Dispersal of phytoplankton by ducks

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Introduction

The methods by which newly formed water masses are colonised by algae (and the discovery of new species in isolated water bodies) has long been of interest to algologists. Transport by wind, insects, mammals and birds are among the means investigated and it has been shown that birds form a major rôle in the dispersal of algae and protozoa over short distances (Schlichting 1960). The unicellular algae known as desmids were taken from the feet, feathers and bills of water birds by Irenée-Marie (1939), while Schlichting (1960) found many species of Chlorophyta, Cyanophyta and a few Chrysophyta. Schlichting lists 86 viable species found on the feet of water birds, and good algal growth was produced in cultures of samples taken from the gullets of birds. In contrast, samples from the faeces contained only a few viable forms. Species of Chlorophyta, Cyanophyta and desmids have been recovered from the digestive system of shot water birds (Proctor 1959, 1966). The same author has shown that when desmids are fed to water birds they can be recovered live from the faeces after being in the digestive system for at least one hour. Some desmids and Chlorophyta (for example *Pediastrum* sp.) could also be recovered viable after up to eight hours retention in the gut of a bird (Proctor *et al.* 1967) while viable *Chara* oospores could be retained for 24 hours. Freshwater algal species listed as food of wildfowl include *Chara*, *Nitella*, *Ulothrix*, *Vaucheria* and filamentous algae (not specified) — Anderson (1959), Festetics and Leisler (1968) and Olney (1963, 1967, 1968). Luther (1963) found *Vaucheria*, *Cladophora*, *Stigeoclonium*, *Oedogonium*, and filaments of Zygnemaceae and Cyanophyta in Mute Swan *Cygnus olor* faeces as well as diatoms (not specified), but did not test for viability.

The only reference to the transport of truly planktonic algae by birds is in Carausu (1968), who found *Microcystis* sp., *Pandorina morum*, *Scenedesmus quadricauda* and *S. obliquus* in cultures taken from the intestinal contents of several water birds. Schlichting (1960) states that planktonic organisms did not attach readily to birds or did not survive after exposure to air. However, Proctor (1959) suggests that ducks and bottom-feeding shore birds have a greater variety of algae in their digestive tracts than do fish-eating birds. Experiments were therefore carried out to test whether transport by such means was likely.

The experiments

The freshwater planktonic diatom *Asterionella formosa* Hass. (Figure 1) was fed to ducks to see if it could be recovered viable from the faeces. Two series of experiments were carried out at Slimbridge with Mallard *Anas platyrhynchos* (two male and two female) which were isolated in a closed room. In the first series of three experiments the culture of *Asterionella* was placed in the drinking water and also mixed with the food (grain). In the second series of four experiments, the *Asterionella* was added only to drinking water and the ducks were kept under observation until at least three had been seen to drink from the culture.

The ducks were allowed access to the alga for varying periods between ¾-hour and 29 hours and the algal culture was then removed and replaced with fresh water and food. After an interval, varied between ¾-hour and 3 hours, since the

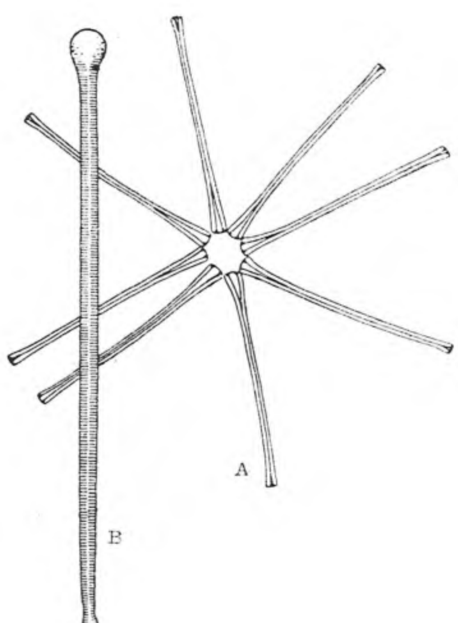

Figure 1. ***Asterionella formosa*: (A) colony (×650); (B) shell (×1950).**
(After Hustedt 1930).

algae had been removed, the birds were driven into a cage with a raised wire-netting floor, passing through a bath of water to ensure that they did not carry viable algae into the cage on their feet or feathers. The faeces were collected after 3-17 hours and made into a suspension in water. Samples of this were examined microscopically for *Asterionella* cells. Two to five millilitres were placed in culture solutions (Chu 10 and Chu 10+soil) and incubated. The remainder of the faeces were treated with nitric and sulphuric acid and examined microscopically for the silica shells of *Asterionella.*

Results

A few *Asterionella* shells were found in the faeces after acid cleaning in all cases except Experiment 1, in which the ducks had not settled down in their new surroundings and so may not have been feeding at that time. In Experiment 6 a few cells were also found before acid cleaning. In each case single cells were seen, not the colonies usually characteristic of *Asterionella* in culture and in the field.

The cultures had produced no live *Asterionella,* after 33-36 days, but, following acid cleaning, a few shells of *Asterionella* were found in them except in Experiment 1. A maximum of ten single cells was found in Experiment 6 in a 100 ml. culture. It would appear therefore that although a few *Asterionella* cells, apparently undamaged externally, could be recovered from the faeces, they were *not* viable when cultured.

The numbers of *Asterionella* cells collected from the droppings and cultures in each experiment was so small that it was not possible to relate them to the periods for which ducks had access to cells nor to the length of time the latter were in the birds' guts (i.e. faeces collected a short time after feeding did not contain more cells than those collected later).

A number of other species found in the tap water supply used were also found in the faeces or cultures, namely *Chlorella,* coccoid Chlorophyta (soil types), Cyanophycean threads (soil type) and mud diatoms. In addition, *Bumilleria* and soil diatoms were found.

Acknowledgements

I should like to thank the Wildfowl Trust and Dr. G. V. T. Matthews for the facilities provided, which enabled me to undertake this project, and I am especially grateful to Dr. J. Kear and Dr. M. Owen for their advice and help.

Summary

In the literature birds have been cited as playing a major rôle in the dispersal of algae. There is no record of the transport of planktonic diatoms.

The freshwater diatom *Asterionella formosa* Hass. was fed to Mallard *Anas platyrhynchos* and the faeces collected, examined and cultured. No viable cells of *Asterionella* were found.

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