

## NEW LOCALITIES OF SEVERAL SPECIES OF VAUCHERIA (XANTHOPHYCEAE) IN POLAND

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**Abstract:** Eight interesting rare species of *Vaucheria* DC. have been found in central and northeastern Poland: *Vaucheria aversa* Hassall, *V. ornithocephala* C. Agardh, *V. walzi* Rothert, *V. taylorii* Blum, *V. verticillata* Menegh. sensu Kütz., *V. dichotoma* (L.) C. Agardh, *V. terrestris* sensu Götz and *V. sessilis* DC. in Lam. & DC. *V. taylorii* has not been recorded in Poland previously.

**Key words:** *Vaucheria*, Xanthophyceae, algae, new localities, distribution, Poland

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### INTRODUCTION

During phycological investigations carried out since 1993, eight interesting rare species of *Vaucheria* DC. have been found in central and northeastern Poland: *Vaucheria aversa* Hassall, *V. ornithocephala* C. Agardh, *V. walzi* Rothert, *V. taylorii* Blum, *V. verticillata* Menegh. sensu Kütz., *V. dichotoma* (L.) C. Agardh, *V. terrestris* sensu Götz and *V. sessilis* DC. in Lam. & DC. (Fig. 1). *V. taylorii* has not been recorded in Poland before, although it has been described from Western Europe and North America (Blum 1971; Rieth 1980). Two of the species are rare: *V. ornithocephala* and *V. aversa*. There are only two other records of *V. ornithocephala* in Poland: from a drainage ditch near Wrocław (Hilse 1865) and from a karstic spring near Częstochowa (Waszkiewicz & Żelazna-Wieczorek 1999); *V. aversa* is known from fish ponds in Ochaby (Mrozińska-Webb 1957). The other species described in this paper are common in Poland.

### MATERIAL AND METHODS

The collected *Vaucheria* filaments were transported in water from natural habitats. In the laboratory the thalli with matured sexual organs were fixed in 4% formaldehyde and prepared as permanent glycerin specimens.

This material was identified according to keys given by Starmach (1972) and Rieth (1980).

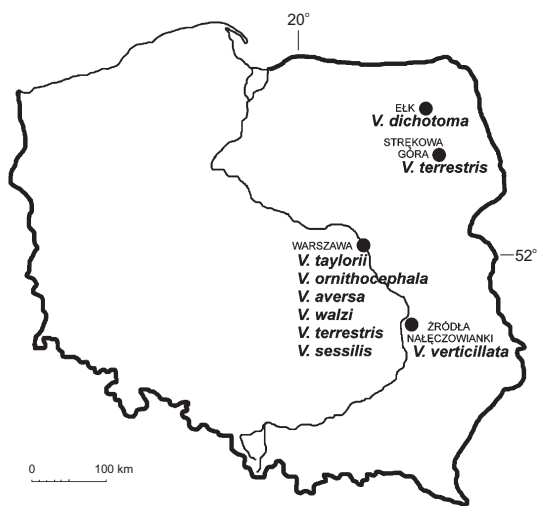


Fig. 1. Location of study areas in Poland.

Sometimes the material was composed of vegetative filaments only, and the specimens could not be identified. In these cases the filaments were kept in laboratory cultures in water from the natural habitats until the sexual organs formed.

## DESCRIPTION OF COLLECTED SPECIES

*Vaucheria aversa* Hassall (Figs 2: 1–3 & 4: 2)

*V. ornithocephala* C. Agardh var. *aversa* C. Agardh – *V. rostellata* Kützing

Sexual organs in groups aligned on one side of thread. Antheridia oblong, cylindrical, single (rarely 2 but never on opposite sides of the filament), on very short stalks parallel to filament and directed towards oogonium. Antheridium opening apical. Oogonia 2–3(–4) in number, rarely single, sitting on short stalks slightly inclined or perpendicular to filament. All oogonia openings in a group face the same way. Oospores ellipsoidal or spherical, not filling the whole oogonium and not adhering to its lateral surface. Dimensions: vegetative filaments 76–86  $\mu\text{m}$  in diameter; oogonia 184–215  $\mu\text{m}$  long, 130–136  $\mu\text{m}$  wide; oospores 114–120  $\mu\text{m}$  long, 83–111  $\mu\text{m}$  wide; antheridia

110–130  $\mu\text{m}$  long, 38–40  $\mu\text{m}$  wide. Sexual organs observed May 1998, May 1999.

