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The genus *Epigloea* in Poland

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The paper presents a description, figures and locations of the species *Epigloea pleiospora*, *E. bactrospora* and *E. soleiformis*, new to Poland, found on the shores of lakes in the Tuchola Forests (Bory Tucholskie) region (NW Poland).

Key words: lichenized *Ascomycota*, symbiosis, semi-lichens, algal parasites, *Epigloea*, Tuchola Forests

INTRODUCTION

The genus *Epigloea* with the species *E. bactrospora* Zukal had been determined in Austria (Oberösterreich, Salzburg). The author of description (Zukal 1890) defined it as the lichen with gelatinous, homoiomerous thallus differing from more common and known gelatinous lichens in its algal partner. On the basis of species mentioned above, which for a long time was known from the Alps and the Czech Forest only, Zahlbruckner (1907, 1926) separated *Epigloeaceae* from *Pyrenocarpeae* family of lichens. Later Döbbeler (1984) included rich Grummann's material into *Epigloea*, with the genus described by this author as *Vorarlbergia* (Grummann 1968) and presented the diagnosis of 7 new *Epigloea* species. According to Döbbeler (1984) two or even three species of this genus remain in one location.

Epigloea has been mentioned in lichen determination keys for a long time (Lindau 1913; Poelt 1969; Poelt and Vězda 1981; Purvis et al. 1994) however there are some doubts concerning counting this genus among lichens. Grummann (1968) determed *Epigloea bactrospora* Zukal and the genus *Vorarlbergia* determined by himself as semi-lichens. Such a character of the genus is supported by observations of *Epigloea bactrospora* cultures. It appeared that alga – fungus relation in this species is not stable but changes depending on external environmental conditions. Fungus – alga interrelations are a kind of fight, where one or the other partner wins. When environmental conditions favour fruiting thalli formation, *Epigloea* becomes, in the light of observations mentioned above, algal parasite (Jaag and Thomas 1934).

MATERIAL, METHODS AND RESERCH AREA

The first species of *Epigloea* genus in Poland was found by chance during microscopic examination of gelatinous material containing pine pollen, collected in December 2000 on the Wielkie Gacno Lake, in the area of the Tuchola Forests National Park. The next year special researches of *Epigloea* fruiting bodies were undertaken on the sandy shores of the lake mentioned above and on some other water basins located on sandr, among pine forest, in the same north Poland region. Special attention was payed to gelatinous matter of overground algae. The algae samples were collected and exactly examined under microscope in the laboratory. The material containing fruiting bodies of the genus sought for was determined according to Döbbeler (1984) key and deposited in the Herbarium of the Institute of Ecology and Nature Protection, Nicholas Copernicus University in Toruń (TRN). Drawing documentation of the species found was done under microscope by the use of drawing apparatus.

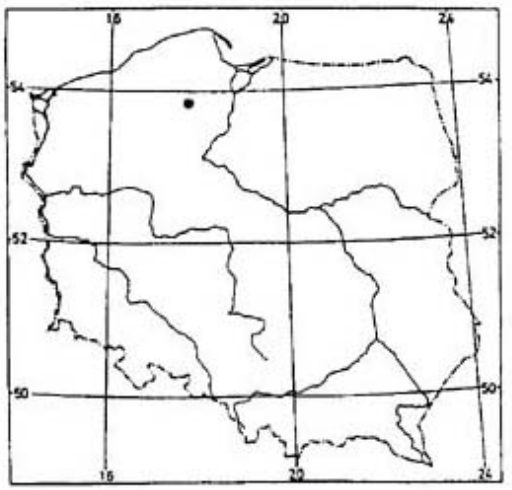

Fig. 1. Location of study area

The research area was limited to the Tuchola Forests region (Fig. 1), which is one of the most interesting in floral respects in Polish lowland. The region is characterized by occurrence of numerous lakes and peat-bogs with rare, partly relict, flora. The material examined was collected on the shores of oligotrophic lakes mainly, which *Lobelia dortmanna* and *Isoëtes lacustris*.

Location list includes (in parenthesis) their situation in Poland on maps according to ATPOL grid square system (Zając 1978).

DESCRIPTION

Epigloea thallus composed of algal and fungal cells is shiny, almost transparent, dirty–green, gelatinous mass, closely adhering substratum. During drying out it becomes viscous and then forms fragile, shiny film. The main thallus components are ± ellipsoidal algal cells, 2.5–10 (-16) x 1.2–7 µm, straight or slightly brown, surrounded by often layered, 4 (5) µm thick, gelatinous envelope (Fig. 2). The algae from *Epigloea bactrospora* culture were determined by Jaag and Thomas (1934) as *Coccomyxa epigloea*. However it is difficult to differentiate them from *Coccomyxa confluens* (Kützing) Fott cells living in colonies devoided of fungus hyphae (Ettl and Gartner 1995). Apart from cells of the main genus *Coccomyxa, Mesotenium macrococcum* and other algae cells also often occur in *Epigloea* gelatinous matter with fungus hyphae. Besides, numerous stranger bodies, like plant pollen grains or spores of other fungal species are found within them. *Epigloea* forms among algae loose net, composed of delicate hyphae connected with algal cells. Hyphae overgrow gelatinous

Fig. 2. The green alga of *Coccomyxa* with hyphae of *Epigloa pleiospora*. Scale bar - 20 μm.

