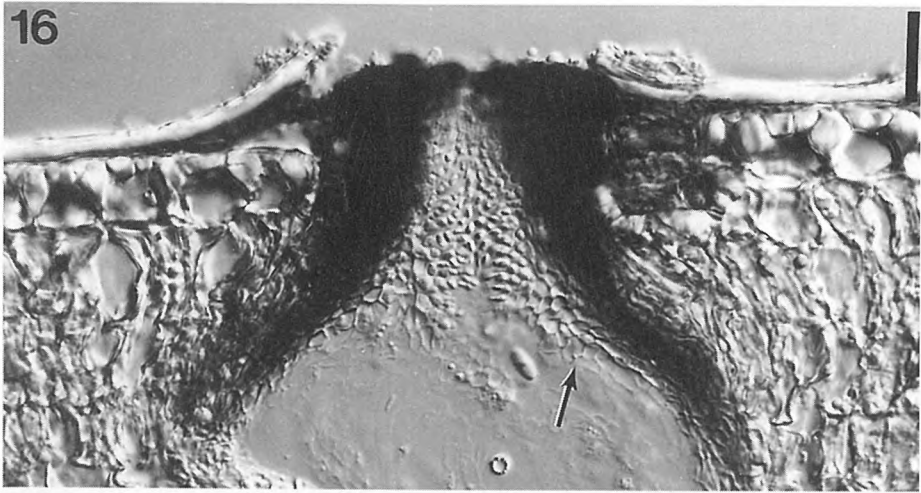


Figs 10–15. *Anthostomella semitecta*.

Fig. 10. Group of mature and immature asci. Fig. 11. Mature asci showing complex apical apparatus, ring arrowed. Fig. 12. Immature ascospore in side view, gelatinous sheath behind spore. Fig. 13. Mature ascospore in front view with gelatinous sheath covering right half. Fig. 14. Mature ascospore in India ink, clearly showing gelatinous sheath on left. Fig. 15. Ascospore in India ink, apical view, showing position of gelatinous sheath. Figs 10–15 from Herb. J. K. 5509. Bar lines, 10 = 20  $\mu\text{m}$ , 11 = 10  $\mu\text{m}$ , 12–15 = 5  $\mu\text{m}$ . Figs 14 and 15 brightfield, all others in Nomarski interference contrast.

Figs 6–9. *Anthostomella semitecta*.

Fig. 6. Mature ascoma with clypeus in longitudinal section, embedded in host tissue. Fig. 7. Group of asci in various stages of development, with apical ring, blue after IKI treatment (arrows). Fig. 8. Section through peridium in base of ascoma. Fig. 9. Section through immature ascoma filled with paraphyses, periphysoids (arrow) and periphyses in upper part. Fig. 6 from Herb. J. K. 5520; Fig. 7 J. K. 5509; Figs 8 and 9 J. K. 5524. Bar lines, 6 = 50  $\mu\text{m}$ , 7 to 9 = 20  $\mu\text{m}$ . Fig. 7 brightfield, all others Nomarski interference contrast.





**Substratum:** Senescent culms of *Juncus roemerianus*.  
**Distribution:** Atlantic Coast (U. S. A.: North Carolina).  
**Material examined:** Dead standing culms of *J. roemerianus*, NC-BC: 30 Jan. 1994, J. K. 5524 (Holotype: IMS; Isotype: UME); same location: 6 Apr. 1993 (J. K. 5505, 5506), 20 June 1993 (J. K. 5509), 25 July 1993 (J. K. 5516), 8 Aug. 1993 (J. K. 5517), 13 Oct. 1993 (J. K. 5520), 28 Nov. 1993 (J. K. 5522); NC-WC: 3 Sept. 1993 (J. K. 5519); NC-OC: 14 May 1994 (J. K. 5533); NC-SC: 14 May 1994 (J. K. 5534).

So far, we have collected *A. semitecta* in January and April through November. Ascomata were found predominantly from 36 to 108 cm above the rhizome (rarely at 25 and 120 cm). The species appears to be halotolerant, but fruits mainly in the not immersed parts of the culms.

