Plants Aid Man in War on Mosquitoes

Entomology

IF THEY WERE AS BIG as they feel: an ordinary mosquito, much magnified

By Frank Thone

Mosquito time will be upon us soon. The resounding slap will echo through the night, and the atmosphere will be blue with the smoke of smudge-fires—and mayhap also with the language of the tormented. Public health workers, disdaining such minor things as itching lumps on the skin, will be spreading oil or arsenic dust on ponds and swamps, and encouraging that helpful little larva-devouring minnow Gambusia to increase and multiply and possess the waters.

In this extensive and sometimes expensive warfare it is comforting to reflect that man has a number of allies, not only among the mosquito-devouring fishes and other animals, but among the humble and usually disregarded plants that live beneath the surface of the shallow waters where mosquitoes love to breed. In several far-away corners of the world live species of water-weeds that are foes of mosquitoes, and some of these are now being brought to the United States, to see whether they will be equally hostile to our own particular species of singing, stinging winged tormentors.

Perhaps the most promising of these mosquito-banning plants is an Australian species known to scientists as *Nitella phaulotes*. It hasn't any common English name, because so far nobody but scientists have had even an inkling of its importance, and hence it has gone virtually unnoticed. It isn't a very noticeable plant anyway. because it grows wholly under water, usually in such dense masses that the casual observer merely gets the impression of a waving, blurry bed of dark green, and lets it go at that.

If you plunge your arm into the water and haul up a few stems of Nitella, you will find them not unattractive objects. They get to be as much as a foot long, and consist of a slender, straw-like central axis or stalk, with whorls of short, pointed branches projecting star-fashion from each of its many joints. It has no leaves; these short branches serve the purpose instead. Other branches also may arise at these joints, and grow out into secondary stems which in their turn bear little stars of short branches like the parent stem.

Nitella, and the other plants of the group to which it belongs, are classed by botanists as among the humblest of the vegetable kingdom. They are known as algæ, and are relatives of the sea-weeds and the slimy scum that forms on stagnant ponds. Nitella and its relatives, however, are commonly rated as the highest algæ; they are the aristocrats of this lowly world.

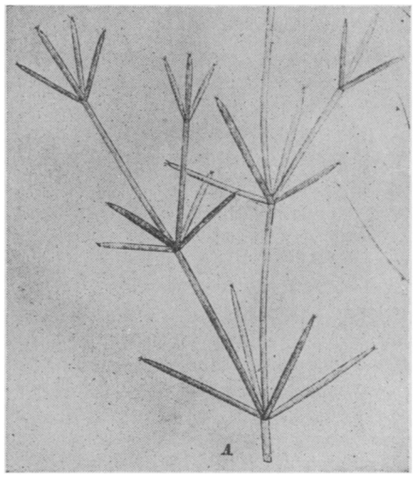
There are many species of Nitella, and they are spread all over the world, but the one most effective against mosquitoes has so far been studied only in Australia. E. W. I. Buhot, a scientist of Brisbane, found the plant growing under running water on the bottom of a creek, and when he noticed it later in stagnant water it was never seen floating at the surface. A green scum and a thin film resembling oil occurs on the water inhabited by this plant. The green scum was proved to be due to a bacterial growth, and the thin film to any oily secretion of the Nitella.

Mr. Buhot found that mosquitoes would not lay their eggs on the surface of the water where this plant grew, but the water was not harmful to either fish, mammals or human beings. The plant grows rapidly, reproduces freely, and is easily transplanted. It can be used on ornamental ponds. Mr. Buhot thinks that it will come into general use in the large lagoons and swamps of the Brisbane area, which breed swarms of mosquitoes to the great discomfort of the city's inhabitants.

Dr. L. O. Howard, who recently retired after many years as chief of the Bureau of Entomology, U. S. Department of Agriculture, has been greatly interested in mosquito problems generally, and has made especial efforts to get mosquito-killing plants introduced into this country. As a result of his interest, Prof. Robert Matheson of Cornell University has undertaken to experiment with Mr. Buhot's species, to learn whether it is adaptable to cultivation under American conditions. The region around Ithaca, N. Y., where Cornell University is situated, is especially suited for such an experiment, for Nitella and its relatives are lime-loving plants and the waters of that part of New York state are well charged with lime. Should the plant thrive here, and prove as effective against American mosquitoes as it is against their relatives in the antipodes, a very useful plant ally will have been recruited for the American anti-mosquito campaign.