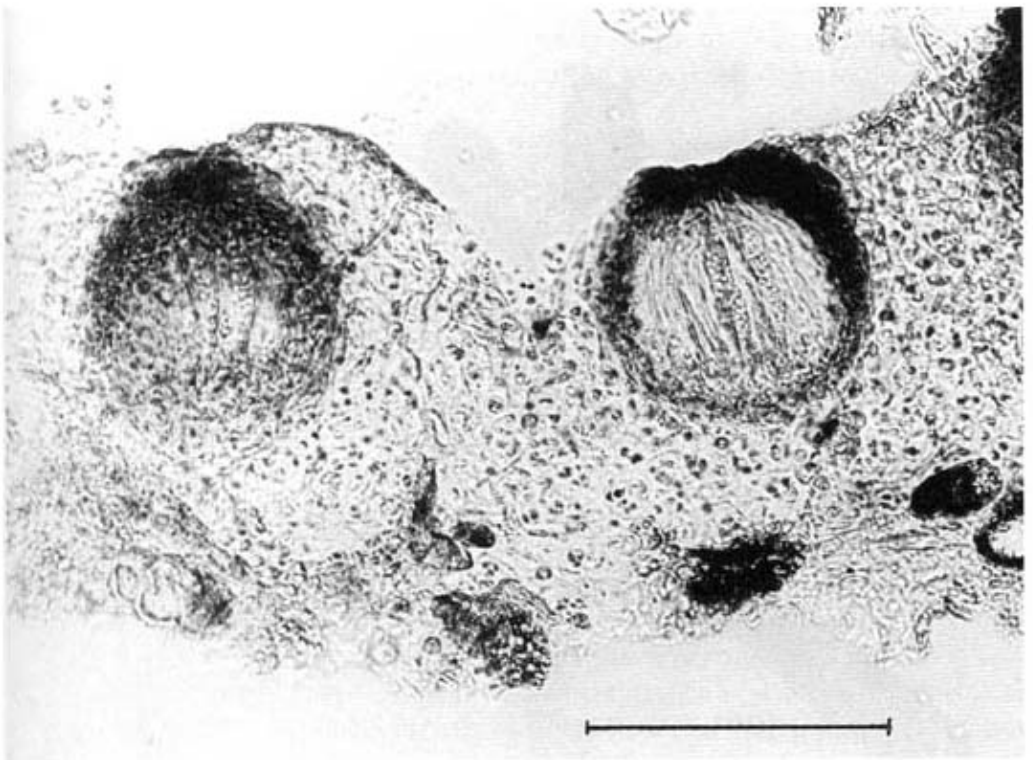

Fig. 3. Vertical section through thallus of *Epigloa pleiospora*. Scale bar - 100 μm.

