OPERATIONAL AND SCIENTIFIC NOTES

DRAGONFLIES VERSUS MOSQUITOES AGAIN

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Many observations of insect behaviour lie buried in books the titles of which give no hint of such content, a fact well-known to all bibliographers although quite lost upon the computer. I recently chanced across one such lost gem while looking through the protozoologist Saville-Kent's copy of the second edition of "The Naturalist in La Plata" (Hudson, 1892). Chapter X of this work by the distinguished field naturalist is entitled "Mosquitoes and Parasite Problems." While balked of a pre-Ross malaria transmission hypothesis (the problems in question concern ticks, fleas and hippoboscids), I found some thought-provoking comments on dragonflies as enemies of adult mosquitoes and, presumably, blackflies, in Hudson's self-styled "parish of Selborne," the Argentine pampas.

The Chapter begins: "There cannot be a doubt that some animals possess an instinctive knowledge of their enemies—or, at all events, of some of their enemies—though I do not believe that this faculty is so common as many naturalists imagine. The most striking example I am acquainted with is seen in gnats or mosquitoes, and in the minute South American sandflies (Simulia), when a dragon-fly appears in a place where they are holding their aërial pastimes. The sudden appearance of a ghost among human revellers could not produce a greater panic. . . . We know that the presence of this noble insect will cause the clouds of stinging gnats and flies, which make life a burden, to vanish like smoke.

"When a flight of dragon-flies passes over the country many remain along the route, as I have said, sheltering themselves wherever trees occur; and, after the storm blows over, these strangers and stragglers remain for some days hawking for prey in the neighbourhood. . . . It is then remarked that gnats and sandflies apparently cease to exist, even in places where they have been most abundant. They have not been devoured by the dragon-flies, which are perhaps very few in number; they have simply got out of the way, and will remain in close concealment until their enemies take their departure, or have all been devoured by martins, tyrant birds, and the big robber-flies or devil's dykes—no name is bad enough for them—of the family Asilidae. . . . When riding over the pampas on a hot still day, with a pertinacious cloud of gnats or sandflies hovering just above my head and keeping me company for miles, I have always devoutly wished for a stray dragon-fly to show himself. Frequently the wish has been fulfilled, the dragon-fly, apparently 'sagacious of his quarry from afar,' sweeping straight at his prey, and instantly, as if by miracle, the stinging rain has ceased and the noxious cloud vanished from overhead, to be re-formed no more. This has always seemed very extraordinary to me; for in other matters gnats do not appear to possess even that proverbial small dose of intellect for which we give most insects credit . . . I suppose that for centuries mosquitoes have . . . been brushed and beaten away with hands and with tails, without learning caution. It is not in their knowledge that there are hands and tails. A large animal is simply a field on which they confidently settle to feed, sounding shrill flourishes on their little trumpets to show how fearless they are. But the dragon-fly is very ancient on the earth, and if, during the Devonian epoch, when it existed, it preyed on some blood-sucking insect from which our Culicidae have come, then these stupid little insects have certainly had ample time in which to learn well at least one lesson."

Interestingly enough, a similar observation had been made in Dakota a few years prior to this and to Wounded Knee. For referring to the summer of 1885 when he was on duty at Fort Abraham Lincoln, Captain C. N. B. Macauley mentioned that old-timers in that area had referred to its being "almost worth a man's life to attempt to walk up to Fort McKean . . . not so much from the Sioux, as from what they (the officers) termed the Sioux's allies—the mosquitoes." (Lamborn, 1890). Captain Macauley quoted his friend Lieutenant H. O. S. Heistand as having seen thick clouds of mosquitoes at Camp Poplar River, Montana, "disappear as if by magic" on the appearance of formations of "a species of devil's darning needle' or dragon fly, of rather a large size."

Whether or not the inferences drawn from the observations cited are valid, that Hudson should have spoken of a "miracle" and Lieutenant Heistand of "magic" suggests a rather dramatic avoidance reaction on the part of obviously large numbers of mosquitoes. Also, Dr. E. A. Mearus and Mr. W. Beutenmüller respectively are quoted in Lamborn (1890) for the information that (at Fort Snelling, Minnesota) "the mosquitoes actually diminish in the presence of the dragon flies" and that when the latter appear in great numbers "the mosquito disappears before them." Is this really true, and if so, why? Sound and sudden air displacement are possible alarm stimuli, but what about pheromones, too? Is there in fact a dragon-fly pheromone, or some other substance which "warns off" mosquitoes—and even, we would hope, blackflies? And if there is, won't somebody

chemically inclined please try analyzing for it, and synthesizing it as the basis for a biting fly repellent that really works?

