SOME REMARKS ON THE GENUS VAUCHERIA IN THE NETHERLANDS

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SUMMARY

Hitherto, 25 species of *Vaucheria* have been observed in the Netherlands. *V. minuta* Blum & Conover is recorded for the first time from the European Atlantic coast and *V. vipera* Blum for the second time. For *V. minuta* and *V. vipera* some morphological details are given. Morphological variation in *V. compacta* (Collins) Collins seems to be correlated with the salinity of the habitat.

1. INTRODUCTION

From the spring of 1967 onwards, the authors have been engaged in a morphological-ecological study of the Dutch *Vaucheria* species. As yet, special attention was paid to marine and brackish species, obtained from the field throughout the year.

From the literature the following records are known for the Netherlands- VAN DEN BOSCH (1846): *V. clavata* Ag. (= *V. sessilis* D.C. s.l.); *V. dichotoma* (L.) Ag.; *V. dillwynii* Lgb. (= *V. pachyderma* Walz); *V. hamata* Lgb.; *V. terrestris* Vauch. WEBER-VAN BOSSE (1887): *V. de baryana* Wor.; *V. dichotoma* (L.) Ag.; *V. pachyderma* Walz; *V. terrestris* Ag.; *V. synandra* Wor. HOCKE HOOGENBOOM (1935): *V. litorea* Hofman & Ag.; *V. sphaerospora* Nordst. var. *dioica* Kolderup-Rosenvinge [= *V. compacta* (Collins) Collins]; *V. synandra* Wor. ZONNEVELD (1960): *V. compacta* (Collins) Collins; *V. medusa* Christensen; *V. sessilis* D.C.; *V. synandra* Wor.; *V. terrestris* Goetz; *V. woroniniana* Heering.

Besides, there are important unpublished records, especially of VAN BOXEM. Unfortunately he died before publishing his data.

Up till now the following species have been observed:

V. arcassonensis Dangeard
V. arrhyncha Heidinger
V. aversa Hass.
V. compacta (Collins) Collins
V. coronata Nordst.
V. debaryana Wor.
V. dichotoma (L.) Ag.
V. erythrospora Christensen
V. geminata Heering
V hamata sensu Goetz
V. intermedia Nordst.
V. litorea Hofman et Ag.
V. longata Blum
V. medusa Christensen
V. minuta Blum & Conover
V. pachyderma Walz
V. sescuplicaria Christensen
V. sessilis D.C. s.l.
V. sphaerospora Nordst.
V. synandra Wor.
V. terrestris sensu Goetz
V. thuretii Wor.

V vipera Blum
V. walzi Rothert
V. woroniniana Heering

2. MATERIAL AND METHODS

Species without reproductive organs in the field – as commonly found – were cultivated in the laboratory, on an Erdschreiber medium in Petri-dishes or in closed plastic tubes. The culture conditions involved a temperature of c. 12 °C, a photoperiod L D 14:10, and a light intensity of 1500–2200 Lux.

Fructifications, that permit determination, appear mostly after 2–3 weeks under the above conditions. Figures are drawn with the aid of a camera lucida.

3. OBSERVATIONS ON THE SPECIES V. MINUTA, V. VIPERA AND V. COMPACTA

3.1. *V. minuta* Blum & Conover

For the Netherlands *V. minuta* was found in a culture of *V. coronata.* This species was obtained on Febr. 16, 1968, from a "*Suaeda maritima-Festuca rubra*" vegetation (upper littoral-supralittoral), in the salt marsh "Springersgors" near Ouddorp on Goeree.

The salinity of the habitat was estimated to be 5–10 $^0/_{00}$ Cl^-. *V. coronata* was fruiting abundantly at the time of collecting, but *V. minuta* at a much lower extent.

The only previous record of *V. minuta* relates to material from New England salt marshes (BLUM 1953). Blum found it fruiting in March, April, and May in habitats ranging "from submerged areas of relatively high salinity (29.5–30.2 parts per thousand) to emergent situations subject to wide range in salt concentration".