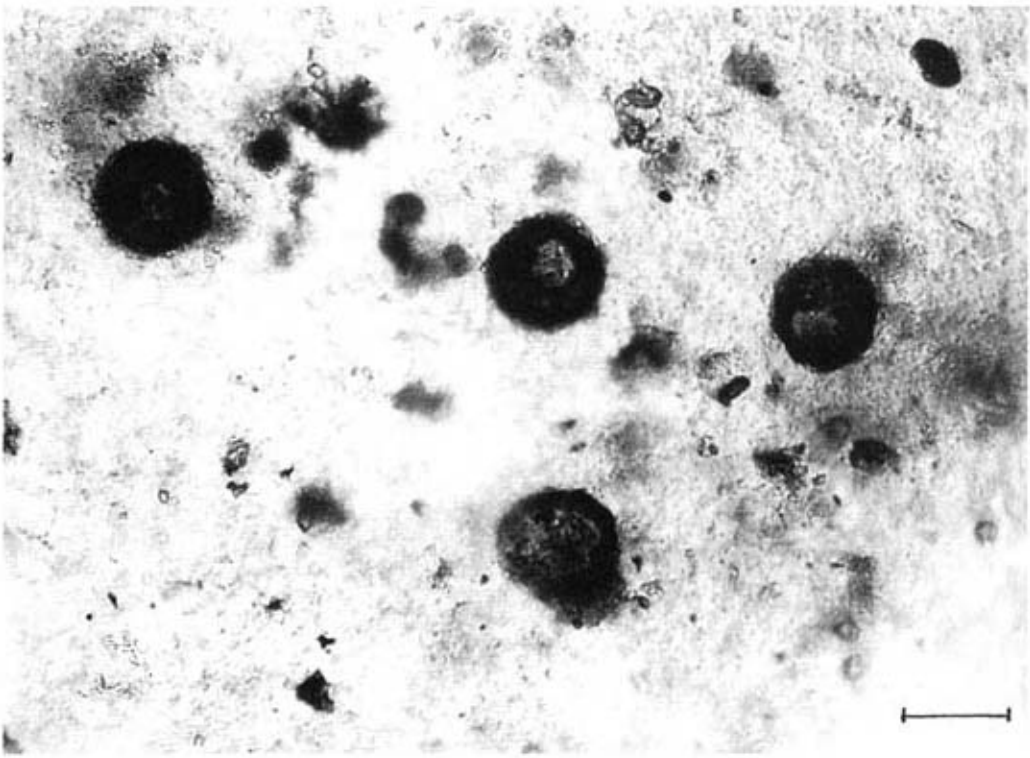

Fig. 4. Perithecia of *Epigloa pleiospora*. Scale bar - 80 μm.

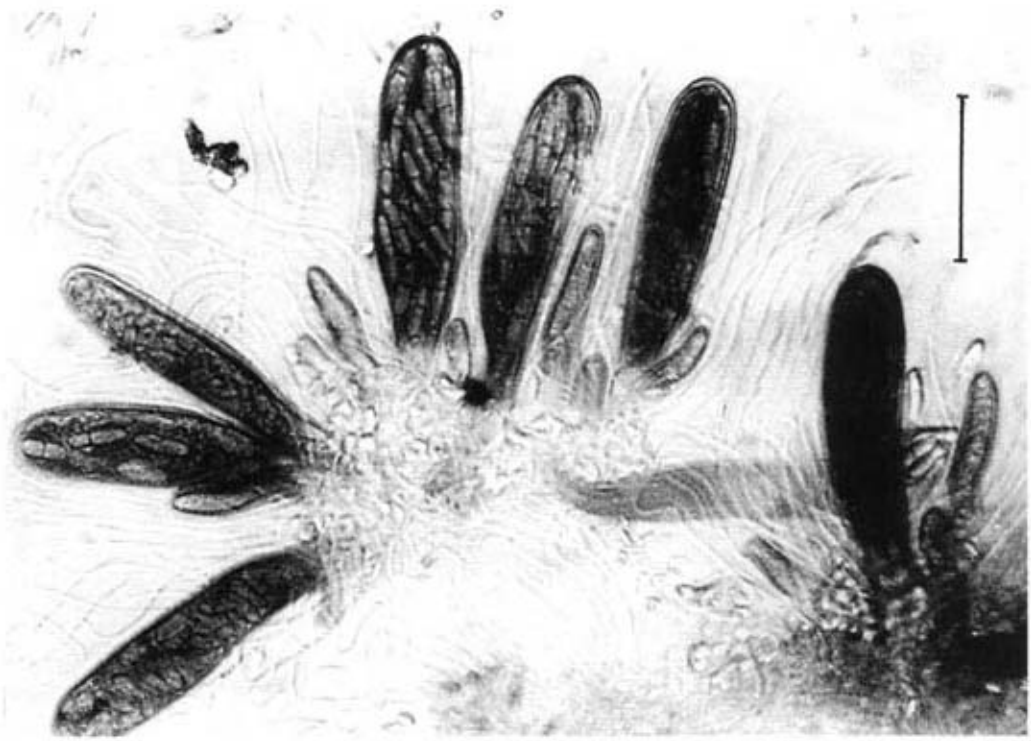

Fig. 5. Asci of *Epigloa pleiospora* (in Lugol's). Scale bar - 25 μm.

algal envelopes and dip simple, beak–like haustoria into their cells. Before penetrating cells, at the joint with gelatinous envelope, hyphae form characteristic knobs or bubble–like callosities (Figs 6d–8d). Close to them, at the hyphae endings, sometimes dividing cells occur, testifying to favourable fungus influence on algal partner development.

Epigloea ascomata occur sometimes abundantly. Their structure at young and mature stage does not differ from typical perithecia. However in old specimens ostiole, originating through looseness or unsticking of middle part of fruiting bodies, exceeds 2/3 of their diameter (Fig. 3). Perithecia are more or less globose, partly or completely immersed in thallus, soft, often green–black, thicker and darker in the upper part (Fig. 4). Their walls are devoid of algal cells. Paraphyses numerous and thin, sometimes branched at the basis, with anastomosis. Asci – unitunicate, eight- or multispored, club–shaped to cylindrical, with longitudinal chin at the apex after ascospores spilling. Ascospores – colourless and thin–walled, ovoid–ellipsoid or bar–shaped, 1- to 5–septate, in some species with an appendage at both ends (Döbbeler 1984). Pycnidia, similar to fruiting bodies, sometimes develop among perithecia, are filled with gelatinous substance with numerous, terminal conidia - bacilliform to narrowly or broadly ellipsoid.

