indistinct scar at the base. As noted by Iturriaga & Korf (1997), ascus width can be quite variable in this species, e.g., 18–25(–30) µm in those from Macaronesia, but in the other collections studied it is 12–19 µm.

Nomenclatural notes.— Saccardo (1873) gave the asci of *Cenangium rosae* as 70 × 20 µm, 8-spored, ascospores 28 × 10 µm, one-celled, hyaline, brown with age. The illustrations in Saccardo (1873) seem to confirm that the spores are relatively broad for *P. rubi*, where the average L/W is 3.3–3.7. One of the two specimens in PAD, '*Cenangium rosae*, *Pezicula*, *Rosa canina*', contains no apothecia. Seaver (1951) only saw a specimen of Brenckle, Fungi Dakot. 392 (sub '*P. rosae* Sacc.'). For the present study, two other specimens of Fungi Dakot. 392 were available (L, CUP). The apothecia occur singly or in small clusters, are very dark brown, and the asci are rather variable in shape, as are the ascospores due to disturbed development. I agree with Groves (1939) that this material is different from *P. rubi*. The conidia at the base of the apothecia in this material lack the pointed tips typical of *C. phaeosora*, the anamorph of *P. rubi*, and suggest a closer relation to species such as *P. hamamelidis* or *P. corni* (or *P. subcarnea*), which have been confused with *P. rubi* in the past. *Pezicula rubi* occurs on *Rosa* in Europe. Whether the type of *C. rosae* Sacc. is conspecific with the American fungus from *Rosa*, remains to be ascertained (see also under *P. rosae*).

Berkeley's description of *Peziza* subgen. *Dasyscypha rhabarbarina* does not disagree with *P. rubi*, but no measurements of asci or ascospores were given.

23. Pezicula sepium (Desm.) Dennis — Fig. 34.

Peziza sepium Desm., Ann. Sci. Nat., Bot., Sér. 3, 14: 111. 1850 ≡ *Helotium sepium* (Desm.) Sacc., Syll. Fung. 8: 229. 1889 ≡ *Pachydisca sepium* (Desm.) Boud., Hist. Classif. Discom. Europ.: 93. 1907 ≡ *Pezicula sepium* (Desm.) Dennis, Persoonia 3: 65. 1964.
Type.— S. loc., dat., coll., 'en hiver, sur les branches et les rameaux secs du *Mespilus Oxyacantha*', distributed in Desmazières, Cryptog. France 2006 (PC, holotype).

Tympanis crataegi Lasch, Bot. Zeitg. 19: 295. 1861 ≡ *Pezicula crataegi* (Lasch) Fuckel, Jahrb. Nassauischen Vereins Naturk. 27-28: 56. 1873 ≡ *Ocellaria aurantiaca* var. *crataegi* (Lasch) Rehm, *in* Rabenhorst, Kryptog.-Fl. 1, 3: 135, 1251. 1888, 1896 ≡ *Dermatea crataegi* (Lasch) Jaap, Abh. Bot. Vereins Prov. Brandenburg 52: 127. 1910.

