A Remedy for the Mosquito Evil.

PRESS BULLETIN No. 15.

University Experiment Station.

MAY 24, 1902.

Mosquitoes at home: *a*, larvæ; *b*, pupæ; *c*, adult leaving pupal skin; *d*, female depositing egg; *e*, male. Greatly enlarged.

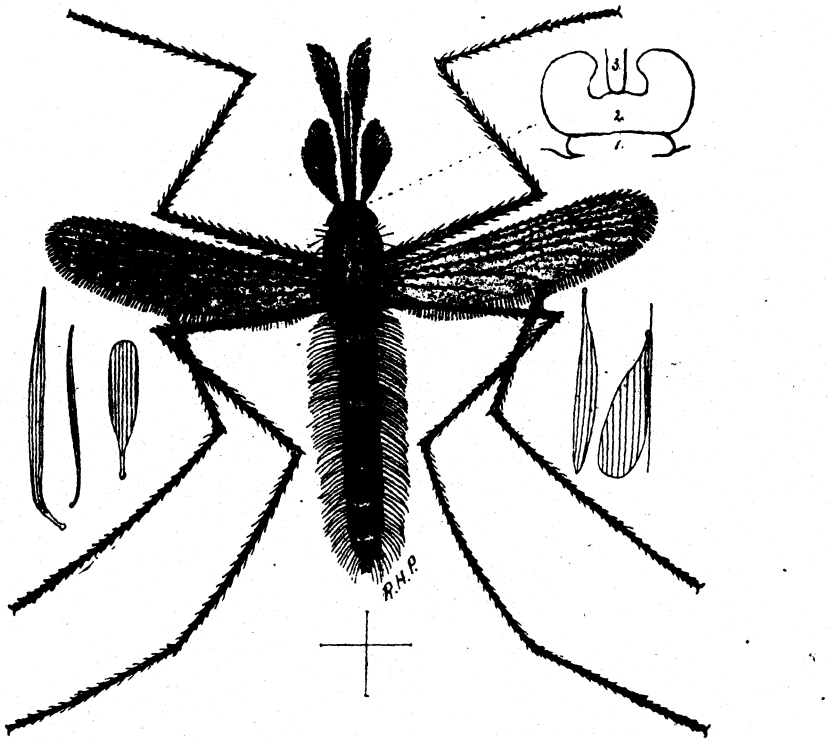
It has been suggested, in view of the need of immediate and general information of this kind, that the Entomologist issue a press bulletin showing how the mosquito evil can be greatly lessened in the vicinity of homes with comparatively slight expense and with but little labor. A preliminary account of the life history of this pest is necessary in order to appreciate the method of treatment. In the United States at least 25 species of mosquitoes are known, and there are probably many more species yet to be described. Of these 25 species four have been reported as occurring in Minnesota. It is not within the province of this bulletin to treat of the different varieties found here, viz: *Culex consobrinus*, *Culex impiger*, *Anopheles quadrumaculata*, *Culex pungens*, the latter being without doubt the most abundant and most troublesome; its life history represents practically the œcology of all species and hence is given.

A proportion of the adults hibernate in protected situations, cellars, stables, rubbish heaps, under planks, in stone piles, in garrets, &c., emerging as soon as the warm weather of spring arrives, and, mating, at once proceed to lay their eggs.

On May 19th and 20th of the present year the writer found a few mosquito larvæ or "wigglers" in protected situations and also a large number of adult mosquitoes, along the edge of a slough near St. Anthony Park, showing the need of immediate action. It is a well known fact also that in midwinter even, a period of mild weather will entice the insects from the secure retreats where they are hibernating.

The eggs are laid during the night or early morning hours upon the surface of water which contains more or less organic matter and which is so situated as not to be readily disturbed by the wind. The egg masses are black, sometimes resembling a small boat in shape, sometimes however quite irregular in outline, and each mass contains from 200 to 400 eggs. In from 16 hours to three or four days after being laid, the time depending upon the temperature, the eggs hatch, each one producing a so-called "wiggler" referred to above, familiar objects in barrels of rain water, and in fact in all stagnant water out-of-doors during the spring and summer. The life of the wiggler or larvæ lasts for seven