Epigloea develops on various substrata, strongly covered with algae. It occurs in wet places, on rocks, mosses, laying trees, lichens and raw humus.

Three *Epigloea* species were found during researches in the Tuchola Forests area. They were determined, according to Döbbeler (1984), on the basis of the following characteristics:

1. Asci multispored 2

2. Asci up to 32–spored; ascospores narrowly–ellipsoid, 2–3 µm thick; perithecia generally black–green, up to 150 µm diam., often with black ring around the ostiole *E. pleiospora*

2.* Asci above 32–spored; ascospores bar–shaped, about 1.5 µm thick; perithecia brown, 115 µm diam., without black ring around the ostiole ..... *E. bactrospora*

1.*Asci 8–spored..... *E. soleiformis*

Epigloea pleiospora **Döbb.** (Figs 2-6)

Perithecia globose, 75–150 (-160) µm diam., black–green or black–blue, the wall 14–20 µm thick in the upper part, 7–10 µm at the bottom and in lateral parts. Ostiole 20–50 µm diam., often surrounded with clearly separated dark ring. Asci (40-) 45–65 (-75) x 9–12 µm, 32–spored or less. Often one perithecium contains asci with different spore number (Fig. 5). Ascospores (5.5-) 6.5–9 (-11.5) x 2–3 µm (larger in asci less than 32–spored), narrowly–ellipsoid, with one septum.

Ascomata sunk into gelatinous matter covering mosses and wet sand with pine pollen sediment (Fig.4).

The species known so far from Bavaria (Oberbayern) only.

Localities in Poland (leg. M. Ceynowa-Giełdon): 1 – on W shore of Wielkie Gacno lake, on the area of the Tuchola Forests National Park (ATPOL grid square – CB44), on *Polytrichum commune, P. strictum* and *Pohlia nutans*, more rarely on *Sphagnum* and raw humus with *Pinus sylvestris* pollen sediment, together with *Boeomyces rufus,*