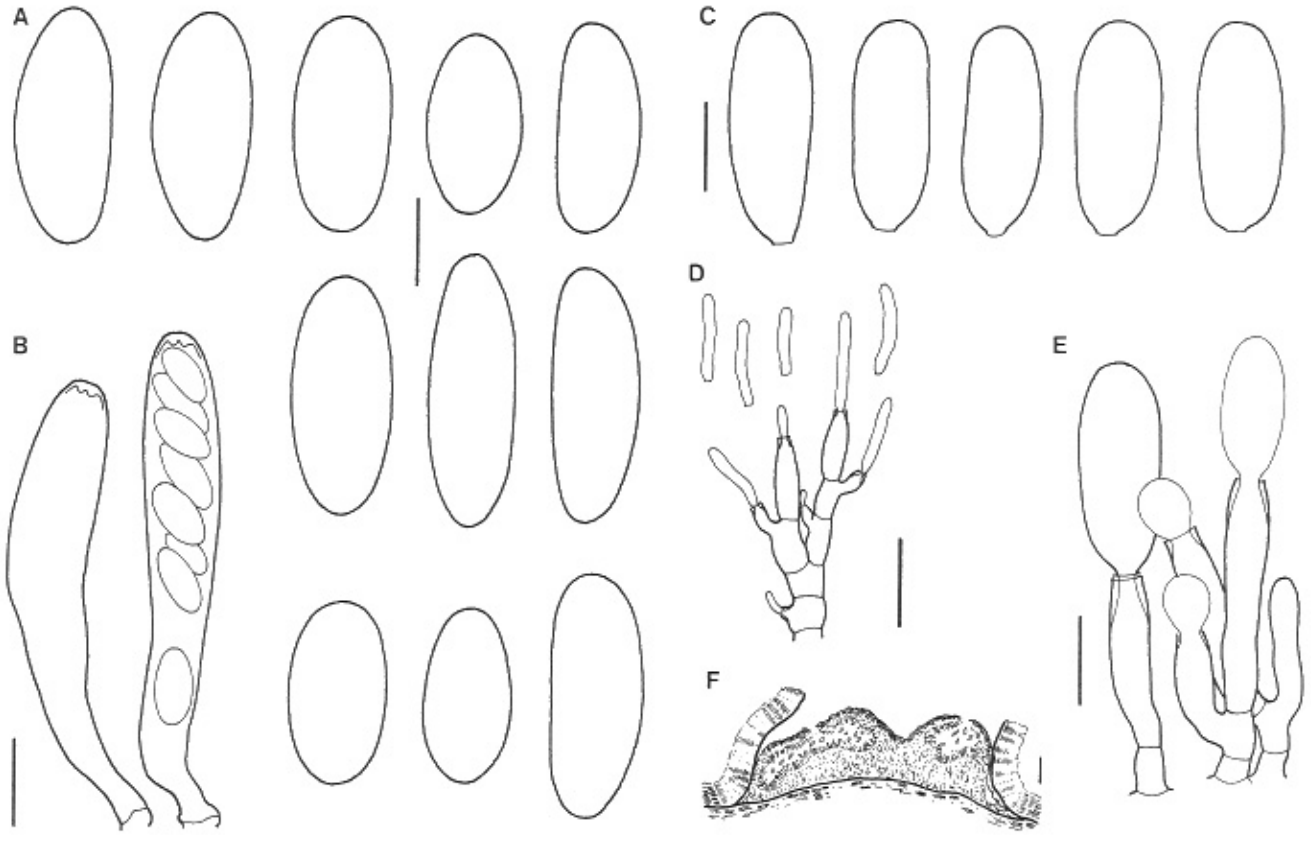

Fig. 34. *Pezicula sepium*, *in vivo*.— **A, B.** Teleomorph (holotype of *P. sepium*, PC). A. Ascospores (NT; scale bar = 10 µm). B. Asci (NT; scale bar = 25 µm). **C–F.** Anamorph (CUP-G 1616). C. Macroconidia (NT; scale bar = 10 µm). D. Microconidia and microconidiogenous cells (scale bar = 10 µm). E. Macroconidiogenous cells (scale bar = 10 µm). F. Diagrammatic section of conidioma (scale bar = 200 µm).

Type.— GERMANY: Near Driesen, on branches of *Crataegus* sp., Lasch s.n., distributed in Rabenh., Fungi europ. 353 (B, holotype; UPS, CBS, L, isotypes).

Dermatea houghtonii W. Phillips, *in* W. Phillips & C. B. Plowright, Grevillea 6: 24. 1877 ≡ *Dermatella houghtonii* (W. Phillips) Sacc., Syll. Fung. 8: 492. 1889 ≡ *Scleroderris houghtonii* (W. Phillips) Massee, Brit. Fung. Fl. 4: 124. 1895 ≡ *Pezicula houghtonii* (W. Phillips) J. W. Groves, Mycologia 38: 417. 1946.
Type.— UNITED KINGDOM: Shropshire, Lilleshall, on *Prunus lusitanica*, W. Houghton s.n., 'Autumn', Phillips, Elvellacei Britannici 144 (K (M) 49295, holotype, on original label '*Dermatea houghtonii*, n.s.'; sub '*P. haughtonii*').

Pezicula gamensis Kirschst., Ann. Mycol. 36: 372. 1938.
Type.— GERMANY: Gamensee, Oberbarnim, on dead stems of *Crataegus oxyacantha*, W. Kirschstein s.n., 26.III.1916 (B, holotype).