In agreement with the supposition of Blum, the antheridium is not always located terminally on a bisexual fruiting branch, as functional antheridia were seen on fruiting branches without an oogonium *(fig. 1, a).*

The following measures were found: diameter of filaments: 12–17 (–28) μ; length of fruiting branches: 220–840 μ; antheridia: 48–70 × 16–22 μ; oogonia: 85–115 × 45–65 μ; oospores: 58–95 × 44–63 μ.

The morphology and measures agree well with the description of Blum.

3.2. *V. vipera* Blum

This species was found in the salt marsh "Springersgors" near Ouddorp on Goeree but is, like *V. minuta,* not yet known from other Dutch salt marshes. It appeared in a culture from a sample taken on Sept. 5, 1967. In preserved wild material from the Springersgors fructifications were present in August and September.

At the above locality, *V. vipera* occurs on silt of creek slopes, especially at the origin of the creeks where the slopes are not steep. *V. vipera* grows together with *V. sphaerospora* and *V. thuretii.* These three species form a zone extending

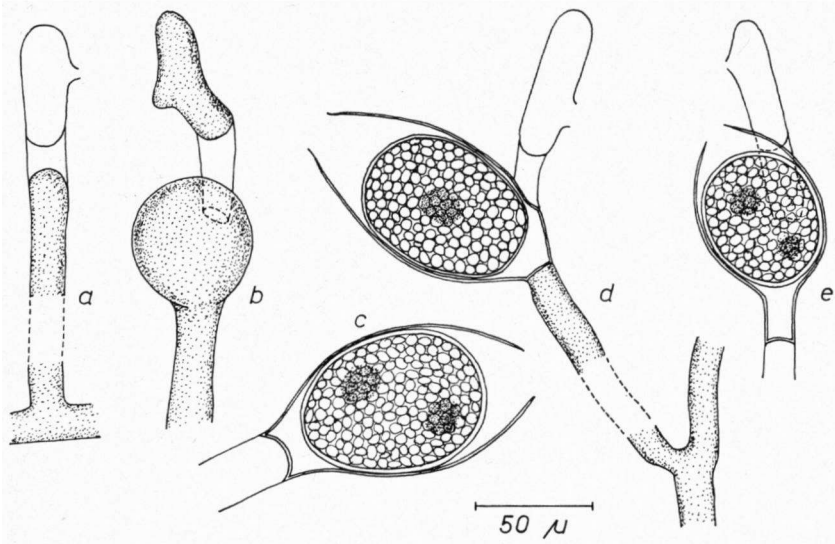

Fig. 1. *Vaucheria minuta* Blum & Conover: a. antheridium; b. young stage in the development of oogonium and antheridium; c. oogonium with mature oospore; d. and e. oogonium with mature oospore and antheridium.

from M.H.W. to about 70 cm below. The salinity of the tidal water in this locality is about $15^0/_{00}$ Cl^-.

The first European record of *V. vipera* was before the description of BLUM (1960). It was NELLIE CARTER (1933) who observed *V. vipera* on a British salt marsh at Canvey Island, but she erroneously called it *V. woroniniana* (Götz) Heering, be it "with some hesitation". Yet, her illustration is undoubtedly *V. vipera*. At Canvey *V. vipera* occurred in an "*Aster-Salicornia*" zone in August.

BLUM (1960) found it fruiting in September in two salt marshes in Massachusetts (Atlantic coast of North America) mixed with *V. thuretii* and *V. compacta* on "organic muck". Recently *V. vipera* was also recorded from Japan by YAMAGISHI (1965) so that the species occurs at the Pacific coast too.

V. vipera is interesting with respect to the formation of the reproductive organs. In cultivated material single terminal fructifications were observed repeatedly *(fig. 2, a, b)*. Similarly, proliferations at the basis of bisexual fructifications were often observed *(fig. 2, c)*. So it seems that a sympodial branching as described by CHRISTENSEN (1952) is involved: forming of terminal male and (or) female fructifications on vegetative branches and growth continuing then by proliferation at the basis of such fructifications.