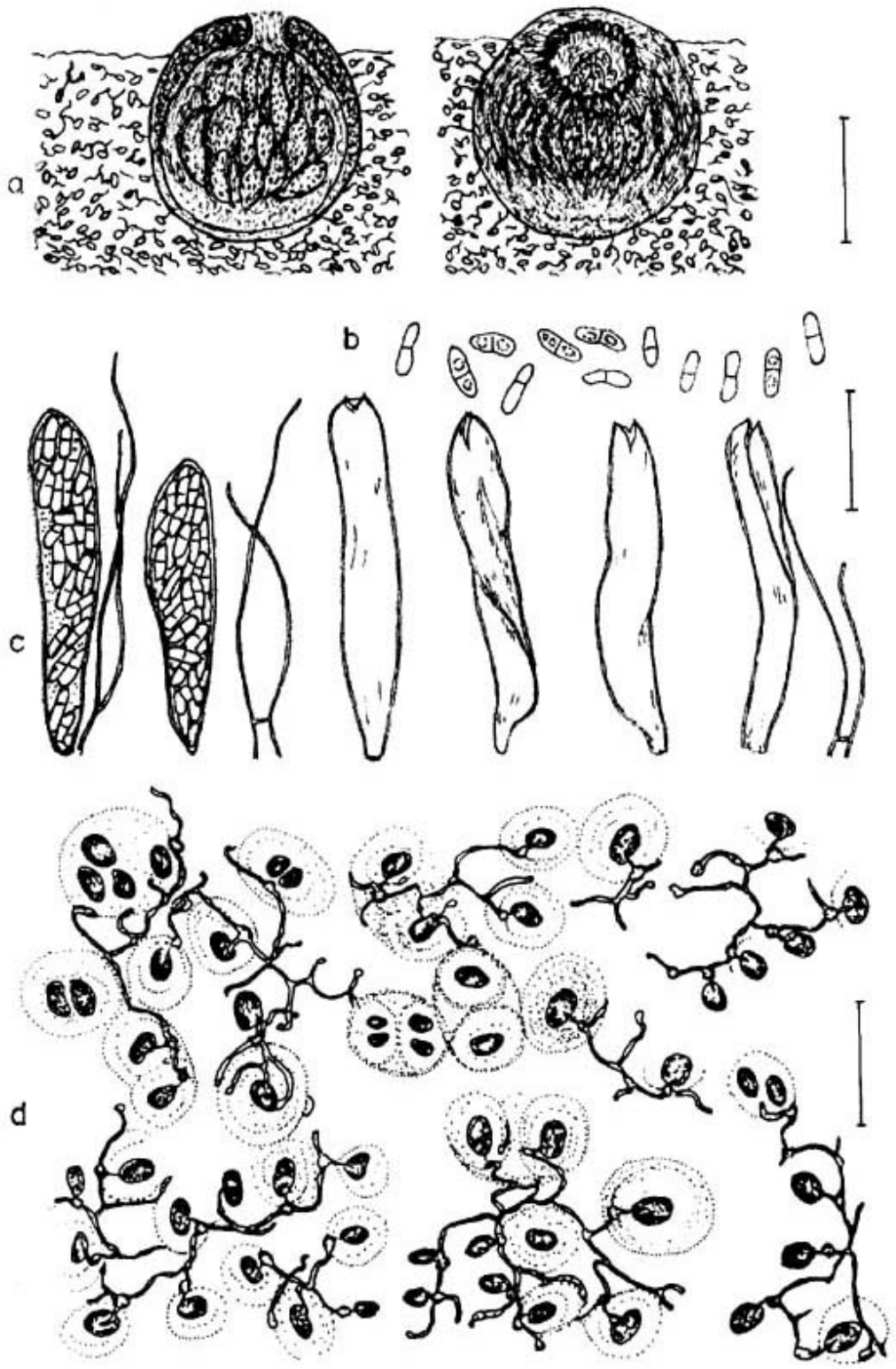

Fig. 6. *Epigloea pleiospora* Döbb. (original; locality: Tuchola Forests) a – perithecia; b – ascospores; c – asci and paraphyses (in Lugol's); d – the geen alga of *Coccomyxa*-typ and hyphae with haustoria of *Epigloea*. Scale bars: a – 50 μm; b-d – 20 μm.

Placynthiella uliginosa and *P. icmalea*, 2.12.2000; 2 – on E shore of Piecki Duże lake, near Laska village, N of city of Chojnice (CD33), on *Sphagnum* and grass remains, 14.09.2001; 3 – on felted tree emerging from Zmarte lake water, near Laska village (CD33), 14.09.2001; 4 – on E shore of Jezioro Piecki Małe lake near Laska village (CD33), on *Sphagnum* and vascular plants remains, 5.10.2001; 5 – on sandy and peaty shore of Moczadło lake, near Męcikał (CB43), 15.09.2001.

Epigloea bactrospora **Zukal** (Fig. 7)

Perithecia globose or ovate, (65-) 75–115 (-130) µm diam., pale to dark brown, with fragile, sometimes transparent walls, occasionally surrounded by colourless, up to 8 µm thick, gelatinous coat at the apex. Ostiole visible as a pale spot. Perithecium walls about 15 µm thick in the upper part, 7–10 µm at the basis and on lateral sides. Asci (30-) 40–55 (-60) x 9–12, above 32–spored. Ascospores (6-) 7–10 (-11.5) x 1.5 (-2) µm, 1–septate, bar–shaped, with rounded or narrowing ends and under extreme conditions, according to Döbbeler (1984) – spindle–shaped.

Ascomata placed on the surface or sunk into algal films on all possible substrata, e.g. dying mosses, squamules of *Cladonia* species, wood and bark of pine.

The species known until now from Germany, Austria, Italy (South Tirol) and Switzerland, mainly from the Alps, Czech Forest and Bavaria Forest, recorded at 700 – 1250 m above sea level (Grummann 1968; Döbbeler 1984).

Localities in Poland (leg. M. Ceynowa-Giełdon): 1 – on W shore of Wielkie Gacno lake, on the area of the Tuchola Forests National Park (CB44), 7.10.2001; 2 – on S shore of Głuche lake in the Tuchola Forests National Park, on dead remains of *Sphagnum* and *Polytrichum* mosses, on squamules of *Cladonia* species and *Hypogymnia physodes* thallus, together with *Botrydina* and *Absconditella sphagnorum*, 13.09.2001.

Epigloea soleiformis **Döbb.** (Fig. 8)

Perithecia globose, (70-) 90–140 (-150) µm diam., often with depression around the ostiole, black–green or black–grey, with colourless gelatinous coat 4–15 µm thick. Asci (34-) 40–55 (-60) x 8–10.5 (-12) µm, 8–spored. Ascospores (8.5-) 9.5–12.5 (-14) x 3.5–4.5 (-5) µm, 1–septate, ellipsoid, with a slight constriction in the middle.

Ascomata on, or immersed in algal films, on lichens or decomposing mosses, rarely on raw humus, rotten wood or acid rocks.

The species known till now from south Sweden (Santesson 1993), Great Britain, Germany, Austria, Italy (South Tirol), and the subantarctic Marion Island (Purvis et al. 1994). Locus classicus and the majority of these species localities known so far occur in the Alps area.

Localities in Poland (leg. M. Ceynowa-Giełdon): 1 – on W shore of Wielkie Gacno lake, on the area of the Tuchola Forests National Park (CB44), associated with *Trentepohlia*, 7.10.2001; 2 – on the Piecki Duże lake, near Laska village (CB33), on squamules of *Cladonia* and dying plant remains, together with *Absconditella sphagnorum* and *Placynthiella uliginosa*.