LOCALITY. Small shallow pond in Olszyna reserve (Warsaw). Formed drifting, felted mats with *Vaucheria ornithocephala*, *V. walzi*, *V. taylorii* and *V. terrestris*. Also on soil surface near banks.

DISTRIBUTION. From Poland the species is known from fish ponds in Ochaby (Mrozińska-Webb 1957). Widespread in Europe, Asia, North America and South America (Rieth 1980).

*Vaucheria ornithocephala* C. Agardh

(Figs 2: 4–6 & 4: 1)

Monoecious. Sexual organs in groups aligned on either side of thread. Antheridia oblong, cylindrical, on very short stalks parallel to filament and directed towards oogonium. Antheridium opening apical. Oogonia 6–8 in number (rarely 2–4, very rarely single), sitting on short stalks strongly inclined to filament. Oogonia shape resembles bird's head. All oogonia openings in a group face the same way. Oospores ellipsoidal or spherical, not filling the whole oogonium but adhering to its lateral surface. Dimensions: vegetative filaments 38–44  $\mu\text{m}$  in diameter; oogonia 88–98  $\mu\text{m}$  long, 55–58  $\mu\text{m}$  wide; oospores 55–58  $\mu\text{m}$  long, 52–53  $\mu\text{m}$  wide; antheridia 93–101  $\mu\text{m}$  long, 19–25  $\mu\text{m}$  wide. Sexual organs observed May 1998.

LOCALITY. Small shallow pond in Olszyna reserve (Warsaw).

DISTRIBUTION. From Poland reported only twice: from drainage ditch near Wrocław (Hilse 1865) and from karstic spring near Częstochowa (Waszkiewicz & Żelazna-Wieczorek 1999). Widespread in Europe, Asia, North America and North Africa. Occurs in stagnant shallow water, but also found in springs and very rarely in brackish water near estuary (Rieth 1980).

*Vaucheria walzi* Rothert

(Fig. 3: 1–2)

*V. racemosa* (Vaucher) DC. in Lam. & DC. – *V. uncinata* Heering

Monoecious. Sexual organs borne on short bisexual fruiting branch. Antheridium cylindrical,

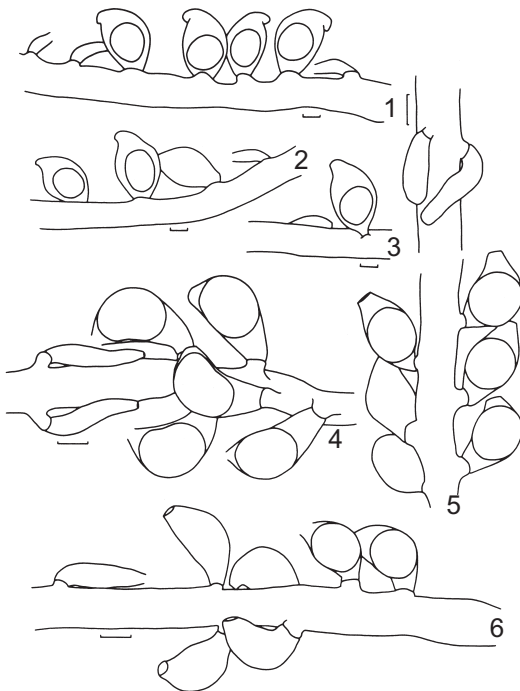
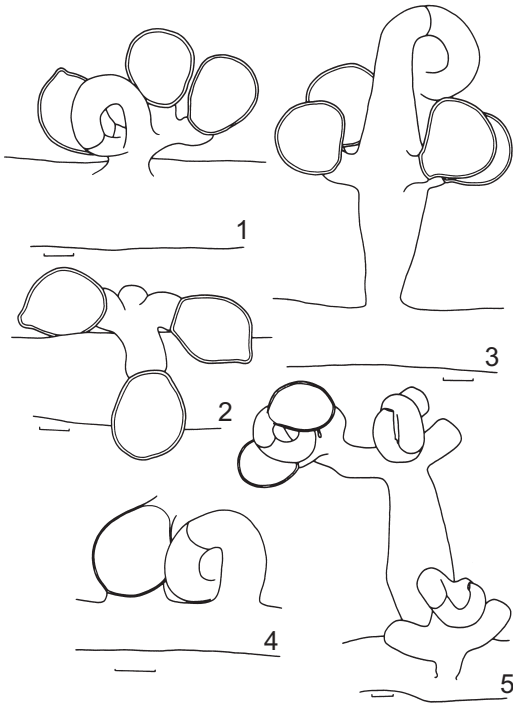


Fig. 2. 1–3 – *Vaucheria aversa* Hassall; 4–6 – *V. ornithocephala* C. Agardh. Scale bars – 50  $\mu\text{m}$  (1–3), 30  $\mu\text{m}$  (4–6).