Anamorph.— *Cryptosporiopsis* sp.

The name *Cryptosporiopsis pyri* (Fuckel) Petr. (= *Phacidiopycnis pyri* (Fuckel) Weindlm. *fide* Sutton, 1977) has been applied for the anamorph by some authors (see *C. pyri* in Excluded names).

Description *in vivo*.— **Apothecia** weakly erumpent, solitary or 2–5 on a basal stroma, sessile or subsessile. **Disc** circular to elliptical, at first plane, then more or less convex, minutely pruinose, dark brown and 0.4–1.0 mm diam when dry, yellow to ochreous with a greenish or olivaceous haze and up to 1.4 mm diam when moist. **Receptacle** dark ochreous or olivaceous-brown, pulverulent due to darker warts; margin entire, pruinose to pulverulent, with a stout, at first slightly raised rim, mostly persistent.

Basal stroma immersed, the upper part dark orange-brown, hyaline in the lower part, consisting of angular cells with pale yellowish to orange-brown walls up to 2.5 µm thick, locally with dark brown intercellular deposits, but the walls of lower cells hyaline. **Medullary excipulum** pale to deep orange-brown, consisting of vertical rows of isodiametric to prismatic cells 7–12 × 5–8 µm, with orange-brown, up to 1.5 µm thick walls. **Ectal excipulum** deep orange-brown or olivaceous-brown, composed of isodiametric cells 8–15 µm diam, the surface of the receptacle roughened by scattered clumps of isodiametric cells with orange-brown up to 1.5 µm thick walls containing fine darker deposits. golden-yellow to pale orange-brown, consisting of closely interwoven hyphae with hyaline walls and granular and yellowish brown contents, the hyphae difficult to separate in water mounts.

Asci clavate or cylindrical–clavate, the apex truncate–rounded, narrowed gradually into a short stalk, 130–165 × 15–23 µm (NT), 8-spored, but occasionally 1–4 ascospores aborted; the apical apparatus IKI+, blue in herbarium material, Mlz+ or –. **Ascospores** inequilateral, ovoid, broadly ellipsoid to ellipsoid (average L/W 2.0–2.2(–2.7)), straight, rarely curved, ends rounded, rarely one end somewhat pointed, 0-septate, the walls hyaline and thickened up to 0.4 µm; 18–34.5 × 7.5–14, range of averages 21.5–29.8 × 9.8–11.8 µm (S = 4; N = 63; NT); later 1–3-septate, rarely muriform, with yellowish brown walls. **Paraphyses** filiform, septate, obtuse, simple or branched, 1–2 µm wide, hyaline; the apical cells irregularly swollen up to 5 µm, with pale yellow to olivaceous, smooth walls, glued together by a yellowish extracellular matrix, forming an olivaceous or yellowish 'epithecium'.

Conidiomata eustromatic, developing from deep within the outer bark layers, circular or irregular, opening the bark by irregular cracks to expose the dark olivaceous to almost black upper wall, with a single or several irregular cavities, 0.3–1.0(–2.0) mm diam, conidia oozing out in whitish masses from one or more openings, often producing macro- and microconidia. **Conidiomatal wall** olivaceous-brown in the upper, pale yellow in the lower part, composed of angular to globose cells 5–12 µm diam with up to 1.5 µm thick walls and olivaceous-brown intercellular deposits, in the lower part of angular to almost hyphal cells running in upward direction, with hyaline or pale yellowish walls up to 2 µm thick.

Macroconidiogenous cells discrete or integrated in simple, rarely branched, 1–2-septate, hyaline, sometimes acropleurogenous conidiophores, 17–25(–30) × 3.5–5.5 µm; indeterminate, percurrently proliferating 1–3 times, scars close and indistinct; cylindrical, hyaline, 10–20 × 4–6.5 µm. **Macroconidia** elongated ellipsoid, straight or slightly curved, broadly rounded at the top, with a slightly protruding scar at the base, 0-septate, thin-walled and hyaline when liberated; 20–32.5 × 7.5–11.5 µm, range of averages 24.8–26.3 × 8.7–9.4 µm (S = 2; N = 33; NT); later 1–3-septate, the walls pale brown and slightly thickened. **Microconidiogenous cells** integrated separately in simple or branched, septate, acropleurogenous conidiophores, 20–35(–50) × 2.5–4 µm; determinate, phialidic, periclinal thickening minute; cylindrical, hyaline, terminal cells 7–12 × 2.5–3.5 µm. **Microconidia** filiform, rounded at the apex, truncate at the base, hyaline, 6–11.5 × 1 µm (NT), with minutely granular contents.