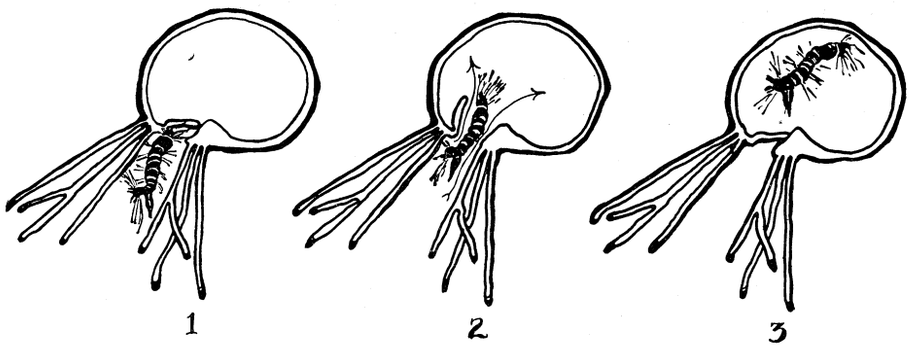
There are other species of Nitella, and of a related plant genus known as Chara, that seems to possess this mosquito-stopping power at least to a certain extent. T. P. Blow, a mosquito specialist working in Madagascar, found no less than three of these plants, one species of Nitella quite distinct from the Australian plant and two species of Chara, that seem to keep the water in their neighborhood clear of mosquito larvæ, or "wigglers" as we commonly call them. Professor Matheson has already tried out a third species of Chara in his experiments at Cornell, and obtained some rather promising results.

Of course, even if some or all of these mosquito-banning plants prove to be well adapted to use in America, that will not mean that the troubles of American mosquito fighters, both lay and profes- (*Turn to next page*)



BRANCH OF NITELLA, the humble aquatic plant whose oily secretion prevents mosquitoes from breeding on ponds where it grows

Plants Aid in Mosquito Fight—*Continued*



THE VANISHING WIGGLER: A Drama in Three Acts. 1: the larva approaches the Bladderwort's trap and feeds on the secreted "bait." 2: The trap is sprung, and the inrush of water carries the luckless larva inside. 3: "All hope abandon": captured and powerless to escape, the larva awaits death and digestion

sional, are at an end. So far as we know at present, Nitella and Chara will grow freely and develop their anti-mosquito properties fully only in limestone regions, so that the granite hills of New England and the sand-bottomed ponds and alluvial swamps of the South will have to look elsewhere for relief. But there is a vast deal of limestone country in America, so that the usefulness of these possible plant allies is not to be minimized.

These plants drive off mosquitoes by means of some substance poisonous or repellant to them; but there is another plant species, much higher in the botanical social scale, that actually traps and eats their luckless larvæ. This is the bladderwort, a floating aquatic plant that sends its bright, odd-shaped but attractive yellow flowers above the surface on short stalks. Nothing but these stalks and the flowers they bear emerges from the water; all the rest —the stems and the finely divided leaves—remains always beneath the surface.

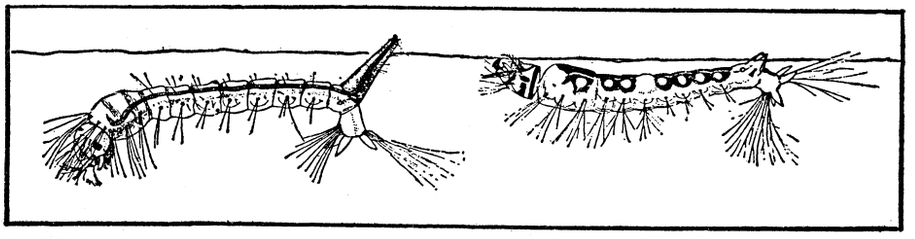
On these underwater stems each plant bears a number of the oddest structures one can find in the vegetable kingdom. They are hollow little bladders, partially or entirely filled with water. At one side there is a small round opening filled with a little trap-door or valve that opens inward.