Proliferation in *V. vipera* can continue for long before new fructifications are formed. This could wrongly suggest monopodial growth (CHRISTENSEN 1952: special fruiting branches which arise at some distance from the top of the filament). Especially in preserved material branching could seem to be monopodial *(fig. 2, d)*. Antheridia can be formed also in the absence of oogonia. Sometimes two sessile antheridia occur close together in sympodial arrangement *(fig. 2, e)*.

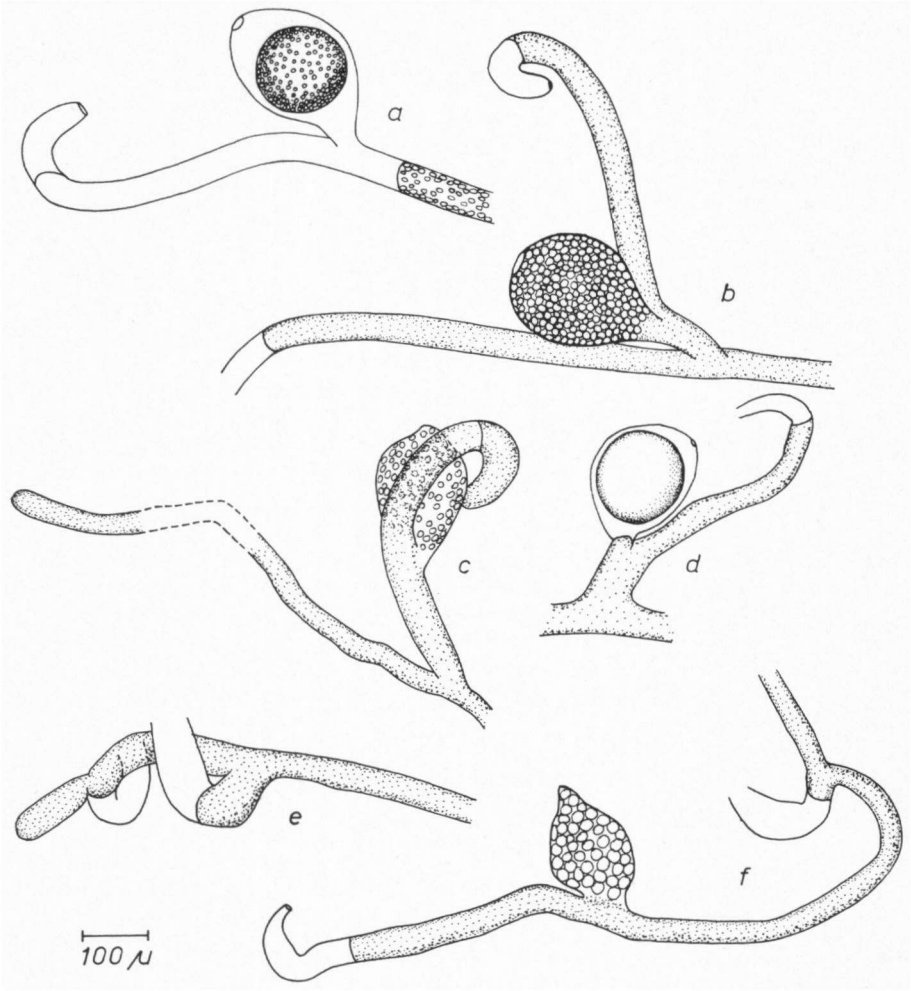

Fig. 2. *Vaucheria vipera* Blum: a. and b. terminal fructifications; c. proliferation at the basis of a bisexual fructification; d. "fruiting branche" from preserved material; e. two antheridia in sympodial arrangement; f. proliferation at the base of an antheridium.

The distance between antheridium and oogonium may be relatively long and proliferation at a variable distance below an antheridium is frequently seen. This, too, causes sessile or semi-sessile reproductive organs *(fig. 2, f)*.