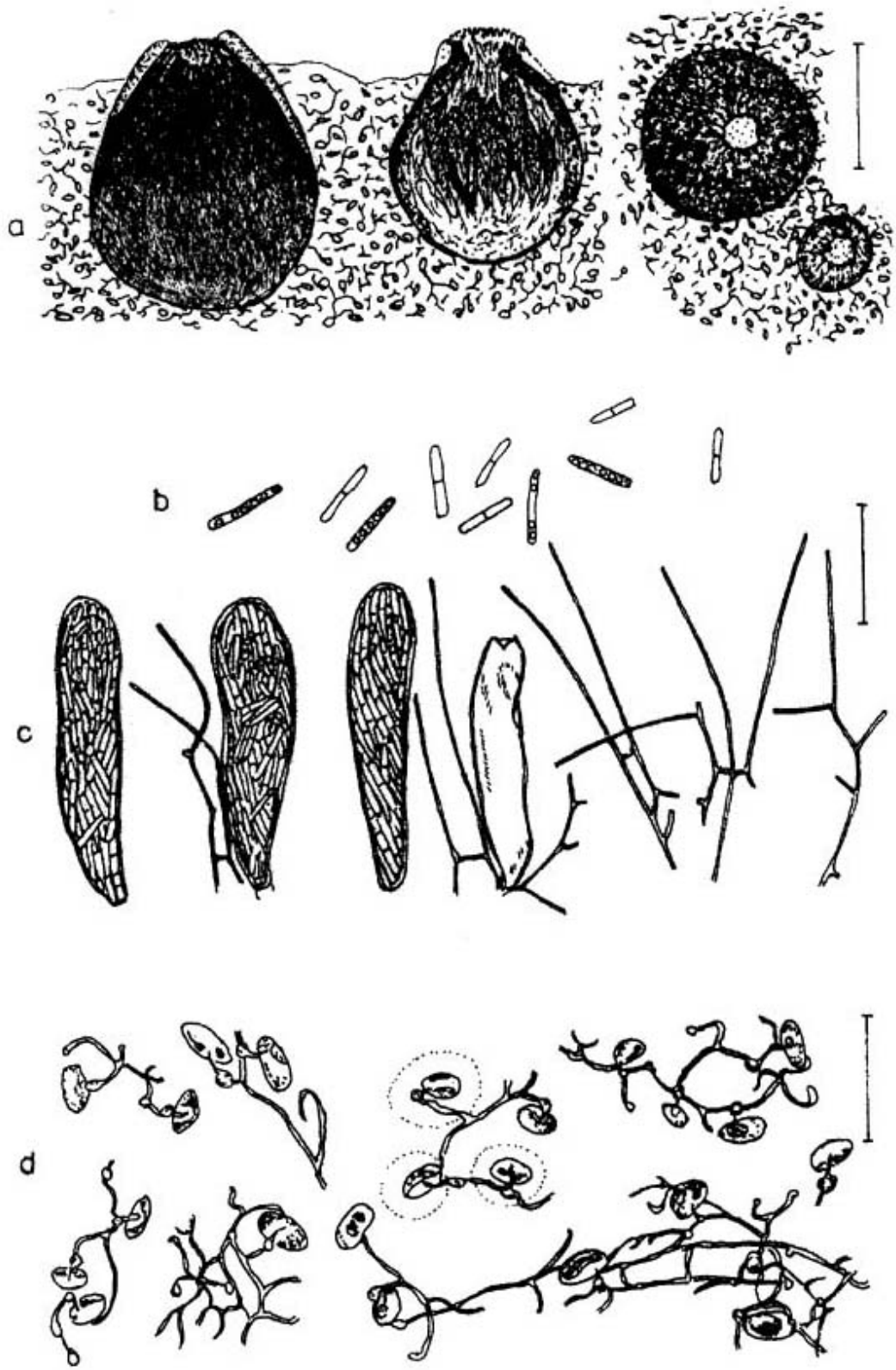

Fig. 7. *Epigloea bactrospora* Zukal. (original; locality: Tuchola Forests) a – perithecia; b – ascospores; c – mature and dehisced asci and paraphyses (in Lugol's); d – the geen alga of *Coccomyxa*-typ and hyphae with haustoria of *Epigloea*. Scale bars: a – 50 μm; b-d – 20 μm.

