LAMPROTHAMNIUM PAPULOSUM (WALLR.) J. GROVES, A THREATENED CHAROPHYTE IN SCANDINAVIA

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ABSTRACT - The distribution of *Lamprothamnium papulosum* in Scandinavia is presented in this paper. There has been a marked decline in the occurrence of the species, most probably due to eutrophication and urbanisation of the localities in question. The number of localities left is presumably small, and the authors group the species under the category *endangered* species. Necessary steps should be taken to protect the species by law, and its distribution in Scandinavia should be further investigated.

RÉSUMÉ - La distribution de *Lamprothamnium papulosum* en Scandinavie est présentée. Cette espèce a subi un déclin marqué dont la raison est très probablement l'eutrophication et l'urbanisation des localités d'où elle a disparu. Le nombre de localités où elle est encore présente est faible et les auteurs placent ce taxon parmi les espèces *en danger*. Des mesures légales nécessaires à sa protection doivent être prises et l'étude de sa distribution en Scandinavie doit être poursuivie.

KEY WORDS : *Lamprothamnium papulosum*, Charophytes, Scandinavia, threatened species.

INTRODUCTION

The old name *Chara alopecuroides* given to this taxon by Wallmann (1853) is the basis for its popular name, «foxtail stonewort». As this species differs from other members of the genus *Chara* by having the antheridium above the oogonium, Leonhardi (1863) placed it into a new genus *Lychnothamnus*. Later the name was changed to *Lamprothamnium* (Groves, 1916). Because an old epithet, *papulosum*, given to the taxon by Wallroth (1833), had priority, the taxon is now called *Lamprothamnium papulosum*. Other details concerning the nomenclature and taxonomy of this species can be found in Daniel (1975).

SHORT DESCRIPTION OF THE SPECIES

Stem slender, up to 30 cm high (Fig. 1). Cortex absent. Stipulodes long, in one row. Monoecious. Oogonium below the antheridium. Bulbils of *Chara aspera* type, white, spherical, up to 1 mm in diameter (McNicol, 1907).

Figure 1. - *Lamprothamnium papulosum*. Photo of a specimen collected 31.08.1994 in Kalvöfjorden, Sweden. The length of this plant is c. 5 cm.

ECOLOGY

Lamprothamnium papulosum is only found in brackish water (Daniel, 1975; Moore, 1986). Observations and experiments on its tolerance to salinity have been done by Dubois (1968); Daniel (1975); Bisson & Kirst (1980); Wichmann & Kirst (1989) and others.

The species can tolerate great variations in salinity. Daniel (1975) has shown experimentally that it grows best in the range 8‰-28‰. In the Baltic Sea, the species has been found between the isohalines of 8‰ and 18‰ (Olsen, 1944). Old plants can survive even greater variation in salinity (Wichmann & Kirst, 1989). Germination of the oospores is optimal at a salinity of 10‰ (Dubois, 1968).

In Scandinavia, *Lamprothamnium* occurs in sheltered bays and brackish water lagoons in the Skagerak and the western part of the Baltic Sea (Olsen, 1944) (Fig. 2).

The alga is most often found on sand/silt bottom in shallow water down to a depth of 1-2 m.