The closest species to *A. semitecta* is *A. tomicoides* Sacc., as described by Francis (1975), a species known also from *Juncus*. However, ascospores of *A. semitecta* are equilateral and have a gelatinous sheath which covers only one lateral half of the spore, whereas ascospores in *A. tomicoides* are strongly inequilateral, surrounded by a sheath which may form a thickened cap at the free end of the spore.

*Phomatospora bellaminuta* Kohlm., Volkm.-Kohlm. et O. E. Erikss., sp. nov.

**Etymology:** From the Latin, *bellus* = beautiful, and *minutus* = small, in reference to the ascospores.

Ascomata 115–125  $\mu\text{m}$  alta, 125–160  $\mu\text{m}$  diam., subglobosa ad ampulliformia, omnino immersa, ostiolata, coriacea, dilute brunnea, sub clypeo nigro parvo, singularia; collum 60–75  $\mu\text{m}$  longum, 45–70  $\mu\text{m}$  diam., cylindricum, apicaliter brunneum ad nigrum, periphysatum; peridium 14–15  $\mu\text{m}$  crassum, bistratum, cellulae strati externi texturam globulosam (vel intricatam) formantes, cellulae strati interni applanatae, texturam angularem formantes; hamathecium paraphysibus simplicibus, 1.8–2.5  $\mu\text{m}$  diam., apicaliter gradatim contractis compositum; cupola epihymenialis pseudoparenchymate hyalino impleta; asci 65–85  $\times$  4.5–6.5  $\mu\text{m}$ , octospori, cylindrici, unitunicati, leptodermi, annulo apicali refractivo, non amyloideo, fasciculum in basem loculi formantes; ascospores 10.1–12.5(–13.0)  $\times$  3.7–4.6  $\mu\text{m}$  ( $\bar{x}$  = 11.3  $\times$  4.1  $\mu\text{m}$ ;  $n$  = 67), uniseriatae, ellipsoideae, unicellulares, hyalinae, tenuiter longitudinaliter striatae, ad apices ambos calyptris gelatinosis, 4.4–5.8  $\mu\text{m}$  diam., tectis.

**Substratum:** Culmi Junci roemeriani.

**Distributio:** Littus Oceani Atlantici, America Septentrionalis (U. S. A.: North Carolina).

**Holotypus:** J. K. 5538 (IMS); **Isotypus:** J. K. 5538 (UME).

Ascomata 115–125  $\mu\text{m}$  high, 125–160  $\mu\text{m}$  in diam., subglobose to ampulliform, immersed in the outer hard tissue of the culm, ostiolate, coriaceous, light brown, with a small, flat black clypeus around the tip of the neck, separating the epidermal cells from the cuticle, single (Figs 16, 17, 19). Neck 60–75  $\mu\text{m}$  long, 45–70  $\mu\text{m}$  in diam., cylindrical, tip dark brown to black, ostiolar canal with short periphyses (Figs 16, 18). Peridium 14–15  $\mu\text{m}$  thick, two-layered, brown; the outside forming a *textura globosa* (or *intricata*), the inside composed of flattened cells, forming a *textura angularis* and merging into thin-walled, hyaline pseudoparenchymatous cells that surround the locule. Hamathecium composed of simple paraphyses, 1.8–2.5  $\mu\text{m}$  in diam., which taper into a thin tip; the epihymenial cupola is filled with a hyaline thin-walled pseudoparenchyma (Figs 16, 18). Asci 65–85  $\times$  4.5–6.5  $\mu\text{m}$ , eight-spored, cylindrical, unitunicate, thin-walled, with an apical refractive ring which does not turn blue in IKI, nor red in Congo Red, but stains blue in methylene blue; developing in a fascicle at the base of the locule (Figs 20–23). Ascospores 10.1–12.5(–13.0)  $\times$  3.7–4.6  $\mu\text{m}$  ( $\bar{x}$  = 11.3  $\times$  4.1  $\mu\text{m}$ ;  $n$  = 67), uniseriate, ellipsoidal, one-celled, hyaline, delicately longitudinally striated, with a persistent gelatinous cap, 4.4–5.8  $\mu\text{m}$  in diam., over each apex; the caps stain blue in methylene blue (Figs 21–23).