This makes it easy for small creatures to enter, but impossible for them to leave, as perfect a trap as you could imagine. Larvæ of insects and other small water animals have often been found in these bladders, among them mosquito wigglers, and it has been assumed that they blundered into these natural traps more or less by accident, there to die and yield nourishment to the plant. But Dr. Howard now reports new information which he has received from F. Brocher, a careful French observer, which indicates that the plant actually snaps up its prey almost as with a shark-like mouth. The mosquito larvæ and other small aquatic animals are attracted to the bladders by a secretion of certain glands close to its opening. They gather round to feed on this bait, the valve then opens, and a slight current in the water caused by its opening sweeps them in through the waiting mouth—and they never come out any more. These observations have been confirmed by those of an English naturalist, C. L. Withycombe, so there seems to be no doubt of their reality. Just how many mosquito larvæ are destroyed in this way there is no present means of telling. but if the bladderwort accounts for only a few, it is to that extent a benefactor of the human race. Every wiggler that is engulfed by its underwater traps means one mosquito that will not live to lance a sensitive earlobe or bite a delicate ankle. And the total must be at least fairly respectable, for the bladderwort is one of the most widely distributed plants in the world. Almost every wayside pond can show a crop of them.

Way down on the Suwannee River, and on innumerable other streams and lakes of the South, there grows a plant immigrant from Africa that has come to be one of the greatest plant tests in Dixie. This is the water hyacinth. Originally cultivated for its spikes of bright blue or purple flowers, it has escaped and run wild and now threatens to close many Southern waters to navigation with its immense mats of spreading vegetation. But pest though it is, it appears to have one redeeming trait, for it has been observed that wherever it grows mosquitoes diminish in numbers. The plant itself seems to have no poisonous or repellant properties so far as the insects are concerned; its influence is indirect, through the harboring of other enemies of mosquitoes.

At first it was thought that these were numerous small predatory insects or crustaceans, but later evidence points to a fish, our old friend Gambusia, who has recently been given the highly honorable title of "mosquito fish." This voracious little minnow, whose favorite food is mosquito wigglers, finds among the dangling roots of the water hyacinth a safe refuge from bigger fish that would very willingly make a meal of him if they caught him in open water. So he and his wife and his friends congregate there, and since there are so many of them, and every one is always hungry anyway, every inch of water-surface is naturally searched and very few wigglers survive to become adult mosquitoes.

The most recent additions to the list of man's vegetable friends are certain plants of the clover family, which do not kill the mosquito but, it is claimed, kill the malaria parasites inside her. This suggestion came originally from Dr. F. d'Herelle, of bacteriophage fame, and is now supported by Sir William Willcocks, who has had long experience as an administrator in Egypt. Dr. d'Herelle called attention to the fact that in certain regions in the Argentine, which are free from malaria, there is an abundant wild plant, a scented clover, which (*Turn to Page* 349)



IF THE MOSQUITO "WIGGLER" sticks only his tail above water he is merely annoying . . . If both head and tail are out, he's a wicked malaria-carrier

Mosquitoes—*Continued*

flowers during the critical period of malaria, from the beginning of summer to the end of autumn. He states that the highly scented blossoms are frequented by the malaria mosquitoes, which feed on the nectar. This nectar contains coumarin, a sugar syrup. The contention is that coumarin plays a role in the mosquitoes comparable to that which quinine plays in man, and that in the insects it stops the development of the malarial plasmodium which the mosquito, therefore, can not transmit to man.

Sir William states that the regions in Egypt where there is abundant cultivation of clover are immune from malaria, and is an enthusiastic supporter of Dr. d'Herelle's "clover-quinine" theory. American students of the malaria-mosquito problem are still slightly skeptical about it. However, like good Missourians, they are willing to be shown; and should the theory be conclusively proven it would give additional good reason for the cultivation of clover crops in malaria-ridden regions.

In addition to the plants that destroy or discourage mosquitoes while they are alive, there are others that do good service in the hands of the human mosquito-fighting forces after they are dead. Pyrethrum powder, one of the commonest of commercial insect powders, consists of the dried flowerheads of a white, daisy-like chrysanthemum; it is much used in clearing houses and other buildings of the winged pests.

A more recent addition to the vegetable weapons in our anti-mosquito armory is the tropical plant Derris, which comes from the Philippines. The dried roots of this plant are powdered and dissolved in water where the mosquito larvæ swarm. Three parts of the powder weight to a thousand of water proved effective in clearing out the hated wigglers. Derris may come to be a useful addition to the oils and arsenical chemicals now used in clearing up infested ponds, swamps and reservoirs.