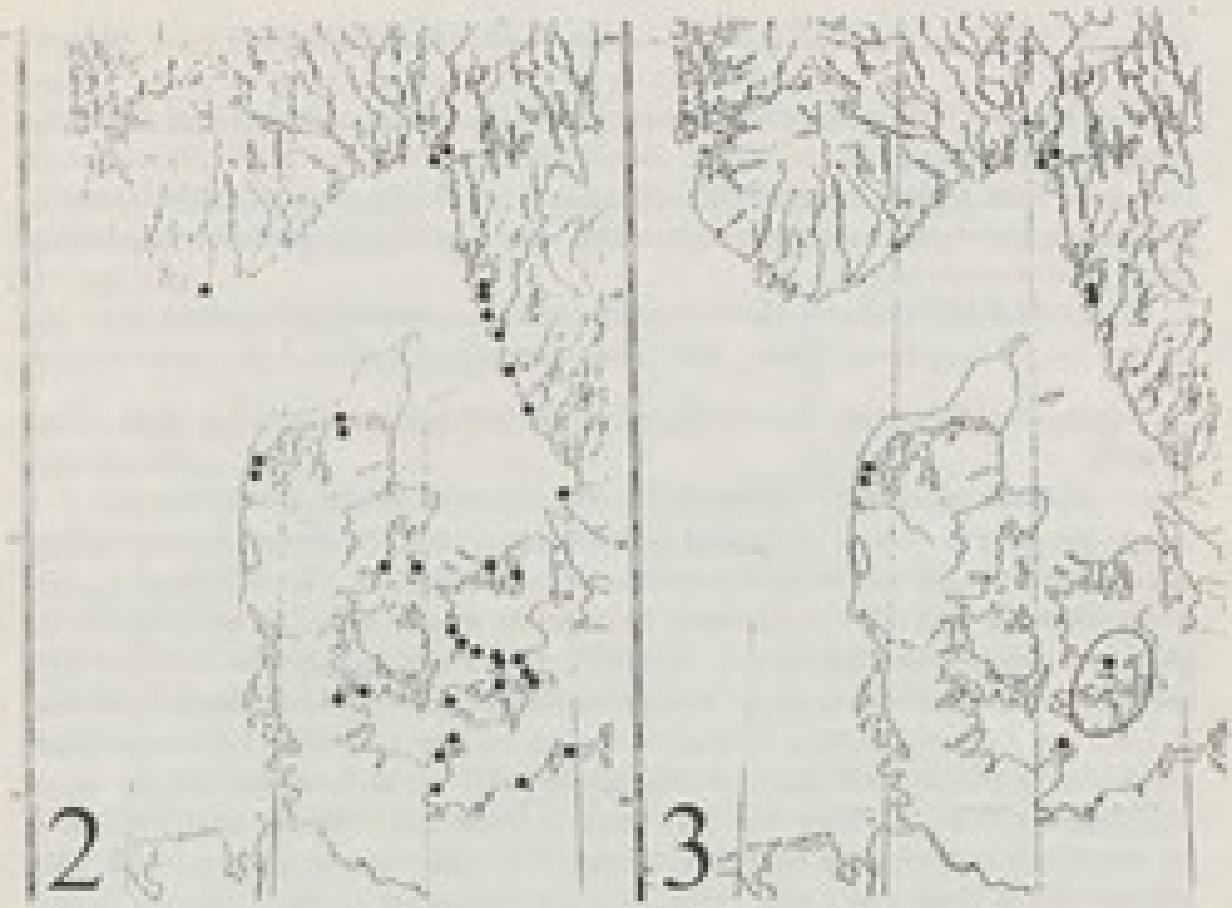

Figure 2. - All known localities of *Lamprothamnium papulosum* in Scandinavia. Some German localities are also added.
Figure 3. - All known localities of *Lamprothamnium papulosum* in Scandinavia after 1983. Circle: Area with several localities (Andersson, pers. comm).

BIOLOGICAL DEVELOPMENT

L. papulosum is normally richly fertile and survives the winter by oospores or bulbils. In Norway, the oospores are mature from August (Langangen, 1974).

DISTRIBUTION IN NORTHERN EUROPE

Lamprothamnium papulosum has been found in some localities on the Baltic coast of Germany (Sonder, 1890; Migula, 1897). The distribution in Britain and Ireland was given by Stewart & Church (1992). A map of the European distribution can be found in Corillion (1957, map 36).

In Scandinavia, *Lamprothamnium papulosum* was found in a number of localities (Fig. 2.) along the coasts of the Skagerak and the Baltic Sea (Hasslow, 1931; Hasslow, 1936; Olsen, 1944; Blindow, 1994; recent localities: see below). Only a few localities are known for the time after 1983 (Fig. 3); these localities are described in detail below.

THE NORWEGIAN LOCALITIES

From the following two localities, *Lamprothamnium papulosum* probably has disappeared. Both localities are clearly eutrophicated.

1. **Vest-Agder**: Mandal: Skogsfjord coll. 1881. During 1991 and 1992, *L. papulosum* was not found; the fjord was filled with *Enteromorpha* sp. and filamentous algae (own observations, A.L.).