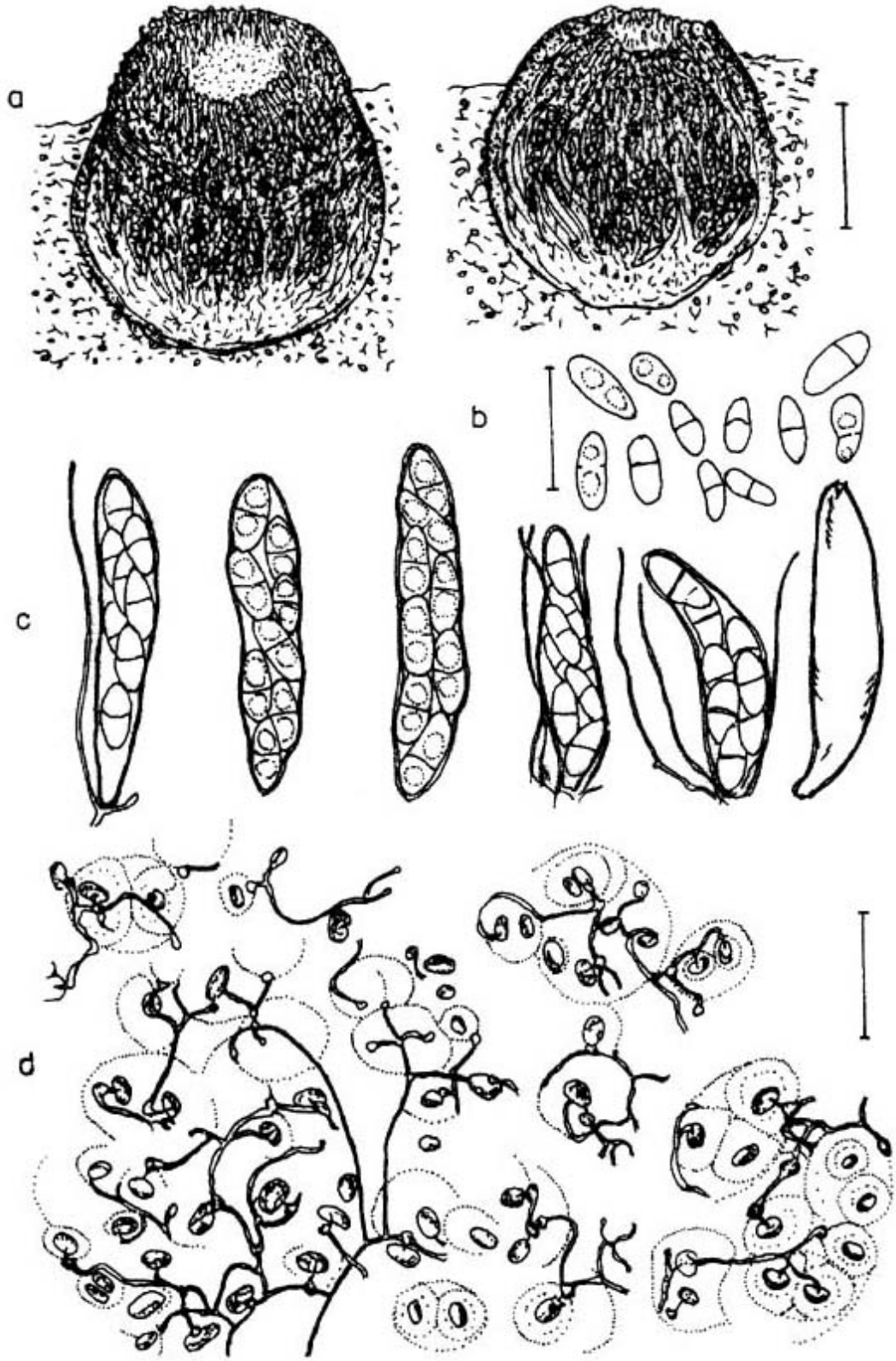

Fig. 8. *Epigloea soleiformis* Döbb. (original; locality: Tuchola Forests) a – perithecia; b – ascospores; c – asci and paraphyses (in Lugol's); d – the geen alga of *Coccomyxa*-typ and hyphae with haustoria of *Epigloea*. Scale bars: a – 50 μm; b-d – 20 μm.

REMARKS

Most of the research material examined was sterile material visible under microscope as delicate hyphae characteristically connected with the alga *Coccomyxa* cells. Solely sterile thalli of *Epigloea* were found among others on the lakes: Nawionek and Czarne near Laska place and on the Moczadło Lake near Męcikał. Unidentified species of *Epiogloea* genus developed on felled trees, more rarely on sandy shores and bark of *Juniperus communis* shrubs and *Pinus sylvestris* trees, growing near water table. Exceptionally such sterile thalli were found on silvan roadside near Widno place.

The frequent absence of fruiting-bodies hindering species determination can point to their special ecological demands including possible substratum – dependence. Similar situation concerns some *Epigloea* species in Bavaria Forest, on the Alps margin (Grummann 1969; Döbbeler 1984). *Epigloea* was found in the mountains in Germany, Austria, Switzerland and Italy, most frequently on the lakes but in fir or spruce forest. May be species of this genus are to be found also in Polish mountains. The similarity of *Epigloea* from Polish localities and those known for a long time from Austria, near locus classicus of *E. bactrospora* species can be also indicative of concomitant species, including *Mesotaenium macrococcum* (Kützing) Roy et Bisselt alga, described earlier as *M. Braunii*.