The files in Dr. Howard's office contain curious bits of mosquito information from all over the world. Some of the oddest bits are about animal enemies of these insect pests. In addition to our valiant little ally Gambusia, which has now been carried from its home in America to such distant lands as Italy, India, and Samoa there are listed a number of other top-feeding minnows, as well as certain kinds (*Turn to next page*)

Million-Volt "Cosmic" Rays

Physics

Extreme high-frequency X-rays, generated in a million-volt tube, are the next item of promise on the program at the California Institute of Technology. Allied to the investigation of the cosmic rays, which has recently yielded such interesting results, is the attempt, long under way at the Institute, at the artificial production of very short waves, and, therefore, very penetrating radiation. In the hands of C. C. Lauritsen and R. D. Bennett this work has already yielded some promising results.

As yet no apparatus can be devised for handling the terrific electric potential required for the artificial production of cosmic rays. For intermediate rays of about one-twenty-billionth of an inch wave-lengths, however, there seem to be experimental possibilities. Such rays are much shorter than the surgeon's X-rays and much more difficult to produce.

The X-ray "tube" used in the new work is several yards long, made in sections similar to the glass cylinders used in gasoline dispensing apparatus. Before operation all but one-billionth part of its air content is pumped out. A water-cooled anode raised to a potential of a million volts pulls electrons bodily and violently out of the nearby cathode by the application of the principle of "field currents" studied intensively for some years past at the Bridge Laboratory by Millikan, Eyring, and Lauritsen. Under this terrific (*Turn to next page*)

Seventeen-Year "Locusts" Appear

Entomology

The seventeen-year cicada, often called the seventeen-year locust, is booked to appear during early June through a wide stretch of territory east of the Alleghenies, from North Carolina up to the Hudson valley and the Long Island Sound region. In a few spots in the middle west, in southern Indiana and southern Michigan, it is also expected to emerge.

These remarkable insects, which are the longest-lived of all the six-legged hordes that crawl the earth, spend over sixteen years under ground, clinging to plant roots from which they suck their nourishment. Then, in the spring of the seventeenth year, they emerge from their burrows, shed their pupa cases, and spend a few weeks as fully developed adults, mating and depositing eggs to provide for the next generation.

During the four or five weeks of their above-ground existence the seventeen-year cicadas make their presence known by the incessant shrill song of the males. The chorus of millions of tiny saw-like voices is very disagreeable to many persons. The Pilgrim Fathers didn't like it. Governor Bradford spoke of it as "a constante yelling noyes, as made all ye (*Turn to next page*)

Red Light Shines Through Fog

Physics

A brilliant red arc light that makes use of the rare atmospheric gas neon, and which can shine through thick fog, has been developed at the Research Laboratory of the General Electric Company. The new lamp is the result of the work of Dr. Clifton G. Found, in collaboration with J. D. Forney, of the Cooper-Hewitt Electric Company, and has just been demonstrated by them to engineers.

Airplane landing fields will probably be among the first to make use of the lamp, for by outlining the fields with them aviators flying above through fog will be enabled to make a safe landing. Such an occurrence as that of Commander Byrd on his flight to Paris, when he actually flew over Le Bourget, but could not see to land, would probably be prevented.

Docks in harbors may also be marked with the lamp. According to Dr. Found, the light has been tested for this use when one was recently placed on a pier in the Hudson River. "Observations from boats during fog," he says, "have shown that it was possible to pick up the red neon light before any of the other lights in the same vicinity were observed."

Earlier forms of neon tubes, which give the characteristic red neon light that is now so common in advertising signs, suffer (*Turn to next page*)

Man-Made Cosmic Rays—*Continued*

force the electrons attain a speed very near to 186,000 miles per second, the velocity of light. Striking the anode at this enormous speed the electrons generate X-rays much like the gamma rays naturally emitted by radium.

In preliminary trials now being run in the high tension laboratory of the Institute, where a million-volts to ground at a thousand kilowatts is available to the experimenters, Messrs. Lauritsen and Bennett have succeeded in obtaining continuous operation of their new tube at voltages that have approached the million mark. The high-frequency rays produced were observable through the steel doors of the laboratory more than 100 feet away.