**Fig. 3.** 1–2 – *Vaucheria walzi* Rothert; 3 – *V. taylorii* Blum; 4 – *V. sessilis* (Vaucher) DC. in Lam. & DC.; 5 – *V. verticillata* Menegh. sensu Kütz. Scale bars – 30  $\mu\text{m}$ .

circinate, on short stalk at top of fruiting branch, not extending beyond the oogonia. Oogonia 2–5(–7) in number, on stalks of different lengths. Oogonial pedicels attached to base of antheridial pedicel. New fruiting branch with antheridium and 2–3 oogonia sometimes emerges from basal portion of first branch. Oospores slightly bilateral flattened, strongly convex in dorsal part, filling the whole oogonium. Dimensions: vegetative filaments 85–112  $\mu\text{m}$  in diameter; oogonia 78–88  $\mu\text{m}$  long, 67–71  $\mu\text{m}$  wide; antheridia 20–23  $\mu\text{m}$  wide. Sexual organs observed May 1998, May 1999.

**LOCALITIES.** Small shallow pond in Olszyna reserve (Warsaw) and shallow pond in Dolina Służewiecka valley (Warsaw).

**DISTRIBUTION.** Common in Poland. Widespread in Europe, Asia, North America and North

Africa. Occurs in springs, ditches and streams, and on moist soil (Rieth 1980).

***Vaucheria taylorii* Blum** (Fig. 3: 3)

Monoecious. Sexual organs borne on bisexual fruiting branch perpendicular to filament. Antheridium cylindrical, circinate or hooked. Antheridial (central) pedicel conspicuously extending beyond the oogonia, curved to one side. Oogonia 3–5 in number, on short pedicels attached near inflated midpoint of fruiting branch. Oospores slightly bilateral flattened, filling the whole oogonium. Dimensions: vegetative filaments (59–)65–81 (–105)  $\mu\text{m}$  in diameter, oogonia 78–92  $\mu\text{m}$  long, 70–84(–93)  $\mu\text{m}$  wide, antheridia 26–30  $\mu\text{m}$  wide. Sexual organs observed May 1998, May 1999. The species shows similarities to *Vaucheria* species from the Geminata group, especially to *V. geminata* var. *longistipata*. Distinguishing features of *V. taylorii* are the shape of the fruiting branch, which is inflated at the level of the oogonial pedicels (the fruiting branch of *V. geminata* var. *longistipata* is not inflated) and the location of oogonia on the fruiting branch, which are attached in the midpoint while the oogonia of *V. geminata* var. *longistipata* are attached to the base of the antheridial pedicel, near the top of the fruiting branch.