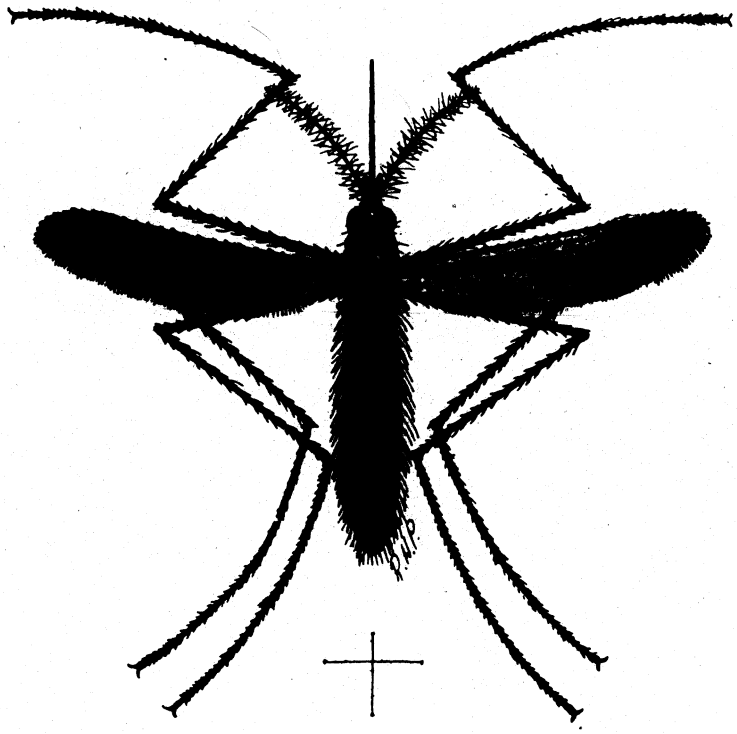
or eight days, or even longer under some conditions, at the expiration of which time it changes into a less active form called the "pupa." The illustrations accompanying this report will serve to explain the appearance of these different stages in the life history of the insect. In about ten days the pupal skin splits and the perfect mosquito emerges ready to begin a life which may be for it full of pleasure, but which brings much annoyance and discomfort to man. There are several generations in the course of a year.



Mosquito, male; showing also scales and section through ear. Greatly enlarged.

It may be some cause for complacency on the part of man to learn that it is only the female mosquito which does the biting,—"the woman, she did it" is as true here as it has been proverbially true from time immemorial; the mouth parts of the male mosquito are not adapted to blood sucking and he, like the male of the human family, leads a blameless existence, passing his time in swampy places, living possibly on malarial atmosphere and doubtless composing love sonnets to his more blood-thirsty mate. It is interesting to

learn, however, that this pest must not necessarily feed upon warm blood. They have been observed puncturing dead fish and hovering about turtles when the latter were on land. They appear to have a special predeliction for beer and wine, and have been kept alive for some time on slices of bananna. Evidence in the possession of entomologists points strongly to the probability that all mosquitoes were originally vegetable feeders and that the blood-sucking habit is an acquired one. Like other insects they are at times attacked by fungus diseases which must lessen their numbers, but hardly to an appreciable extent.

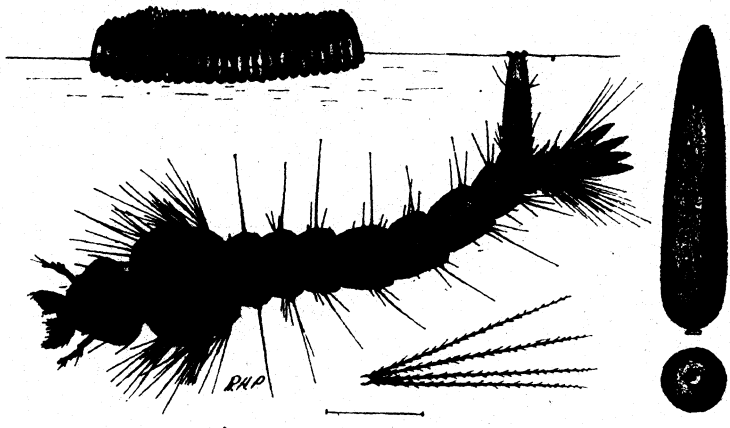


Female mosquito, greatly enlarged.

To show what an enormous number of mosquitoes may come from a small amount of water, the writer quotes statistics from a bulletin of the late Otto Lugger, who in 1896 estimated the number of mosquitoes in two barrels of rain water in the vicinity of a farm house. Upon "July 6th the water in one barrel was filtered. It contained 35 grams of mosquitoes, each gram by count numbering 217, hence 35x

217=7595 larvæ and pupæ. Besides this 32 egg masses, each containing on an average 302 eggs, were found, which would hatch (all conditions being favorable) into 302x32-=9,664 mosquitos. Total number of eggs, larvæ and pupæ 17,259. July 22nd, 1896, by a similar process 19,110 mosquitoes were counted." The words in parenthesis are the writer's. Just think of it, an average of 18,000 mosquitoes, eliminating all conditions unfavorable to the life of the insect, from each barrel of rain water in the vicinity of a farm house or other residence!

In view of this statement it is comforting to know that we have at our disposal a preventative both cheap and easily applied. This agent is kerosene, and its use is based upon the fact that the larvæ and pupæ, although living in the water are air-breathing animals and obtain air at the surface of the water. Further, the eggs are laid upon the surface, and the female mosquito, in egg-laying, rests upon the surface. A glance at the illustration of the larval mosquito shows a tube near the posterior end of the body, and every observer has noted how the "wigglers" come to the surface frequently, while the pupæ, whose breathing tubes are nearer the head (see illustration) remain at the surface quite constantly.



Mosquito larva and eggs; also a single egg, greatly enlarged.