2. **Østfold**: Hvaler: Vauerkilen coll. 1838 and 1969. In subsequent years, the species has not been found (Steen, 1993; own observations, A.L.).

On the following two localities, *Lamprothamnium papulosum* was found recently.

3. **Østfold**: Hvaler: Skipstadkilen (Fig 4), close to the Swedish border is a lagoon covering an area of about 0.15 km^2 and with a depth of about 1 m. It is mostly surrounded by belts of *Scirpus tabernaemontani* C.C.Gmel., *S. maritimus* L. and *Phragmites australis* (Cav.) Steud and, in the water, *Ruppia* spp. The inner part of the pond is dominated by charophytes, especially *Chara aspera* Deth. ex Willd., which grows in dense stands. In openings in these stands specimens of *Chara canescens* Desv. & Lois. and *Tolypella nidifica* (Müller) A.Br. can be found. In 1969 *Lamprothamnium papulosum* grew in most parts of the lagoon both in shallow and deeper water (Langangen, 1972). In 1993 it was only found in a few places mostly in the middle of the locality. The specimens were up to 17 cm long, richly fertile and with some ripe, black oospores. Other algae were found, such as *Cladophora* sp., *Enteromorpha* sp. and *Rhizoclonium* sp. Over the years the salinity ranged from 7‰ -to 13‰ (own observations, A.L.).

Bharathan & Sundaralingam (1984) used specimens of *L. papulosum* from Skigstad kilen in their description of the developmental morphology of the species.

4. **Østfold**: Borge: Hunnebunnen is an old oyster poll. Klavestad (1957) reported *Chara canescens* and *Tolypella nidifica* from this locality. During 1994, a few specimens of *Lamprothamnium papulosum* were found in the poll; the plants were normally developed and richly fertile. Masses of filamentous algae occurred covering all plants including the charophytes. The salinity was 10 ‰. (Own observations, A.L.).

THE SWEDISH LOCALITIES

In Sweden, *Lamprothamnium papulosum* has only been found along the west coast. The following five older records are known:

1. **Bohuslän**: Marstrand coll. 1891, 1892. It is unknown if *Lamprothamnium papulosum* still occurs; the locality should be revisited.

2. **Västergötland**: Göteborg 1885. This area is urbanised, and we assume that *Lamprothamnium papulosum* has disappeared from this locality.

3. **Halland**: Varberg, north of the island Getteron and N.Näs, both coll. 1933. The locality was revisited during 1994, but *Lamprothamnium papulosum* could not be found (own observations, A.L.). According to Flodin (pers. comm.), the locality has

changed much since 1933, especially in connection with the new road, when the island became a peninsula, and the area was filled up with sediments.

4. **Halland**: Onsala coll. 1868. Untersträm-Gustavsson (1993) visited the area during 1987-1990, but neither during these years nor during a revisit in 1994 (Untersträm-Gustavsson, pers. comm), she could find any charophytes. The water was heavily eutrophicated; in later years, the water quality improved after the building of a sewage plant.

5. **Skåne**: Norrviken nearby Råstad coll. 1912. We have no information if *Lamprothamnium* occur on this locality today.

During the last years *Lamprothamnium papulosum* was found on the following three localities:

6. **Bohuslän**: Ångholmen on the island of Mjörn (Coll. 1903, 1965 (Pehrsson, 1976). The area was revisited during 1994 (A.L.) (Fig 5).

Small (5-7 cm), well developed specimens grew scattered in shallow water on soft bottom (Fig. 6). All specimens were richly fertile in an early stage of development with the old oospore still attached to the rhizoides. *Ruppia* spp., *Zostera marina* L. and different filamentous algae (e.g. masses of *Cladophora* spp.) dominated the submerged vegetation. The locality was clearly eutrophicated.

7. **Bohuslän**: Kalvsfjorden nearby Haga (own observations 1994, I.B.). *Lamprothamnium papulosum* grew on shallow water (10 cm) together with *Ruppia* sp., other submerged plants and masses of filamentous algae. The specimens were small (5-7 cm, Fig. 1), well developed, richly fertile with some ripe black oospores. The locality was clearly eutrophicated.

