SOME ENTOMOLOGICAL ASPECTS OF A FLOOD EMERGENCY

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From time to time persons charged with mosquito control planning are faced with the problem of establishing an emergency program to abate the hordes of mosquitoes occasioned by a flood. Often the communities involved have not conducted routine mosquito control nor is information available on the mosquito fauna. Consequently, when entomological information is available from a flood site, it seems desirable to pass it on to others who may face a similar problem.

The city involved in the mid-summer flood emergency which provides the subject of this paper was Great Bend, Kansas. It is a city of about 11,000 population located near the center of the state in the broad, flat flood plain of the Arkansas River. Great Bend is bordered on the south by the Arkansas River and on the north by Walnut Creek. Walnut Creek has two branches, Dry Walnut, at the north edge of the city and Wet Walnut, two to three miles north of the city.

The flood involved both branches of Walnut Creek although Dry Walnut was the principal contributor to the inundation of the city. The flooded area was principally grassland. The Arkansas River, fortunately, stayed within its banks although it lacked only two inches of overflowing. Had the Arkansas overflowed along with Walnut Creek, the entire city would have been inundated.

We have been engaged in Kansas in surveying the mosquito fauna in our principal river basins. One of our light traps had been placed near the southern city limits of Great Bend approximately six weeks before the flood. It was operated nightly throughout the flood and for nearly two months after the recession of the waters.

Mosquitoes were rather scarce throughout June and July. Almost all of the specimens collected were *Culex tarsalis,* a common mosquito in the general area. During the last week in July, heavy rains fell and at the end of the month the flood occurred. About seven days later the trap catches increased abruptly as did mosquito annoyance. The flood waters subsided from the city during this period, but the area between Wet and Dry Walnut Creeks remained inundated until near the end of August. A large part of the catches remained *Culex tarsalis* although *Aedes vexans, Aedes dorsalis* and *Psorophora signipennis* occurred in significant numbers. Two weeks after the flood, the trap catches increased abruptly. The highest post-flood catch was more than two hundred times greater than the average catch for the pre-flood period.

At this point control measures were undertaken. The control consisted of fogging the entire city in one night with 5 per cent DDT in oil. The equipment used was a TIFA fog generator. This operation resulted in an overnight reduction in trap catches of about 80 per cent. This level of control persisted for four days. The fogging was then repeated and a satisfactory reduction was again achieved. Although it is fortunate that the fogging was effective, it seriously interfered with the data from the standpoint of observing how long the outbreak would have lasted in the absence of control.

It may be noted that throughout the flood period the bulk of the mosquitoes were *Culex tarsalis.* Night biting collections supported the evidence of the light trap in this particular. After the recession of the flood *tarsalis* declined in numbers. Several species of *Aedes* and *Psorophora* and *Culex quinquefasciatus* and *pipiens* became the predominant mosquitoes. *Anopheles quadrimaculatus* first appeared in early September, but never reached significant numbers. Prior to the flood only four species had been collected. During the height of the post flood outbreak, twelve species occurred. Most of the newcomers were *Aedes* and *Psorophora.* Nearly all of these species persisted for the remainder of the active breeding season, appearing graphically as regularly spaced peaks about a week apart. During the entire season, sixteen species were collected. These include six species of *Culex,* two of *Anopheles* and four each of *Aedes* and *Psorophora.*

In attempting to draw conclusions from the light trap records, the following generalizations might be mentioned:

1. The tremendous expanses of potential breeding areas provided by floods can result in abnormal numbers of mosquitoes.
2. The variety of ecological situations provided by flooding and the subsequent recession of the water increases the number of species encountered. The components of the fauna undergo progressive change as the water recedes and new ecological situations are created.
3. If the predominant preflood species is capable of breeding under the ecological conditions presented by flooding, it will continue to be predominant during the flood period. *Culex tarsalis* is, of course, readily adaptable to breeding under flood conditions.
4. Peaks, or waves, of mosquito abundance may occur regularly for some time after the highest peak of mosquito abundance. These peaks are spaced approximately the length of a mosquito generation apart. Apparently these are reflections of the principal peak.
5. Effective emergency control can be obtained by city-wide fogging. This control is temporary and must be repeated if satisfactory levels of mosquito abundance are to be maintained.

STRIP SPRAYING BY HELICOPTER TO CONTROL BLACKFLY LARVAE

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Investigations in many areas have confirmed the reports of Fairchild and Barreda (1945) that DDT will control blackfly larvae. Gjullin *et al.* (1949) showed that DDT and a number of other insecticides were effective when applied to Alaskan streams with various types of ground equipment and by aerial applications. Hocking *et al.* (1949, 1950) working in Churchill, Canada, showed similar results. Other workers (Kindler and Regan, 1949; Hocking, 1950; and Goulding and Deonier, 1950) have also obtained good results with various formulations of DDT and other new organic insecticides. The earlier aerial spray data were obtained largely from plots originally laid out and used for mosquito control experiments or for forest insect control (*e.g.* gypsy moth), or from selected sectors of streams sprayed for blackfly control. Arnason *et al.* (1949) in Canada obtained complete control for 17 miles downstream when a large amount of DDT was applied across one sector of the Saskatchewan River.

From the information cited it would appear that it should be possible to

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