**Substratum:** Lower parts of senescent culms of *J. roemerianus*.

**Distribution:** Atlantic Coast (U. S. A.: North Carolina).

**Material examined:** Dead standing culms of *J. roemerianus*, NC-BC: 28 Nov. 1993, J. K. 5538 (Holotype: IMS; Isotype: UME); same location: 1 Apr. 1975 (J. K. 3645), 1 Aug. 1977 (J. K. 3848), 5 Feb. 1978 (J. K. 3894), 28 Feb. 1978 (J. K. 3902), 20 Dec. 1992 (J. K. 5491), 20 June 1993 (J. K. 5509), 25 July 1993 (J. K. 5516), 13 Oct. 1993 (J. K. 5520), 31 Dec. 1993 (J. K. 5523); NC-WC: 8 Mar. 1993 (J. K. 5499).

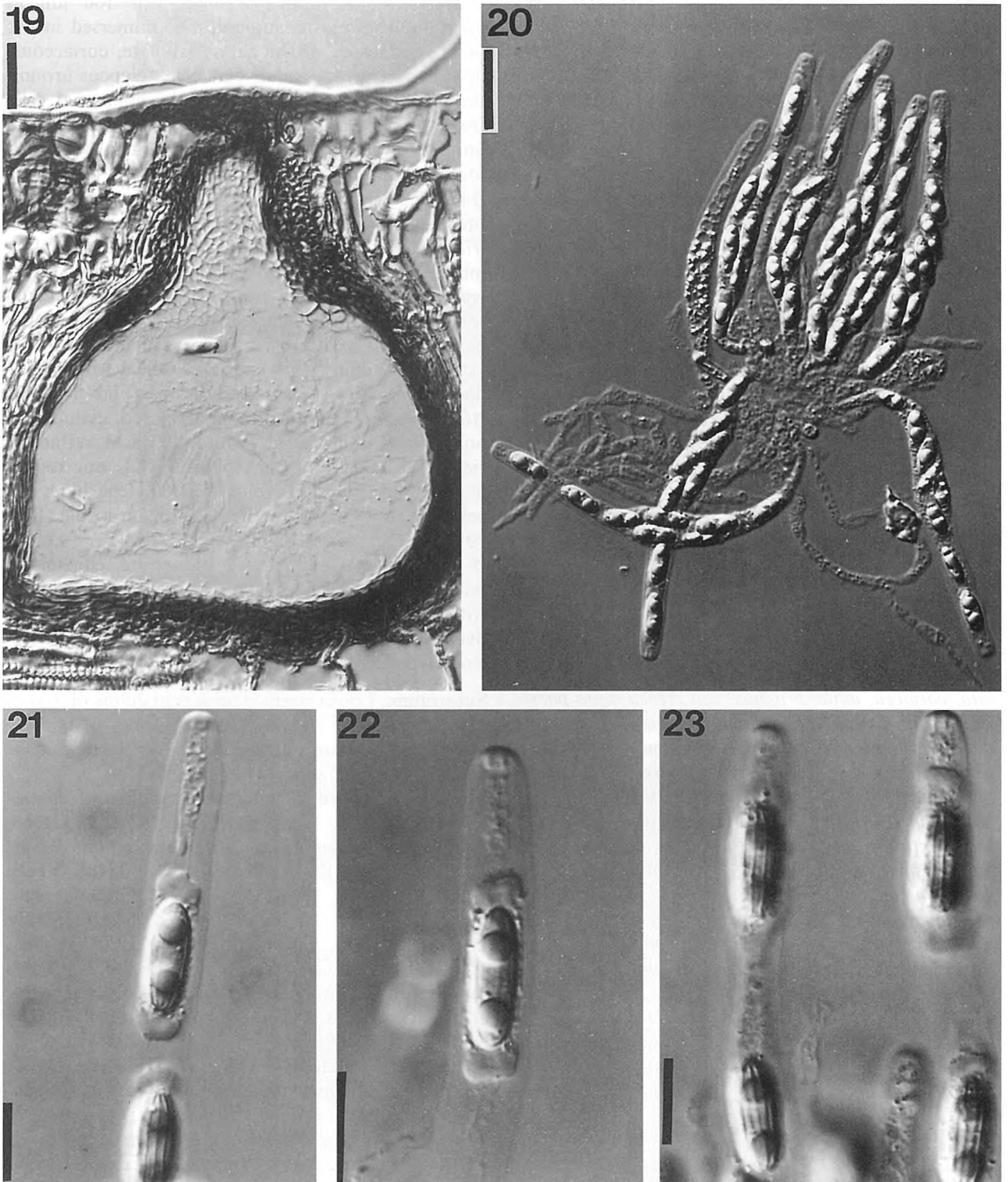
Ascomata of this species have been collected in every month of the year and occur exclusively in the lower part of the culm in the zone of epiphytic algae and barnacles, 20 to 44 cm above the rhizome. Therefore, it can be considered an obligate marine fungus.

