THE EYE GNAT PROBLEM

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Everyone who has been annoyed by the common eye gnat of the southern United States will agree that this insect *(Hippelates pusio)* is a problem in itself. For a pest which does not sting and whose beak can only rasp human flesh, it torments man out of proportion to its often tremendous numbers. Sometimes there is only one gnat buzzing around the head like a mosquito or lighting on an eyelid, but often it is a whole swarm effectively preventing any consecutive effort unless one hand can be used to fan the face.

The eye gnat is also a problem from the viewpoint of disease, for it appears to transmit a severe conjunctivitis, commonly known as sore eyes, which occurs in the same geographical area. Recent studies of this disease by Drs. Dorland J. Davis and Margaret Pittman of the National Institutes of Health show that it probably is caused by a single species of bacteria. Whether the gnat is an important carrier of this organism remains to be determined. Certainly the habits of the adult gnats suggest that they might be vectors of an eye disease because they commonly feed on the moist secretions of the eye. They also are attracted by sweat, open cuts and sores, and various animal secretions. It is not known whether some odor or group of odors draws them to these different sources of food, or whether there is a visual response to glistening objects.

Fortunately, the eye gnat is usually troublesome outdoors only. Though it is less common in houses, this fact does not appear to have any particular relation to the kind or condition of the screening. When gnats are abundant, one has only to open a can of sardines or try to shuck shrimp to find that they soon will be swarming over the food. The ability of gnats to pass through tiny openings can be demonstrated by placing them in a jar covered with fine screening and directing the jar toward light. In one test lasting 5 minutes, four-fifths of the enclosed gnats escaped through wire mesh with 20 openings to the inch. Ordinary house screening has 14 or 16.

If one cannot avoid the swarms of gnats by going indoors, the newer types of mosquito repellent are helpful in keeping them at a distance. These liquids will cause a severe smarting if they get in the eyes, and this misfortune is all the more likely when one is hot and perspiring and the gnats are really bad.

In regions where the gnats are abundant, it is well known that they are not troublesome in a breeze. No one knows exactly where they go, but on a windy day the swarms often vanish so completely it is hard to realize that they will reappear when the wind dies down. Because of this response to the motion of air, fans (either electric or hand-operated) are very useful in gnat-infested areas.

The shade, when the weather is cool, or the sun, when the weather is extremely hot, sometimes affords refuge from the gnats. If all known measures fail, the only other source of relief is nightfall. Then, just as on windy days, the gnats disappear.

Most of these facts about the eye gnat are common knowledge, but there are others about its early history which probably would not have been discovered if it were not such a pest. The larvae of some members of the same family (Chloropidae) feed in or about the stems of grasses, for example, the well-known wheat-stem maggot (*Meromyza americana*). Others appear to live as scavengers in decaying parts of plants. The genus of the common eye gnat, however, seems to prefer organic matter in an advanced state of decomposition. By rearing eggs laid by caged females, Dr. David G. Hall, working in California, obtained the largest percentage of adults from human excrement, though well-rotted figs and oranges were nearly as favorable. He found that fermenting media were not so advantageous, and considered fecal pollution an important factor.

Taking a different line of attack, John T. Bigham, in Florida, sought to discover what type of habitat produced the most gnats. He used emer-

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gence traps a foot high and a yard square which were covered with light canvas and had a fruit jar inserted in one corner. The object of the fruit jar was to catch those gnats which, having come from the ground, would be trapped by their tendency to move toward light. Sixty-nine settings of these traps were made over grass and weed sod, leaf mold, rotting fruit or vegetables, duff in pine woods, and other situations where the soil had not been disturbed by plowing, harrowing, digging, or other procedures. No gnats were recovered in any of these places. Over four hundred other settings were made where the soil had been disturbed in some way, usually by agricultural practices. These produced an average of 24 gnats per setting. Following this lead, Bigham set emergence traps over plowed soils at different intervals after the plowing, and found that most of the eye gnats were produced in 3 to 6 weeks, also that few or no eggs were laid after 1 week. It appeared that most of the eggs were laid within a few hours after the plowing.

To locate areas of eye gnat infestation, Bigham and others have made wide use of another kind of trap which attracts adult gnats with the odor of decayed liver. The bait is placed in a dark shelter, and the gnats are caught in a glass jar placed at the top, which operates as a collecting device just as in the emergence trap. In 1938, Bigham operated liver-baited traps of this type in numerous localities in Alabama, Georgia, and Florida. His results indicated that the abundance of gnats is closely related to the amount of sandy or muck land under active cultivation. Similar observations had been made previously by R. W. Burgess in California. Thus it seems reasonable to believe that the soil-inhabiting larvae feed on organic matter which has been made accessible by cultivation.