References

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Lamborn, R. H. 1890. Dragon-flies *vs.* mosquitoes. Can the mosquito pest be mitigated? Appleton, New York pp. 202.

AN EFFECTIVE FILTER FOR ULV APPLICATION OF MALATHION [1]

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The use of the Beecomist spray head (Model 275) presented a serious problem in experimental ULV malathion applications in New Jersey in the fall of 1970 and the summer of 1971. The greatest amount of material that could be applied before either the aircraft's filter (100 mesh) or the sintered metal sleeve (20 microns) of the Beecomists clogged up was approximately 25 gallons. This blockage was apparently caused by water-soluble salts in the malathion, and even material which had been filtered through a 5-micron element by American Cyanamid could not be utilized since it had been pumped back into the original drums in which there were enough residual salts to contaminate the filtered material. Thus, in order to eliminate any chance of contamination, we would have to pump the filtered malathion directly into the containers in the aircraft, an operation which indicated a portable unit.

For the design of the filtration system (Fig. 1), we established four criteria: (1) ease of operation in changing filter elements and in directing the flow of liquid, (2) cleanliness in operation, (3) variability in degrees of filtering efficiency, and (4) compactness for ease of moving. For pumping the malathion, we already had experience with the Hypro roller pump (Rupp, 1970), and this unit plus a ⅓-hp electric motor provided a compact system (Cardinal 1/3MSN 4100C) for moving the material from the drum to the plane. The use of a small motor generator takes this unit from the hangar to the field for servicing aircraft. Initially we installed a 100-mesh line strainer as protection for the nylon pump rollers; however, the salts clogged this strainer so frequently that we spent more time washing it out than changing filter elements. For field loading of aircraft, this was unacceptable; the strainer was removed.

Since we were not concerned about corrosion, we used ¾-inch galvanized pipe with brass valves (Consolidated Brass, "Apollo"TM 70-104-01) and fittings. For the hoses between the drum and the pump and the filters and the containers in the aircraft, we employed clear vinyl tubing so that we could tell when the hoses were completely drained.

Having determined that our operation required a portable field unit, a further consideration became evident; we would need two filters in the unit so that delays for changing filters while servicing the aircraft could be avoided. The first of the two filters we tried was a Purolator PR81-5. This was a duplex filter with one degree of filtration, 5 microns. Although it was a self-contained unit, which meant less plumbing, removal of the element was not as simple as could be desired, an important factor especially when the element had to be changed after filtering each drum of malathion.

The second filter, a Purolator P192-01, was a single unit and required more plumbing than the PR81-5 to make up into the desired 2-filter unit. Elements for this filter are available in 4 degrees of filtration—2, 5, 10, and 25 microns—and are more easily changed than those of the PR81-5. We modified this filter by replacing the original drain plug with a pipe shut-off (Weatherhead 6825) and a 2-inch nipple for more sanitary draining of the filter when changing elements. Another alteration of the original filter involved replacing the standard 15/20 psi relief valves (63176) with 45/55 psi valves (64552) from a higher pressure (400 psi) filter in the same series. This change was made necessary because the lower pressure relief valve opened before the filter element had been fully utilized.

To accurately monitor the condition of the element in the filter, we installed a pressure gauge in the line between the pump and the filters. Experience has indicated that when the pressure reaches 35 psi, the element is so loaded that it no longer operates efficiently. Generally, elements had to be replaced after one drum had been filtered; however, this number was subject to variation. Also the degree of filtration governed the frequency of element changing, a 2-micron element lasting only half as long as the 5-micron size.

Since initiating direct filtering, we have applied over 700 gallons of malathion without any blockage of the aircraft insecticide dispersal system, neither the line strainer nor the Beecomist. The aircraft operators are pleased because effective

[1] Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers—The State University of New Jersey, New Brunswick, New Jersey 08903.