Figs 16–18. *Phomatospora bellaminuta*.

Fig. 16. Upper part of mature ascoma in longitudinal section, showing clypeus and neck with periphyses; epihymenial cupola with hyaline pseudoparenchyma (arrow). Fig. 17. Top of ascoma in longitudinal section; flat black clypeus around tip of ostiolum under cuticle; pseudoparenchyma of the ostiolar canal. Fig. 18. Neck of young ascoma in longitudinal section showing periphyses and pseudoparenchyma in epihymenial cupola (arrow). Figs 16–18 from Herb. J. K. 5538. Bar lines, 16 and 17 = 20  $\mu\text{m}$ , 18 = 10  $\mu\text{m}$ . All in Nomarski interference contrast.

So far, we have been unable to isolate *P. bellaminuta* in pure culture, and, therefore, do not know if an anamorph is produced.

The key in Müller and v. Arx (1973) leads to *Phomatospora* Sacc., but our species appears to differ from the concept of this genus as characterized by



Figs 19–23. *Phomatospora bellaminuta*.

Fig. 19. Mature ascoma in longitudinal section, embedded in host tissue. Fig. 20. Group of mature/immature asci and paraphyses. Figs 21–23. Asci with ascospores, showing longitudinal striation and gelatinous caps; ascus tip with refractive ring. Figs 19 and 20 from Herb. J. K. 5538; Figs 21–23 J. K. 5523. Bar lines, 19 and 20 = 20  $\mu\text{m}$ , 21 to 23 = 10  $\mu\text{m}$ . All in Nomarski interference contrast.



the type species, *P. berkeleyi* Sacc. (v. Arx and Müller 1954, Eriksson 1967, Magnés and Hafellner 1991, Rappaz 1992, Scheuer 1988), by the presence of distinct clypei, long necks, a thicker peridium, broad persistent paraphyses, a thin-walled pseudoparenchyma in the epihymenial cupola, IKI-negative asci that do not stain red in Congo Red, and an obligately marine occurrence. We conclude that the species from *Juncus roemerianus* can be assigned to *Phomatospora* only if this genus is accepted *sensu lato*. Dr C. Scheuer, who kindly read a draft of the manuscript and examined *P. bellaminuta* opined that, in spite of the differences, this species should best be assigned to *Phomatospora*. *Phomatospora bellaminuta* is superficially similar to the two other marine species, *P. acrostichi* K. D. Hyde (Hyde 1988) and *P. kandeliae* K. D. Hyde (as *P. kandelae*, Hyde 1992). It differs from *P. acrostichi* mainly by larger ascospores with caps over both apices and the presence of paraphyses. Features of the ascoma have not been described in detail by Hyde (1988), except for the peridium, which is single-layered. The main difference with *P. kandeliae* is that *P. bellaminuta* has smaller ascospores ( $10.1\text{--}12.5 \times 3.7\text{--}4.6 \mu\text{m}$  versus  $11.5\text{--}16 \times 5.5\text{--}8 \mu\text{m}$ ). Barr (1994) discussed the North American species of *Phomatospora*. A check for *P. bellaminuta* in her key leads to *P. striatispora* from *Cowania* in Utah, which, however, has somewhat larger ascospores without terminal appendages.