No cultures were available for study. A collection from Michigan with conidiomata and rather immature apothecia of *P. sepium* (J. W. Groves 567) was used by Groves to inoculate sterilized *Crataegus* twigs. Unfor-

tunately, the dried cultures only contain sterile stromata, and no living cultures have been preserved.

Substrata.— On recently dead bark of woody *Rosaceae*, *Crataegus*, *Prunus*, and also on *Malus* and *Pyrus*, where it has been observed in association with bark canker (Netherlands).

Distribution.— Known from Europe, Macaronesia, and Ontario and Michigan.

Selected illustrations.— Boerema & Gremmen (1959): Fig. 3 [as *P. corticola*].— Dennis (1964): p. 63, Fig. 45. 1964.

Additional specimens examined.— **CANADA.** Ontario: S of Rideau River, on *Crataegus* sp., J. W. Groves 567, 25.XI.1937 (DAOM 5005, sub *P. olivascens*), also dried cultures on *Crataegus* from ascospores (DAOM 220880, 142307), and conidia (DAOM 150098); 'K.N.P.', on *Rosa* sp. (?), M. Corlett s.n., 7.VII.1978 (DAOM 170032, sub *P. brenckleana*). **U.S.A.** Michigan: Cross Village, on *Crataegus* sp., J. W. Groves 891, 16.VI.1948 (DAOM 142359, sub *P. crataegi*).
CANARY ISLANDS. Tenerife, Monte de las Mercedes, on *Prunus lusitanica*, R. P. Korf *et al.*, 5.I.1976 (CUP-MM 106, sub *P. houghtonii*).
AUSTRIA. Wienerwald near Preßbaum, on *Pyrus communis*, C. Keißler s.n., 'May', distributed in Krypt. exs. 2650 (L, sub *Discosporium pyri*). **NETHERLANDS.** Prov. Gelderland, Beusichem, on dead bark of *Pyrus communis* ('Louise Bonne d'Avranches'), J. Gremmen 1595, 6.III.1959 (CUP-G 1618; also PD, sub *P. corticola*); same loc., substr., date, J. Gremmen 1596 (CUP-G 1616, anamorph, sub *P. corticola*); Prov. Gelderland, Lienden, on dead bark of *Malus pumila* ('Jonathan'), J. Gremmen 1589, 19.II.1959 (CUP-G 1617, anamorph only, sub *P. corticola*); prov. Zuid-Holland, Barendrecht, on branch of *Pyrus communis* ('Oomskinderpeer'), G. H. Boerema & J. Gremmen 1597, 4.VI.1958 (CUP-G 1615, anamorph only, sub *P. corticola*). **SWEDEN.** Västergötland, Göteborg, on *Crataegus* sp., T. Nathorst-Windahl s.n., 26.XI.1941, distributed in Fungi exs. suec. 3436 (UPS; DAOM 109198, ex UPS, Fl. Suec. 826, sub *P. crataegi*). **UNITED KINGDOM.** England, Ipsley near Redditch, on *Crataegus* sp., M. C. Clark s.n., 2.III.1969 (DAOM 127276, sub *P. crataegi*); Yorkshire, Pickering, on *Crataegus* sp., W. G. Bromley 463/92, 27.XI.1963 (DAOM 142390).

Additional dried cultures examined.— J. W. Groves 508, on *Crataegus*, from ascospores (DAOM 142314) and conidia (DAOM 142317).