The oospores are thin-walled and have a brownish colour. BLUM (1960), dealing with preserved material only, recorded special fruiting branches and occasionally, sessile reproductive organs. Sometimes he observed sympodial-like proliferation (*sensu* Christensen). These observations and those obtained from cultivated material strongly suggest that branching in *V. vipera* is essentially sympodial, allthough this is more evident in other species (*e.g. V. litorea* and *V. sphaerospora*).

Table 1. Measurements of *V. vipera* by different authors.

Author:	BLUM	CARTER	SIMONS	YAMAGISHI
Diameter of filaments	(22–)27–60(–75) μ	60–100 μ	42–92 μ	45–80 μ
Antheridia	(30–)60–106 × 37.5–46 μ		98–196 × 32–55 μ	90–110 × 35–55 μ
Oogonia	105–150 × 135–195 μ		168–252 × 126–182 μ	185–225 × 120–175 μ
Diameter of oospores	97–126 μ	150 μ	112–154 μ	120–190 μ

The measures found by Carter and by the present authors differ from those of Blum, but agree better with those of Yamagishi.
So the European and Japanese specimens have much longer oogonia and larger oospores than the American ones.

3.3. *V. compacta* (Collins) Collins

This species has been collected in many places near, and in, fresh or salt water. It occurs in great masses in the freshwater tidal area named the "Biesbosch", growing on silt or sand in the littoral zone. Furthermore, it has been observed far landinward along the great rivers. In the brackish deltaic district it grows near oligohalinic to polyhalinic waters. Thus, it was found on salt marshes near Waarde and Ellewoutsdijk on the Wester-Scheldt estuary at M.H.W. The salinity of the Wester-Scheldt water in these localities varies between 10 and $15^0/_{00}$ Cl^-. One measurement from the *Vaucheria* habitat near Waarde from the water in the *Vaucheria*-mat at low tide yielded a value of $11.5^0/_{00}$ Cl^-. No variation in filament diameter and in the form and diameter of oospores from

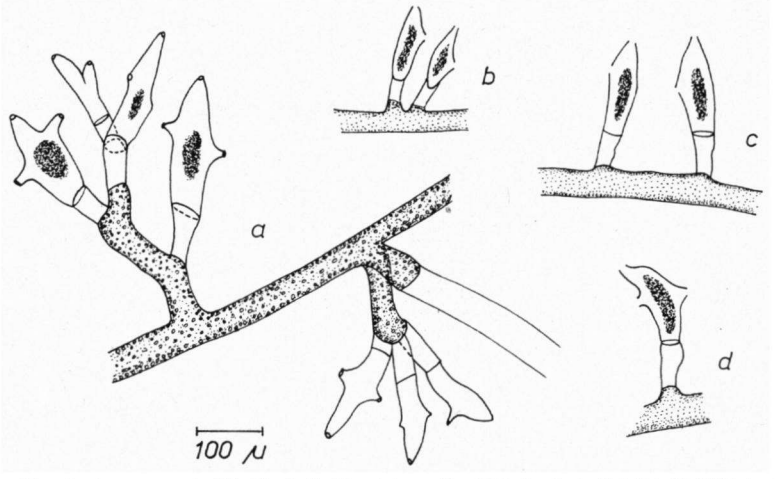

Fig. 3. *Vaucheria compacta* (Collins) Collins: a. antheridia from a sample of Ellewoutsdijk (culture); b, c and d. antheridia from preserved material from S. Flevoland (salinity $< 1^0/_{00}$ Cl^-).

these habitats has been established yet. However, a morphological variation was found in the clustering of antheridia, possibly correlated with the salinity of the habitat *(fig. 3)*.

Clustering of antheridia in sympodial arrangement was also observed by RIETH (1956) in a culture of material from the Baltic (salinity of the habitat $5.7^0/_{00}$ Cl^-), be it at a lower rate. The clustering occurs in freshwater material of *V. compacta* too, but only in terminal antheridia.

This phenomenon *(fig. 3, a)* has not only been observed in cultures, but also in preserved wild material.

Further investigations are needed to find out to what extent this variation is modificative.

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