***Physalospora citogermians*** Kohlm., Volkm.-Kohlm. et O. E. Erikss., sp. nov.

**Etymology:** From the Latin *cito* = quickly, and *germinans* = germinating, in reference to the quickly germinating ascospores, once they are submerged in fresh water.

Ascomata  $110\text{--}180 \mu\text{m}$  alta,  $115\text{--}175 \mu\text{m}$  diam., subglobosa, omnino immersa, ostiolata, collo longo, coriacea, rubrobrunnea, singularia; collum  $195\text{--}270 \mu\text{m}$  longum,  $50\text{--}65 \mu\text{m}$  diam., dilute brunneum, periphysatum (periphyses in matrice gelatinosa), saepe curvatum, apex super epidermidem projectus; peridium  $10\text{--}15 \mu\text{m}$  crassum,  $4\text{--}5$  stratis cellularum compositum, stratis externis brunneis, multiangulatis, stratis internis hyalinis ad brunneis, texturam angularem formans; hamathecium paraphysibus simplicibus, septatis,  $2\text{--}5 \mu\text{m}$  diam., inter ascos et secus peridium ordinatis, apicibus in cupola conjunctis; asci  $110\text{--}145 \times 20\text{--}26 \mu\text{m}$ , octospori, cylindrici ad clavati, breve pedunculati, pachydermi, nonfissitunicati, persistentes, annulo apicali refractivo circum apicem oculi (annulus  $4.7\text{--}5.2 \mu\text{m}$  diam.), non amyloideo, successive e textura ascogena basale exorientes; ascosporae  $24.5\text{--}32.5 \times 8.7\text{--}12.9 \mu\text{m}$  ( $\bar{x} = 27.5 \times 10.2 \mu\text{m}$ ;  $n = 60$ ), uni- ad biseriatae, ellipsoideae, unicellulares, hyalinae, tunica gelatinosa tectae, cito germinantes;  $1\text{--}5$  septatae post germinationem.