Discussion.— The problems of delimiting *Pezicula* species from woody *Rosaceae* are comparable to those in the *P. cinnamomea* complex, where taxa are also difficult to distinguish morphologically *in vivo*. Due to a lack of morphologically well-defined strains from *Rosaceae*, it was not possible to further characterize and delimit the species with cultural and molecular methods as was done for the *P. cinnamomea* complex in this study. The strains of *P. corticola* preserved in CBS are heterogeneous in their restriction patterns of ribosomal DNA (see p. 21), but unfortunately could not be sufficiently characterized morphologically. By comparing material and the data presented by Jørgensen (1930) and Boerema & Gremmen (1959), it becomes clear that there are two species found on cankered bark of pear and apple trees, *P. corticola* and *P. sepium*, but the pathogenecity of the latter has not been confirmed experimentally. All the relevant types and a limited number of additional specimens have been examined critically for the first time in the present study as a first step towards a better understanding of this group.

Pezicula crataegi was accepted by Wollenweber (1939), with *P. corticola* as a synonym. Johansen (1949) followed Wollenweber. Boerema & Gremmen (1959) considered *P. crataegi* and *Cenangium polygonum nomina confusa*, and possible synonyms of *P. corticola*. However, Dennis (1974) regarded *P. crataegi*, *P. crataegicola*, and *P. olivascens* as synonyms of *P. sepium*, and accepted *P. corticola* as a separate species. Having seen all the types, I accept the following species: *P. corticola*, *P. crataegicola* (syn. *P. olivascens*), and *P. sepium* (syn. *P. crataegi*, *P. gamensis*, *P. houghtonii*).

In the closely related *P. crataegicola*, only known form North America, the asci are wider (28–35 µm) and the ascospores are on average larger, although the extremes of length and width do overlap somewhat (25–39.5 µm in *P. crataegicola*). In *P. crataegicola* the surface of the receptacle is pulverulent due to scattered groups of entangling slender hyphae with dark brown amorphous material deposited on the walls.

Pezicula sepium and *P. corticola* can best be distinguished by the shape of the ascospores, ovoid to ellipsoid, average L/W 2.0–2.2(–2.7) in the former and ellipsoid (L/W 2.7–2.9) in the latter. In addition, the surface of the receptacle is roughly pulverulent in *P. sepium* and pruinose in *P. corticola*. In a dried state, the disc in *P. sepium* appears much darker than the receptacle, whereas in *P. corticola* they are almost concolorous.

In vivo the conidiomata of *P. sepium* can be strongly erumpent but even then they remain largely closed by a dark olivaceous upper wall, whereas those of *P. corticola* open in a very early stage and soon become pulvinate (acervular). Sizes of conidia overlap considerably and seem of no diagnostic value. The anamorphs of *P. sepium* and *P. corticola* still need further study, especially in culture. *P. crataegicola* is a third species occurring in North America and may have a similar anamorph, but this is unknown.

ADDITIONAL NOMENCLATURAL NOTES.— The type of *Peziza sepium* in PC contains many well-developed apothecia, less erumpent than usual for this species, while the margin and receptacle are less mealy and of about the same colour as the discs, warm orange-brown to ochreous. Anatomically the type of *P. sepium* agrees closely with most other collections seen, and thus provides the earliest name for this species.

Fuckel (1873) cited Auerswald ('in sched.') as the author of *Tympanis crataegi*, and this has been so cited later by some workers. However, the first description was published by Lasch in 1861. Wollenweber (1939) already noted that two different fungi were distributed in the exsiccate Rabenhorst, Fungi europ. 353, a species of *Tympanis* and a *Pezicula*. The description by Lasch (1861) seems to refer to the latter only. The specimens of Rabenh. Fungi Eur. 353 received from B and UPS each only contain a few apothecia of the *Pezicula*, the one in CBS only a typical *Tympanis* with pruinose, blackish erumpent apothecia seated on a common stroma, asci about 140 × 15 µm with ascospores 5–6 × 4–5 µm; Wollenweber (1939) saw an exsiccate from B containing both fungi, while Ouellette & Pirozynski (1974) cited a specimen in CUP-D under *Tympanis alnea*.

According to Jaap (1910), the ascospores in Fungi sel. exs. 413 measure 22–32 × 9–13 µm. Groves (1946) studied a specimen and mentions its resemblance with *P. crataegicola* in gross appearance but with much smaller ascospores. This information indicates that this exsiccate also is *P. sepium*.

