

## Effects on Mosquito Larvæ of a Queensland *Nitella*.

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Ever since Caballero<sup>1</sup> in 1919 first published his experiments with *Chara fœtida* on the larvæ of mosquitoes of the genera *Stegomyia*, *Culex*, and *Anopheles*, considerable interest has been taken on the question of the effect of various species of Characeæ in different parts of the world on mosquito larvæ.

My attention was first drawn to the subject by a résumé of Caballero's work in the "Bulletin des Sciences Pharmacologique."<sup>2</sup>

Since Caballero's researches a number of contributions to the subject have been made by various authors—some supporting and others rejecting his theory. The latest contribution on the negative side has been made by Macgregor,<sup>3</sup> who conducted experiments with both living plants and watery and alcoholic extracts. His views on the matter are summarised in the following paragraph:—

"Taking the evidence as a whole it is difficult to conclude whether *Chara* is entirely devoid of the larvicidal action imputed to it, or whether under certain conditions, and in certain localities, some species have the power of inhibiting mosquito development, but I am convinced personally by my own experiments and observations that even some of the reputedly toxic species are often devoid of any toxicity whatever."

At a meeting of the Linnean Society of London on the 19th June, 1924, reported in the "Journal of Botany,"<sup>4</sup> Mr. T. B. Blow gave an account of his work in Madagascar in which he spent seven weeks making a large collection of Charophytes and studying the various species in their relationship to mosquito larvæ. The species that seemed to keep the water quite free from mosquito larvæ were as follows:—*Chara zeylanica*, *C. gymnopitys*, *Nitella Roxburghii*, and some other species of *Nitella*, probably new.

In January, 1925, I obtained specimens of a Charophyte which were submitted (through the Government Botanist, Mr. C. T. White) to Mr. Jas. Groves, the well-known authority on the group.

Mr. Groves replied:—

"I am sorry not to be able to speak with greater certainty about the plant as all the mature pieces sent belonged to the male plant, which is not nearly so satisfactory for identification as the female of a dioecious species. However, I feel little doubt that it is a new species, and I have provisionally called it *Nitella phauloteles* on account of the very small end cells of the dactyle."



The experiments with the *Nitella* were commenced on the afternoon of the 20th January, 1925. I collected and planted the *Nitella* in a glass aquarium in ordinary black soil and three parts filled the aquarium with rain water—13 gallons. The plant was well under the surface of the water, as I noticed that it grew on the bottom of the creek well under the running water, or, where noticed in stagnant water, the plant never rose to the surface. The fact is worthy of notice that the plant slowly dies if the water is not kept well over it. It was also noticed that the plant never attains to the surface of the water in any place where it has been observed.

Daily observations of the plant were made as to growth, &c., also attention was paid to the depth of water in the aquarium, this being always at about the same height, never allowing the plant to grow too near the surface of the water.

On the morning of the 27th January a green scum and also a thin film resembling oil were noticed on the surface of the water. Upon examination, the green scum proved to be due to bacterial growth, and the thin film being the peculiar oil-like substance given off by the plant, which, in my opinion, has the deterrent effect on the female mosquito, preventing her from laying her eggs upon the surface of any creek, pool, tank, or receptacle where this plant should be growing.

On Saturday morning, 31st January, I collected some mosquito larvæ, *Culex fatigans*, and placed them in the tank where the *Nitella* was growing. On Monday morning, 2nd February, the larvæ were still alive. On the succeeding day they were still alive and remained so for two more days, when they were noticed to be very sick, and on the 6th February the larvæ were found to be dead.

I then placed two other aquaria alongside the one which contained the *Nitella* and put the same amount of water in them with soil and other aquatic plants. Mosquitoes bred in these aquaria, but not in the one containing the *Nitella*, thus to some extent proving that the water in this particular aquarium was repellent to the female mosquito. To prove this further, I procured some female mosquitoes which I had bred out and which had been fecundated and allowed them to feed upon my blood; after which I transferred them under a mosquito net which was screening the *Nitella* aquarium and allowed them full access to the surface of the water, watching them whenever opportunity offered. A month elapsed, and during that time I continually found dead female mosquitoes on the surface of the water, and on careful examination of the surface I could not discover any eggs nor did any mosquito larvæ appear in the aquarium up to the 1st October, 1925. Some mosquitoes were also found on the floor; these had apparently fallen off the net where they had been resting.

I may also mention that in the other aquaria where mosquitoes were caged they laid their eggs upon the surface of the water in great numbers. This appears to be another link in the chain of evidence that at least some species of Characeæ have repellent properties to the mosquito.



Various species of mosquitoes were tried, including *Stegomyia fasciata* (*Aedes aegypti*), *Culex fatigans* (*quinquefasciatus*), and *Anopheles nyssorhynchus*. All gave the same favourable and pleasing results, not laying their eggs upon the surface of the water in the aquarium where the *Nitella* grew.

Then came the necessity of proving that the toxic effect given off by this plant was not poisonous to man and animal life.

The following methods were adopted and their results carefully noted:—

On the 11th June, 1925, I obtained seven live rats which I placed in a cage and fed them on dry food; the only drinking water given them daily for a period of one month was the water taken from the aquarium containing the Characeous plant; the rats lived and were always well and in a healthy condition. No difference was noticed in the health of the rats after another month under the same conditions. The rats were then destroyed and post-mortem examination showed all internal organs to be in a healthy state.

To further test the water, I introduced fish, and they have lived and thrived for some months in the aquarium containing the *Nitella*; also slugs have been placed in the same water and are still alive.

To further demonstrate the harmlessness of water from any creek, tank, or pond in which *Nitella* grows, I have for the past two months been drinking two glasses daily of the water taken from the aquarium and have not noticed any ill effects therefrom.

The plant grows prolifically, reproduces freely, and is easily transplanted, also fresh growths may flourish until the whole bed of the creek becomes closely covered with the growth of the plant.

For ornamental ponds it can readily be used and should prove a boon to the users. From all my experiments I cannot speak too highly of the *Nitella phauloteles*, and I feel sure when my further experiments have been completed through this summer the plant will come into general use in the large lagoons and swamps which abound in the Greater Brisbane area and which now afford a breeding-ground for mosquitoes.

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