**LOCALITY.** Small shallow pond in Olszyna reserve (Warsaw).

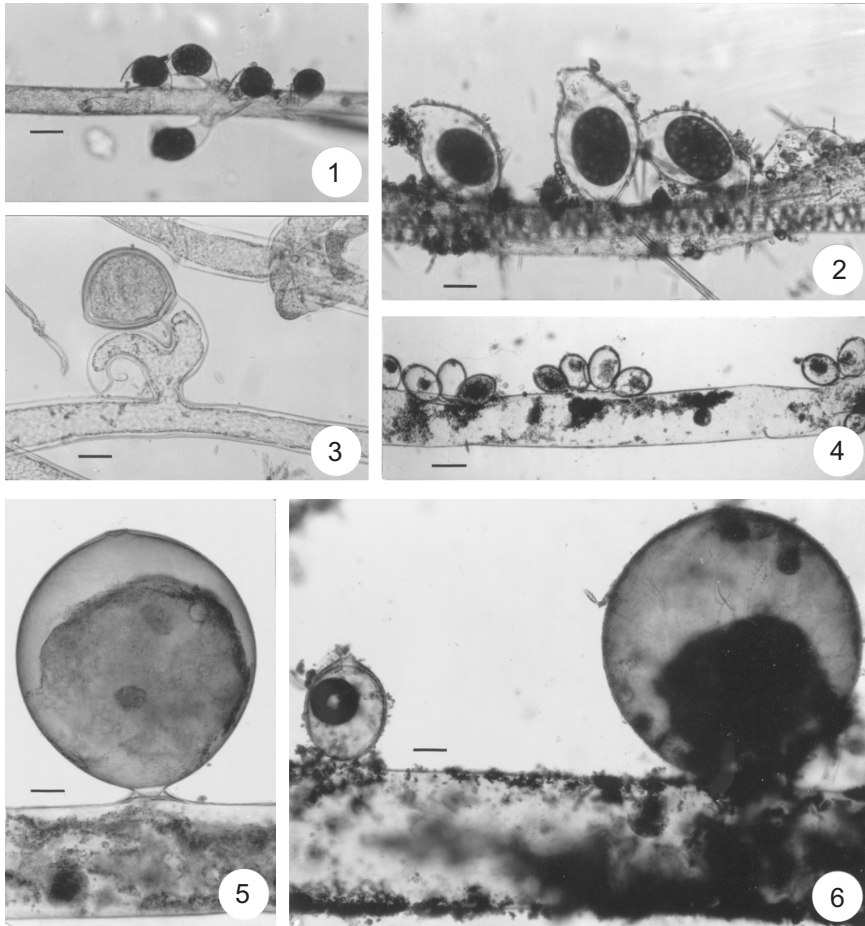
**DISTRIBUTION.** *V. taylorii* has not been recorded from Polish territory yet. The species is widespread in Western Europe and North America. It occurs in stagnant fresh water (Blum 1971; Rieth 1980).

***Vaucheria verticillata* Menegh. sensu Kütz.**

(Fig. 3: 5)

*V. trigemina* Kütz.

Monoecious. Sexual organs borne on a long, bisexual fruiting branch, perpendicular to the filament. Antheridium cylindrical, circinate, on a short stalk at the top of the fruiting branch. Oogonia 3–6 in number, rare single, on short pedicels,



**Fig. 4.** 1 – *Vaucheria ornithocephala* Agardh; 2 – *V. aversa* Hassall; 3 – *V. terrestris* Götze; 4–6 – *V. dichotoma* (L.) C. Agardh: 4 – fragment of male filament with antheridia, 5 – fragment of female filament with oogonium, 6 – fragment of bisexual filament. Scale bars: 50  $\mu\text{m}$  (1–3 & 5–6), 100  $\mu\text{m}$  (4).

attached to the base of the antheridial pedicel. Sometimes the new fruiting branch with the antheridium and 1–3 oogonia arises from the basal portion of the first branch. Oospores are slightly bilateral flattened, fill the whole oogonium. Dimensions: vegetative filaments 63–70  $\mu\text{m}$  in diameter, oogonia 78–88  $\mu\text{m}$  long, 63–70  $\mu\text{m}$  wide, antheridia 31–33  $\mu\text{m}$  wide. Sexual organs observed October 1993 (the material was collected from natural habitats in May 1993 and kept in laboratory cultures until formation of the sexual organs).

LOCALITY. Źródła Nałęczowianki springs.

DISTRIBUTION. Known from Polish territory (Amirowicz 1983). Widespread in Europe and China. Occurs in ditches and forest puddles (Rieth 1980).

*Vaucheria dichotoma* (L.) C. Agardh

(Figs 4: 4–6)

Dioecious, rarely monoecious. Antheridia in groups, rare single, usually perpendicular to the filament, oval, with a small beak on the top. Oogo-

nia sitting, almost spherical, usually single. Dimensions: vegetative filaments 180–235 µm in diameter; oogonia 317–450 µm long, 317–406 µm wide; antheridia 152–216 µm long, 105–156 µm wide. Sexual organs observed October 1995 (material collected from natural habitats in August 1995 and kept in laboratory cultures until sexual organs formed). Dioecious threads occur less often than monoecious ones in my material.

**LOCALITY.** S part of Jezioro Etckie lake in Etka, near mouth of Etka River, covering considerable part of bottom surface at about 1 m depth.

**DISTRIBUTION.** From Poland, noted from few localities, including Pełczyska near Łódź as *V. starmachii* Kadlub. (Starmach 1972). Widespread in Europe, Asia, South America, North Africa, Australia and Bermuda. Occurs in brackish and fresh water (Rieth 1980).