The physicists of the Institute make no pretense of any immediate project beyond an extension of spectrographic studies, long a part of Dr. Millikan's program. It is suspected, however, that these new and very difficult experiments are a preliminary skirmish in a further campaign on the nucleus of the atom. It is well-known that the gamma rays of radium are intimately connected with nuclear disintegration and transmutation of elements. The structure of the nucleus, to be sure, is a profound mystery, but there is plausible evidence of enormous forces connected therewith. Electrically the problem is one where voltage is counted in seven and eight figures. Economically the problem suggests fabulous power values as yet wholly within the domain of fancy.

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Seventeen-Year Locusts—*Continued*

woods ring of them and ready to deafe ye hearers."

The immense number of these rather large insects sometimes causes alarm, but they are really comparatively harmless. They feed very seldom or not at all, depending on the reserves accumulated during their long underground life. The principal mischief is caused when the females lay their eggs, which they deposit in furrows cut into the green bark of young twigs. This causes a temporary defoliation of many trees, but no permanent harm in the forests. It may be very damaging at times, however, in orchards and nurseries.

There are 17 "broods" of the seventeen-year cicada, distributed in various parts of the country. One brood comes out each year. The one emerging this year is designated as Brood II. Brood III, which is due in 1929, has its headquarters in the prairie states, especially Iowa. In addition to the seventeen-year species there is an allied thirteen-year form which ranges principally in the lower Mississippi region. This is divided into 13 broods, so that an outbreak of this insect also is to be expected somewhere in the South every year.

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Red Neon Arc—*Continued*

from what is called the "cathode drop." This is the great difference in voltage between the electrode through which the electric current enters the tube, and the nearby gas. On account of it, also, tubes must be operated with a high voltage, and must be made quite long in order to be efficient. Another disagreeable effect is that the gas is made to gradually disappear.

The new tube of Dr. Found and Forney heats the cathode, or the electrode through which the current enters the tube, by means of an additional electric circuit. This causes it to give off the electrons which cause the neon gas to glow, but without the high voltages that are needed in the older tubes. By such means an extremely efficient source of brilliant red light can be obtained. Light of this color is best for penetrating fog.

Another possible use of the lamp is in photography, especially in colors. The mercury vapor lamp, which gives a characteristically violet colored light, has often been used for ordinary photography, but the unnatural pallor which it causes is a disadvantage, especially where colors are concerned. By combining the neon light with the mercury vapor lamp, the former supplies the red rays which are lacking in the latter, and the result, said Dr. Found, is a good approximation to white light.

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Mosquitoes—*Continued*

of tadpoles and newts. Russia reports that one species of leech gobbles up mosquito larvæ most greedily. Many insects, including water bugs, beetles and certain kinds of flies, assist in the massacre. There are two or three genera of beneficial mosquitoes recorded, whose carnivorous larvæ make cannibal feasts out of the larvæ of other species of mosquitoes. Two new tropical forms of these have been reported within the past year. From Russia again comes the astonishing statement that mosquitoes have been seen feeding on lice and bedbugs, thus getting their ration of human blood at second hand, but incidentally also killing other insect foes of man!

Yet, in spite of all the help we get from our plant and animal allies, and of all our efforts on our own behalf with oil and arsenicals and other poisons, the war with the mosquito hosts is by no means near a victorious end. Years of battle with the buzzing, biting, disease-bearing pests are still ahead.

"I understand," says Dr. Howard gravely, "that before he lost his money, the great philanthropist, Andrew Gump, offered a reward of fifty million dollars for the last mosquito. In spite, however, of the wonderful anti-mosquito work that is going on, I have an idea that any one of us, however modest his financial condition, would be fairly safe in adding a hundred millions more to this apparently generous sum offered by Mr. Gump."

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Howling monkeys have such extraordinary vocal abilities that many zoos refuse to keep them because they disturb the other animals.

The grocery bill for the London Zoo last year included seven tons of apples, two tons of grapes, 175,000 bananas and 32 tons of potatoes.

Bulgarian rose growers who sowed their fields with tobacco after the World War are returning to the production of rose oil for the perfume trade.

Although the number of apple trees in this country is declining, the output per tree is increasing sufficiently so that the apple crop is larger than ever.

About 95 per cent. of the whale oil used in this country goes into soap.