It has been found that kerosene allowed to spread over the surface of stagnant pools, ditches, and the like, in the proportion of 1 oz. to every 15 square feet, will not only kill all the larvæ, pupæ and eggs in the water treated, but is

fatal to the adult mosquito whose instinct prompts her to oviposit on the surface, in spite of the presence of kerosene. The oil may be simply poured upon the water, preferably upon the windward side and allowed to spread, or it may be sprayed. An objection to spraying is the fact that some oil is wasted, and that vegetation is unnecessarily killed. Under some circumstances, however, spraying is certainly the best method, as in the case of low, hummocky land, with water in innumerable small holes all over the field. Here it would be manifestly a herculean task to pour oil in each hole, and a spray is resorted to as the best and quickest method, new vegetation quickly taking the place of that killed by the oil. How often should one apply the oil? This is a question for which no reliable data appear as an answer, and will be the subject of study in some experiments now being conducted by the writer at St. Anthony Park. Prof. L. O. Howard, U. S. Entomologist, who has probably done more in this line than any one, and who has recently published a book on mosquitos, says that one application every four weeks during the summer is sufficient. It would seem that this is a matter easily determined by observation, for as long as the film of oil can be seen on the surface, no further treatment is necessary, and the volatility of the oil must be dependent in a great measure upon meteorological conditions.

I believe that a more frequent application, perhaps once in three weeks, is safer in this vicinity, but this point, as said above, can be readily decided by observation, and will be the subject of further reports from this department later. One or two spoonfuls of kerosene poured upon each of the two barrels of rain water, mentioned above, would have killed all the mosquitos enumerated.

Mosquito pupa greatly enlarged.

As to the date of first application that too is easily determined by observation. As soon as "wigglers" are first seen, or even earlier, when the adult mosquitos are noted about the water, preparing to lay their eggs, then the oil should be applied. It is claimed that this method can be used with safety in the case of large tanks, the water in which is intended for

drinking purposes; provided, the water is drawn from the bottom of the tank.

It is very evident that there must be co-operation in this work, for it would profit but little if one citizen should treat all the stagnant water upon his place, while his neighbor across the fence leaves untouched pools and ditches capable of producing millions of mosquitoes. Further, inasmuch as only ten or eleven days elapse, as a rule, between the laying of the eggs and the emergence of the mosquito, another source of infection must not be overlooked. To emphasize this I will enumerate some of the places which afford breeding places for this pest; drains, ditches, ponds, puddles, post holes, depressions under sidewalks, watering troughs where the water remains unchanged for some time, muddy holes about watering troughs, marshy places in meadows, uncovered water tanks, fountain basins where the use of the fountain is not constant enough to keep the water in motion and renewed, *old basins*, *tin cans*, *bottles*, *etc.*, in rubbish heaps. It is the latter to which I wish to call particular attention; a rusty wash basin, or a *broken bowl* or an old coffee pot lying unnoticed under a bush, may, if each contains but a pint or two of water, be the source of hundreds of mosquitoes.

It is evident then that the work must be most thorough and that a community must cooperate in order to secure best results. Under the most favorable conditions of treatment, some breeding places will be overlooked, so that one can hardly expect complete immunity. One town, Winchester, Va., is reported to have an ordinance requiring all property owners to use kerosene on drains and stagnant pools in summer.

The most effective and most permanent means of relief is to drain, or fill, or both, marshy spots, ponds and sloughs which are the breeding places of the mosquito. This is not always practicable or possible. The introduction of fish into ponds and lakes affords a means of lessening the evil for fish feed upon the larvæ and pupæ.

For freeing bed chambers of these pests when in spite of screens a few obtain an entrance, the writer well remembers a process in common use in his boyhood. The round cover

of a tin box was tacked to the end of a broomstick, forming a shallow cup into which a little kerosene was poured. Every night before retiring a search was made for mosquitoes and as soon as one was discovered upon the ceiling, it was promptly "cupped" by bringing the shallow tin cover quickly over the insect and holding it against the ceiling a moment until the mosquito succumbed. Not until every mosquito in the room had been "cupped" was the occupant sure of undisturbed rest.

Many ointments and compounds for face and hands are on the market intended by their application to repel the mosquito. Some of these concoctions are about as unpleasant as the bite itself. One recommended is as follows: Olive oil 3 parts, oil of pennyroyal 2 parts, glycerine 1 part, ammonia 1 part.

A very weak wash containing ammonia will generally relieve the pain and itching caused by the bite.

The illustrations used in this bulletin are taken from a report of my predecessor, the late Prof. Lugger. The writer claims no originality in the publication, the information contained herein having been obtained from various sources, and the excuse for the publication is found in the fact, that there is a call for immediate information of this nature which will enable citizens in mosquito infested portions to obtain relief. As stated above, L. O. Howard, of Washington, D. C., has done more work than any one in the U. S. on this subject, having found in 1867 that kerosene would kill the larva, but beyond confirmation of certain important details, Mr. Howard himself does not claim to be the originator of the method. The use of kerosene in this connection is reported as early as 1847 and was suggested apparently as early as 1812.

Copies of this bulletin will be sent to any citizen requesting the same.

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Entomologist.