***Vaucheria terrestris*** sensu Götze (Fig. 4: 3)

*V. frigida* (Roth) C. Agardh

Monoecious. Sexual organs borne on bisexual fruiting branch perpendicular to filament. Antheridium cylindrical, circinate. Oogonium single, on stalk. Sometimes new fruiting branch with antheridium and oogonium emerges from first branch. Oospores spherical or slightly bilateral, flattened, filling the whole oogonium. Dimensions: vegetative filaments 50–80 µm in diameter; oogonia 130–140 µm long, 117–124 µm wide; antheridia 27–30 µm wide. Sexual organs observed May 1999.

**LOCALITIES.** Ditch in lower basin of Biebrza River, 8.3 km N of bridge on Narew River in Strękowa Góra, and in small shallow pond in Olszyna reserve (Warsaw).

**DISTRIBUTION.** Common in Poland, and was found in inland saline waters and salt marshes (Pliński 1973). Widespread in Europe, Asia, North America, Australia, New Zealand and North Africa. Occurs in stagnant and flowing freshwater, and on moist soil near streams, lakes and ponds (Rieth 1980).

***Vaucheria sessilis*** (Vaucher) DC. in Lam. & DC. (Fig. 3: 4)

*V. bursata* (O. F. Müll.) C. Agardh

Monoecious. Antheridia cylindrical, slightly circinate at top, borne on slightly curved stalks. Oogonia single or 2 in number; when 2, then antheridium lies between oogonia. Opening of oogonium is oblique. Oospores fill the whole oogonium. Dimensions: vegetative filaments 36–42 µm in diameter; oogonia 78–82 µm long, 58–60 µm wide; antheridia 65–70 µm long, 25–26 µm wide. Sexual organs observed September 1995.

**LOCALITY.** On moist soil in Botanical Garden of Warsaw University.

**DISTRIBUTION.** Common in Poland. A cosmopolite. Occurs in stagnant and flowing water and on surface of moist soil (Rieth 1980).

**CONCLUSIONS**

Of the eight species described in the present paper, *V. taylorii* is particularly interesting. This species has not been reported in Poland previously, though it is rather common in Western Europe (Rieth 1980). Possibly the species was mistakenly identified because it is very similar to *Vaucheria* species from the Geminata group, especially *V. geminata* (Vaucher) DC. var. *longistipitata* Chapman.

The localities of the next two species, *V. ornithocephala* and *V. aversa*, are rare in Poland. The other species described in this paper are common but were not recorded from NE Poland earlier.

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**REFERENCES**

- AMIROWICZ A. 1983. *Vaucheria* species in the neighbourhood of Cracow. *Fragm. Flor. Geobot.* **29**(3–4): 465–474.
- BLUM J. L. 1971. Notes on American *Vaucheriae*. *Bull. Torrey Bot. Club* **98**(4): 189–194.

- HILSE W. 1865. Beiträge zur Algenkunde Schlesiens, als Fortsetzung der Beiträge im Jahres Bericht für 1864. *Jahresber. Schles. Ges. Vaterl. Cult.* **43**: 109–129.
- MROZIŃSKA-WEBB T. 1957. Fadenalgen, die auf der Oberfläche der höheren Wasserpflanzen in der Versuchsteichwirtschaft Ochaby vorkamen. *Fragm. Flor. Geobot.* **3**(1): 141–152 (in Polish with German summary).
- PLIŃSKI M. 1973. The algae of salt marshes near Łęczycza, Central Poland. *Monogr. Bot.* **39**: 3–88 (in Polish with English summary).
- RIETH A. 1980. Xanthophyceae. 2. Teil. In: H. Ettl, J. Gerloff & H. Heynig (eds.), *Süßwasserflora von Mitteleuropa*. **4**. Gustav Fischer, Jena.
- STARMACH K. 1972. Zielenice nitkowate. Chlorophyta. 3. In: K. Starmach & J. Siemińska (eds.), *Flora Ślaskowodna Polski*. **10**. Państwowe Wydawnictwo Naukowe, Warszawa-Kraków.
- WASZKIEWICZ D. & ŻELAZNA-WIECZOREK J. 1999. The second discovery of *Vaucheria ornithocephala* (Xanthophyceae) in Poland. *Fragm. Flor. Geobot.* **44**(1): 202–204.

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