**Substratum:** Culmi *Junci roemeriani*.

**Distributio:** *Littus Oceani Atlantici, America Septentrionalis* (U. S. A.: North Carolina).

**Holotypus:** J.K. 5519 (IMS); **Isotypus:** J.K. 5519 (UME).

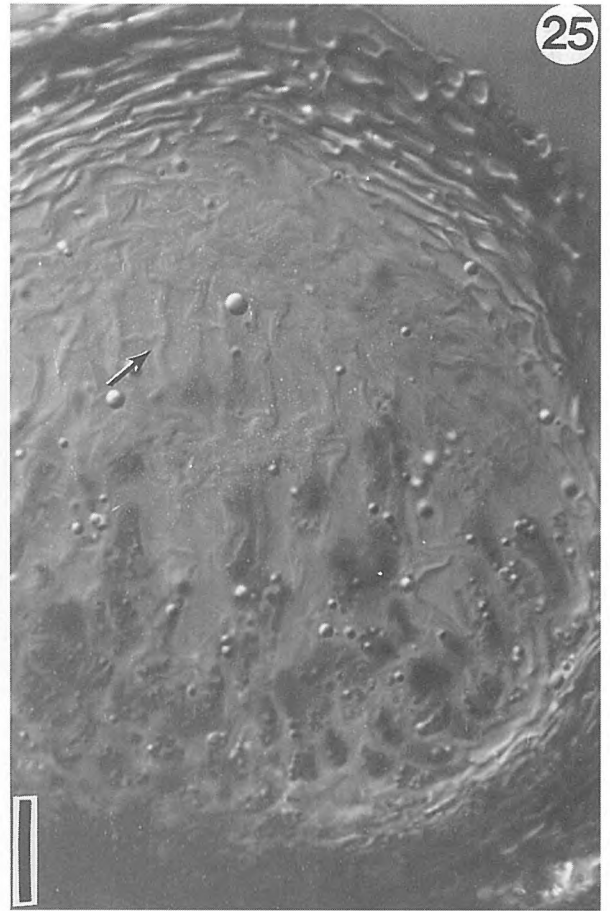
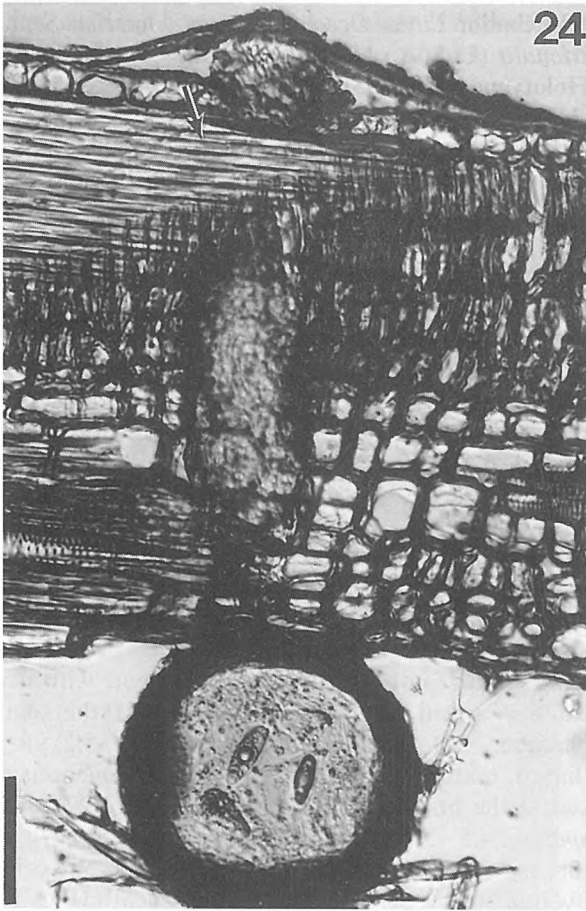
Ascomata  $110\text{--}180 \mu\text{m}$  high,  $115\text{--}175 \mu\text{m}$  in diam., subglobose, completely immersed under the hard outer tissue of the host, ostiolate, with a long neck, coriaceous, reddish brown, single (Fig. 24). Neck  $195\text{--}270 \mu\text{m}$  long,  $50\text{--}65 \mu\text{m}$  in diam., light brown, periphysate (periphyses covered with a gelatinous matrix), when growing upwards curving around heavily lignified tissues, tip slightly raised above the epidermis (Fig. 24). Peridium  $10\text{--}15 \mu\text{m}$  thick, composed of  $4\text{--}5$  layers of cells, the outer two layers brown, multiangular, the inner two layers hyaline to brown, flat, forming a *textura angularis*. Hamathecium composed of simple, septate paraphyses,  $2\text{--}5 \mu\text{m}$  in diam., between asci and surrounding them, with their tips meeting in the cupola of the ascomatal cavity (Fig. 25). Asci  $110\text{--}145 \times 20\text{--}26 \mu\text{m}$ , eight-spored, cylindrical to clavate, short pedunculate, thick-walled, not fissitunicate, persistent, with a refractive apical ring around the tip of the ocular chamber, not blueing in IKI (ring  $4.7\text{--}5.2 \mu\text{m}$  in diam.), maturing successively on the ascogenous tissue at the bottom of the locule (Figs 26, 27). Ascospores  $24.5\text{--}32.5 \times 8.7\text{--}12.9 \mu\text{m}$  ( $\bar{x} = 27.5 \times 10.2 \mu\text{m}$ ;  $n = 60$ ), one- to biseriatae, ellipsoidal, one-celled, hyaline, with a persistent gelatinous sheath (Figs 27–29); ascospores stain blue in methylene blue and cotton blue, the sheath stains only faintly; when placed in distilled water, the ascospores germinate within  $\frac{1}{2}$  hour, even those enclosed in asci. Upon germination the ascospores form 1 to 5 thin septa (Fig. 30), however, mature ascospores enclosed in ascomata are always non-septate. The species fruits in pure culture on freshwater agar. Senescent ascomata from culture contain three-to-five septate ascospores.