8. **Bohuslän**: Kalvöfjorden, Räsön close to Hjälmvik, coll. Mokshes 1994, det. I.B. This locality is situated close to the former locality. Different persons observed *Lamprothamnium* on this locality during 1991-1994. *Lamprothamnium* was growing on 0,5 m depth together with *Zostera* sp. and *Ruppia* sp. (M. Kuylenstierna, pers. comm.)

THE DANISH LOCALITIES

Olsen (1944) reported about 25 localities for *Lamprothamnium papulosum* in Denmark, most of them from the 1800s. It is unknown how many of these localities still exist, but we assume that *Lamprothamnium* has decreased also in Denmark. In Vestsjælland, *Lamprothamnium* has not been refound in areas where the species occurred earlier. The areas in question have been heavily eutrophicated since 1960 (J. Stuemberg, Vestsjællands Amt, pers. comm.).

Christensen (pers. comm.) reported that the Limfjorden area has been heavily eutrophicated, and he doubts that *Lamprothamnium* still exists on its former localities in this area. On the other hand, *Lamprothamnium* was reported from two new localities in this area (see below).

The present known localities of *Lamprothamnium papulosum* in Denmark are:

1. **Limfjorden**, western part (Doverkil nearby Ydby, coll. 1981 T. Christensen). The plants have decreased during the last years probably due to mass growth of *Cladophora* sp. covering the bottom (T. Christensen, pers. comm.).

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2. **Limfjorden**: Nissum Broding (a lagoon by Follup Odde nearby Lemvig, coll. 1991 T. Christensen).

3. **Dybse Fjord** 1983, leg. Werner Krause, herbaria of Copenhagen and Oslo. The specimens are small, 5-7 cm high, and richly fertile. According to Christensen (pers . comm.) masses of free-floating *Cladophora* sp. now cover the bottom of this fjord.

4. Several localities in the area around Nykøbing, Sjælland for the period 1989-1991 are given by J.Andersson (pers. comm.). The plants are not deposited in any herbarium. The area is marked by a circle (Fig. 3).

THE STATUS OF *LAMPROTHAMNIUM PAPULOSUM* IN SCANDINAVIA, ITS THREAT AND PROTECTION

In all three countries (Denmark, Norway and Sweden) records of *Lamprothamnium papulosum* are sparse during the last years. This is partly due to the fact that this species as well as other members of the group of Charophyta often are neglected during investigations of the vegetation. Another reason is that the species has declined during the last decennia. In all countries, *Lamprothamnium papulosum* could no be refound on several localities where it occurred before. In Sweden, the species was therefore listed as *endangered* (Blindow, 1994). The same status was given *Lamprothamnium papulosum* in the German Red List (Krause, 1984). Glowinski (1984) reported the species from several localities on Fehmarn (see Fig. 3).

Eutrophication is the most probable reason for this decline. Mass growth of filamentous algae like *Cladophora* is reported from many of the polluted areas. These filamentous algae often cover *Lamprothamnium* totally. Therefore, we assume that competition with other primary producers for light and space is the effective mechanism for the disappearance of *Lamprothamnium papulosum* during eutrophication. From one locality (Sweden, Varberg) *Lamprothamnium* disappeared probably due to the construction of a new road.

To protect *Lamprothamnium papulosum*, the following steps should be taken:

1. Most important is the decrease of pollution in the brackish water habitats which are situated within the distribution range of this species. In the future, the construction of sewage water plants may perhaps change the negative trend of this species.

Figure 4. - Skipnadkilen, Norway. Photo 23.05.1993 A.L.

Figure 5. - Ängholmen, Sweden. The asterix marks the place where *Lamprothamnium papulosum* was found. Photo 05.08.1994 A.L.

Figure 6. - Ängholmen, Sweden. *Lamprothamnium papulosum* (small, darker dots) growing on shallow water in association with other plants. Photo 05.08. 1994 A.L.

2. In all Scandinavian countries, the occurrence of *Lamprothamnium papulosum* should be further investigated, especially on its former localities, its actual localities should be legally protected against destruction.

3. The species can be protected by law as was done in Britain in 1987 (Wildlife and Countryside Act 1981).

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