In the original description of *Dermatea houghtonii*, no ascospore measurements were given, but Phillips (1893) reported them as 27 × 6–9 µm. The holotype contains several clusters of apothecia with poorly developed hymenia. Dennis (1974) gave no measurements of its ascospores but, according to the key, they were over 10 µm wide. He considered it closely related but distinct from *P. sepium*, as the apothecia are more strongly erumpent and lack the pulverulent margin characteristic of *P. sepium*. However, the ascospores I observed, 20–26 × 7–11 µm, fall within the range of that species, and considering the state of the type and lack of additional material, I prefer to consider *P. houghtonii* a synonym of *P. sepium*.

The hymenium in the type of *Pezicula gamensis* is almost black when dry, surrounded by a orange-brown, pulverulent margin. Most ascospores in the aged apothecia are brown, and 1–3-septate.

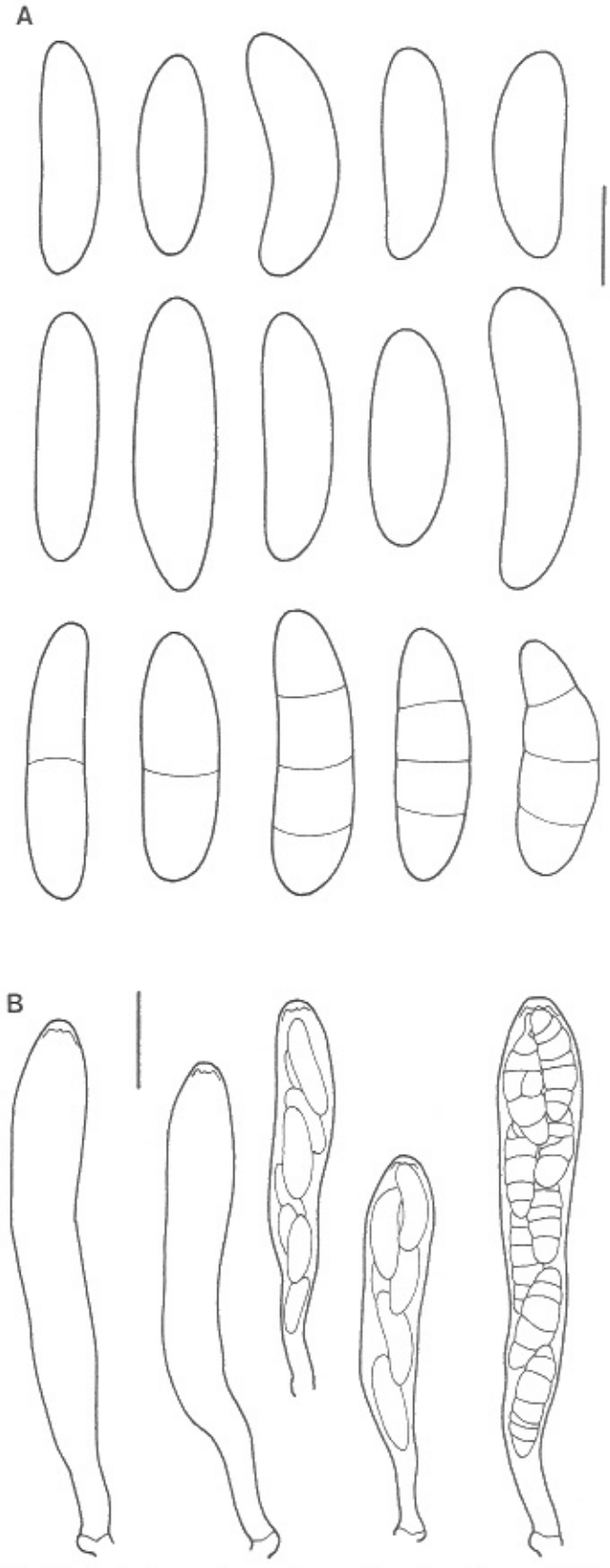

Fig. 35. *Pezicula sporulosa*, teleomorph *in vivo*, holotype (CBS, G.J.V. 369).— **A.** Ascospores (T; scale bar = 10 µm). **B.** Asci (NT; scale bar = 25 µm).

24. Pezicula sporulosa Verkley, *sp. nov.* — Figs 35, 36, 47 E–G, 50 O, P.

Type.— NETHERLANDS: Prov. Utrecht, near Auster-