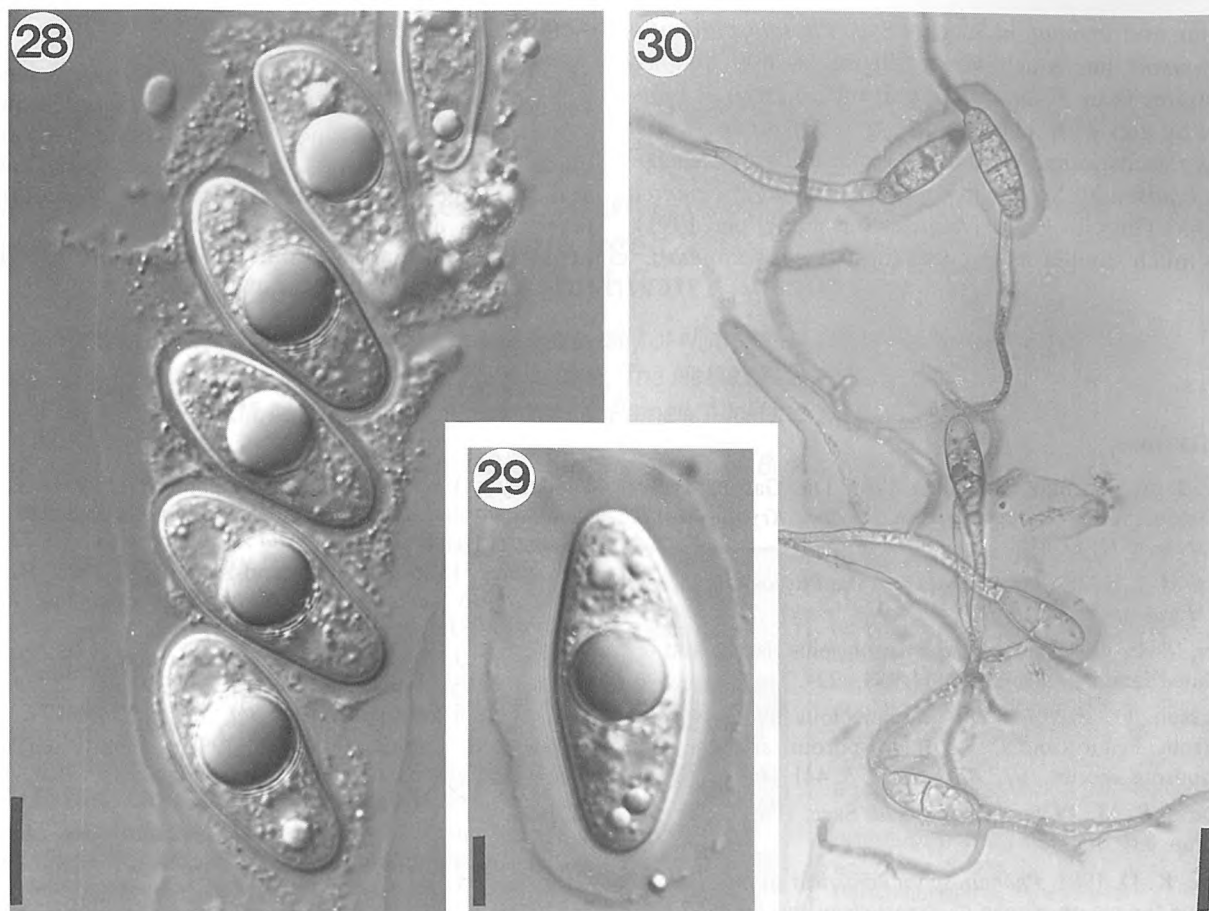
**Substratum:** Lower and upper parts of senescent culms of *J. roemerianus*.