The various studies of eye gnats made up to the present time have not been confined to obtaining information on their life history or examining their relation to the prevalence of conjunctivitis. Much work has been done on methods of control, but without the discovery of any completely satisfactory or economical means of reducing their numbers. Traps baited with decayed liver will catch eye gnats by the thousands, and have been recommended for use in small areas such as around houses. Space spraying with insecticides has been given numerous trials, but regardless of any immediate success it does not produce lasting results. Besides these measures against the adult gnats, experiments have been made with soil poisons and with special methods of cultivation directed against the larvae. It has been found that in areas where subirrigation is used, flooding will completely prevent gnat breeding. To date, however, no single measure has been proved universally effective.

Nevertheless, because of the suggestive relation of eye gnats to the spread of conjunctivitis in the southern United States, as well as the great loss of time and effort caused by their annoying habits, further studies of eye gnats and conjunctivitis now are being conducted at the CDC Activities Station in Thomasville, Ga.

The first objective of the entomological work is to study the life history and habits of the gnat in the hope of uncovering new information leading to the development of feasible and economical measures for its control. One of the big gaps in our present knowledge is the question of where the adult gnat rests at night and during cold or windy weather. In this connection it is interesting to recall that, whereas anopheline mosquitoes once were controlled commonly by larviciding, DDT has made it more practical to kill adults in their natural resting places. Other unknowns in the biology of the gnat are the precise conditions necessary for oviposition and the food requirements of the larvae. Thoughtful investigation of such questions ultimately may suggest control methods unsuspected at the present time.

The second entomological objective is, briefly, to devise methods for measuring populations of gnats and making reliable indexes thereto. This will have a double purpose: to evaluate measures which are being tested or used for control, and to provide data for epidemiological studies and evaluations regarding conjunctivitis. At present the standard method of sampling adult populations is to operate traps baited with liver and to compare the resulting catches. Such collections vary greatly in size, partly as a result of meteorologic conditions. Other factors are probably involved, such as lack of uniformity in the bait, and the possibility that the traps reduce the numbers of gnats to such an extent that they are no longer merely sampling the population.

Another aspect of this part of the investigation is the determination of the numbers of larvae occurring in the soil, and the relation of larval abundance to adult prevalence in respect to both time and place. At present there seems to be no

practical method for counting the larvae in samples of soil.

Finally, when promising leads on control procedures have been determined and have proved their value in small-scale tests, the entomological phase of the project will undertake to control gnats in one or more towns severely affected by conjunctivitis. In this way it will be possible to study the effect of a reduced population of eye gnats upon the incidence of sore eyes. This is preferable to evaluating the incidence of conjunctivitis in terms of natural populations of eye gnats because it is an experimental method which can be employed in different places and at different times, and begun or discontinued at will.

Though it is surprising that a pest as common as the eye gnat has failed thus far to yield to the efforts made by entomologists to find an effective means of control, there is hope for the future in the fact that there are still many facets of its life history which are unknown. Man's experience with other insects which formerly were considered inevitable should offer encouragement both to those who still endure eye gnats and those who are trying to do something about them.

ANIMAL CONJUNCTIVITIS

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Whenever infectious conjunctivitis is considered in either human or animal medicine, the infective agent predominately present is the *Hemophilus* organism known in human medicine as the Koch-Weeks bacillus. From fowl coryza to pinkeye of humans, and whether the symptoms are primarily systemic as in equine influenza or more localized as in pinkeye of cattle, the gram-negative, small, rod-shaped bacillus is usually present in the early stages as an early secondary invader. Later, other secondary invaders change the picture from acute to chronic keratoconjunctivitis. The work of Reid and Anigstein (1945) and of Farley, Kliewer, Pearson, and Foote (1950) clearly indicates the role the *Hemophilus* organism plays in affecting the economy of the livestock industry. The disease always has been a serious problem in Texas in cattle, sheep, and goats, particularly in white-faced cattle. The white hairs reflect the ultraviolet rays of the sun into the eye, increasing the photophobia always present in pinkeye. The effect is similar to snow blindness in man. Some stockmen are endeavoring to develop cattle with a dark pigmentation around the eye. Even in dairy cattle, pinkeye is more serious in the white animals. Every Texas veterinarian knows that in middle to late summer he can expect many cases of pinkeye, although it can occur at any time of the year. The hot Texas sun, and dust and wind are physical factors influencing its prevalence and severity. The practicing veterinarian will describe the disease symptoms as unilateral or bilateral photophobia, lacrimation, opacity of the cornea, in some cases protrusion of the cornea, vascular congestion, and mucopurulent discharge. The acute stage lasts about 3 days. The spread of the disease is by direct or indirect contact, although some insects are thought to be mechanical carriers.

The veterinarian has a different problem with beef than with dairy cattle. In beef cattle, it may be more desirable to provide shade, food, and water, and not handle the animals – isolation in a fly-proof, shady place being more effective than treatment. Shade is essential if the disease is not to progress into the chronic form, with loss of the eyesight after rupture of the eyeball. Attacks of the disease always are increased greatly in severity where shade is lacking.

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