In some algal colonies of *Coccomyxa* genus studied in the Tuchola Forests area, the competition was stated between very delicate *Epigloea* hyphae and *Omphalina* hyphae, a lichenized basidiomycete. The competition resulted in formation of "*Botrydina*" – type thallus and limited development of *Epigloea* hyphae, penetrating the same algal colony.

The lichen nature of *Epigloea* species is controversial, connected to a large extent with the definition of lichens. According to Döbbeler (1984) the species of the genus described above can be interpreted as "highly adapted algal parasites". I think that specialistic studies of the structure and interesting biology of these species can elucidate evolutionary mechanisms of lichens genesis.

REFERENCES

Döbbeler P. 1984. Symbiosen zwischen Gallertalgen und Gallertpilzen der Gattung *Epigloea* (*Ascomycetes*). Beih. Nova Hedwigia 79: 203-239.

Ettl H., Gärtner G. 1995. Sylabus der Boden-, Luft- und Flechtenalgen. Gustav Fischer Verlag. Stuttgart. Jena. New York.

Grummann V. J. 1968. Alte und neue Halbflechten. Ein neuer Flechtenparasit. *Placynthium asperellum* neu für Mitteleuropa. Sydowia 22: 216-224.

Jaag O., Thomas E. 1934. Neue Untersuchungen über die Flechte *Epigloea bactrospora* Zukal. Ber. Schweiz. Bot. Ges. 43 (1): 77-89.

Lindau G. 1913. Die Flechten. Mit 306 Figuren im Text. Berlin. Verlag von Julius Springer.

Poelt J. 1969. Bestimmungsschlüssel europäischer Flechten. J. Cramer, Lehre.

Poelt J., Vězda A. 1981. Bestimmungsschlüssel europäischer Flechten. Ergänzungsheft II. Bibl. Lichenol. 16. J. Cramer, Vaduz.

Purvis O. W., Coppis B. J., Hawksworth D. L., James P. W., Moore D. M., 1994. The lichen flora of Great Britain and Ireland. Natural History Museum Publications in association with The British Lichen Society. Ed. 2. St. Edmundsbury Press, London.

Santesson R. 1993. The lichens and lichenicolous fungi of Sweden and Norway. SBT-förlaget, Lund.

Zahlbruckner A. 1907. Lichenes (Flechten), B. Specieller Teil. (In:) A. Engler, K. Prantl (eds) Die natürlichen Pflanzenfamilien I.: 49-249. Leipzig Verlag von Wilhelm Engelmann.

Zahlbruckner A. 1926. Lichenes (Flechten), B. Spezieller Teil. (In:) A. Engler, K. Prantl (eds) Die natürlichen Pflanzenfamilien. Ed. 2. Vol. 8: 61-270. Leipzig Verlag von Wilhelm Engelmann.

Zukal H. 1890. *Epigloea bactrospora*. (Eine neue Gallertflechte mit chlorophyllhältigen Gonidien). Österr. Bot. Z. 40: 323-328.

Zając A. 1978. Atlas of distribution of vascular plants in Poland. ATPOL. Taxon 27: 481-484.

Rodzaj *Epigloea* w Polsce

Streszczenie

Trzy gatunki nowego dla Polski, rodzaju *Epigloea*, noszącego charakter półporostu, stwierdzono w Regionie Borów Tucholskich, w południowej części województwa pomorskiego. Są nimi: *Epigloea pleiospora, E. bactrospora* i *E. soleiformis* – taksony różniące się między sobą m. in. liczbą zarodników w workach. Znaleziono je na obumierających mchach i szczątkach roślin naczyniowych, na piaszczystych i lekko zatorfionych brzegach, niektórych, przeważnie oligotroficznych, jezior śródleśnych. Większość dotychczas znanych stanowisk wymienionych gatunków znajduje się w Alpach i na obrzeżu Alp, dlatego można spodziewać się znalezienia ich również w górach południowej Polski.

Perytecja gatunków z rodzaju *Epigloea* tkwią w brudnozielonej, galaretowatej masie glonów z rodzaju *Coccomyxa* przerośniętej przez delikatne strzępki grzyba. Końce tych strzępek wiją się wśród galaretowatych otoczek i zapuszczają do wnętrza komórek glonu charakterystyczne haustoria (Figs 6d-8d). Podczas prowadzonych badań stykano się najczęściej z płonnymi plechami *Epigloea*. Owocniki wyżej przedstawionych gatunków, w niektórych miejscach bardzo liczne, stwierdzono w stosunkowo nielicznych próbach badawczych.