**Distribution:** Atlantic Coast (U. S. A.: North Carolina).

**Material examined:** Dead standing culms of *J. roemerianus*, NC-WC: 3 Sept. 1993, J.K. 5519 (Holotype: IMS; Isotype: UME; also fruiting pure culture); same location, 8 Mar. 1993 (J.K. 5499), 29 Apr. 1993 (5507), 16 Mar. 1994 (J.K. 5528); NC-B: 19 Nov. 1992 (J.K. 5487); NC-S: 21 Sept. 1966 (J.K. 1981), 12 Oct. 1975 (J.K. 3681); NC-BC: 20 Dec. 1992 (J.K. 5491), 6 Apr. 1993 (J.K. 5505), 20 June 1993 (J.K. 5509), 25 July 1993 (J.K. 5516), 8 Aug. 1993 (J.K. 5517), 13 Oct. 1993 (J.K. 5520), 28 Nov. 1993 (J.K. 5522), 31 Dec. 1993 (J.K. 5523), 30 Jan. 1994 (J.K. 5524), 5 Apr. 1994 (J.K. 5530); NC-OC: 14 May 1994 (J.K. 5533); NC-SC: 14 May 1994 (J.K. 5534).

Like *Anthostomella poecila*, *Physalospora citogermians* is among the most common species on old culms of *J. roemerianus*. It occurs in North Carolina in every month of the year. Its vertical distribution is





Figs 28–30. *Physalospora citogerminans*.

Fig. 28. Ascospores in ascus, gelatinous sheath narrow. Fig. 29. Ascospore with gelatinous sheath swollen in water. Fig. 30. Ascospores germinating in water forming one, two and three septa, sheath slightly stained in methylene blue. Figs 28 and 29 from Herb. J.K. 5517; Fig. 30 J.K. 5519. Bar lines, 28 = 10  $\mu\text{m}$ , 29 = 5  $\mu\text{m}$ , 30 = 20  $\mu\text{m}$ . Fig. 30 brightfield, others Nomarski interference contrast.

from 20 to 100 cm above the rhizome although it was found occasionally even down to 10 cm, thus, fruiting in parts of the culm that are periodically covered by saltwater, as well as in upper areas, subjected to desiccation and rain. It fruits in laboratory culture on salt-free agar. We consider *P. citogerminans* a facultative marine fungus.

The new species appears to be best placed in *Physalospora*, although the thin-walled ascomata of *P. citogerminans* are deeply immersed in the substrate and connected with the surface by a long cylindrical neck. Barr (1976) depicts ascomata of *Physalospora* as being seated directly under the surface or breaking through, and also v. Arx and Müller (1954) charac-

terize ascomata as ‘... brechen mit einer papillen- oder kegelförmigen, kahlen oder mit Borsten besetzten Mündung hervor.’ The type species, *P. alpestris* Niessl, differs from our species by papillate or apapillate ascomata and yellowish-greenish ascospores. No mention is made by v. Arx and Müller (1954), Scheuer (1988) and Nograsedk (1990) that the spores of *Physalospora* species become three-septate upon germination. Another, superficially similar species, *P. vaccinii* (Shear) Arx et E. Müll. on *Vaccinium* spp. has setae around the ostiole, much larger ascomata and asci, and brownish ascospores with larger diameter. Two *Physalospora* species have been described from *Juncus* spp., i. e., *P. antarctica* P.

Figs 24–27. *Physalospora citogerminans*.

Fig. 24. Mature ascoma in longitudinal section, immersed under hard outer host tissue, with long neck curving around lignified tissue (arrow); epidermis raised by tip of neck. Fig. 25. Immature ascoma in longitudinal section showing paraphyses (arrow) and ascogenous tissue (stained in methylene blue). Fig. 26. Asci, upper part with refractive apical ring. Fig. 27. Ascus with germinating (arrow) ascospores. Figs 24–27 from Herb. J.K. 5519. Bar lines, 24 = 50  $\mu\text{m}$ , 25–27 = 10  $\mu\text{m}$ . Fig. 24 brightfield, all others Nomarski interference contrast.



Henn. and *P. moutoni* Sacc. et Syd. *Physalospora citogerminans* has much larger ascomata, asci and ascospores than *P. antarctica* and differs from *P. moutoni* by asci with a short stalk, and ellipsoidal, much larger ascospores. A freshwater species from *Eleocharis*, *Equisetum*, *Schoenoplectus* and *Typha*, *P. aquatica* Ingold (Ingold 1955, Magnes and Hafellner 1991), has much smaller ascospores than *P. citogerminans*.

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