

THE "PUMPING" OF CERTAIN MOTHS AT WATER<sup>1</sup>

by HARRY K. CLENCH

The chief "road" through Carnegie Museum's new Powdermill Nature Reserve (located about 4 miles south of Rector, in eastern Westmoreland County, Pennsylvania) consists of a pair of deep and often rocky ruts through the forest in the bottom of the Powdermill Run valley. Drainage is not good and these ruts usually have standing water in them and even a running trickle.

On August 3, 1956, Dr. NEIL D. RICHMOND (Curator of Reptiles and Amphibians at the museum) and I paid a visit to the Reserve with the double object of collecting moths and salamanders. As it happened, the evening was not an outstanding success, mediocre for moths and almost a total failure for salamanders; at about midnight we decided to leave.

While we walked along the road back to the car our lantern picked up numbers of the little green geometer, *Dyspteris abortivaria* H.-S., sitting along the edges of the water in the ruts. A few minutes later, as we drove down the lower part of the road, the car lights showed many more in a similar situation. In both cases we stopped to examine them more closely.

Every specimen that we could see was engaged in the same activity: with wings erect over its body, the rather short proboscis was extended into the water, while from its anus dripped, at between one and two second intervals, a steady procession of glistening clear drops, each drop growing rapidly and then falling, to be replaced by the next. At the same time the antennæ were nervously waving, sometimes alternating, sometimes together. So far as we could see the activity went on without interruption.

We estimated that over about fifty yards of suitable situation about fifty *Dyspteris* were seen, all thus engaged, all seemingly fresh and apparently all males, though on this last point we are not at all sure. Although numerous, the individuals were not clustered but on the contrary were well and more or less evenly dispersed. How long this activity lasted we do not know. They were first noticed at about 11:30 P.M. (E.D.S.T.); they were still "pumping" when we finally left at about 1 A.M.

The day had been only moderately warm, temperatures probably in the low 80's (°F); the sky more or less clear all day, clouding up a little at night-fall. The evening was rather humid at first, later becoming much drier and by the time we left the temperature had dropped considerably, probably to the low 60's. Shortly before leaving we noticed a slight breeze.

A week later, on August 10th, we again visited the Reserve, this time with a definite intent to gather further data on this curious behavior in addition to routine collecting. The data obtained have been grouped for convenience under several headings below.

1. SPECIES INVOLVED. Although more frequently observed than any other, *Dyspteris abortivaria* was not the only species so engaged. *Drepana*

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*arcuata* Wlk. was also seen in some numbers (see below). On the previous trip a few had been seen at the water but their position, with wings flattened and covering the abdomen, was such that we could not observe any dripping from the anus, though on the second trip it was looked for — and seen. Two other species, one a geometer and one of unknown family, were seen pumping, but both eluded capture. The latter one is especially regrettable, for its pumping activity differed from the others: instead of dripping from the anus the liquid was forcibly ejected in a fine jet, perhaps  $1\frac{1}{2}$  or 2 inches long, at about the same intervals as in *Dyspteris*.

2. TIME OF ACTIVITY. At about 8:30 P.M., at dusk, only a single worn *Dyspteris* was seen at the road and it was not pumping. At 9:30 it was dark and both *Dyspteris* and *Drepana* were present and pumping, the former numerous, the latter scarce. Fifteen minutes later the numbers of *Drepana* had increased a little and continued to increase until midnight or thereabouts. At midnight a count was made along a continuous 17 yards of the most favorable part of the road: 14 *Dyspteris* and 13 *Drepana* were present. At 1:45 A.M., when we left, both species were still present in numbers though no count was made.

3. OCCURRENCE. It was noted that the moths showed a definite preference for stretches of the road where the trickle of water was comparatively rapid — narrows between stones and the like — and for places where stones or other solid perches were available for them to rest upon. Acting on this information, we tried to find a natural setting for this activity. One was located almost immediately: about 10 yards from the road in a stretch of tiny brook flowing among muddy flats, stones, rocks, and many dead branches, some overhanging and others partly submerged. Here both *Dyspteris* and *Drepana* were found, a few individuals of each in the 15-20 yards of the stream that we could observe. They perched mostly on wet sticks and branches, less often on rocks, at the water's edge. All were pumping.

Concurrent with the observations on the "pumping" moths, we were running a sheet with Coleman lantern in an open part of the woods, about 30 yards from the road (and in sight of it), alongside an old trail which leaves the road at right angles. At the same time we established a bait line along the trail, running from about 5 or 6 yards of the road, past the sheet, for a considerable distance into the woods. The bait used was a mixture of fermented fruit juice, crushed rotten apples, and brown sugar. No *Dyspteris* at all came either to the sheet or to the bait. At one time, at about 11 P.M., five *Drepana* came in to the sheet, almost at once, but no others either before or after and none at all came to the bait.

At one place on the road (but in the other rut) a patch of about two yards length was liberally poured with bait mixture; about ten yards farther on a fresh urine sample was provided: both at about 8:30 P.M. Nothing, however, came to the bait mixture all evening, not even species which we obtained in abundance on the bait painted on the tree trunks. At the urine we found only a single worn *Calocalpe undulata* L. and one *Desmia funeralis* Hbn. in the course of the night. This, parenthetically, was in itself rather in-

teresting. Both of these we had seen a week or so earlier, *Calocalpe* by the hundreds, at night on a restricted patch of sand and gravel along the edge of Powdermill Run. Our guess at that time, which this second observation tends to confirm, was that the attractant was some sort of animal urine, possibly deer.

Both *Calocalpe* and *Desmia* came sparingly to the sheet. The former was clearly close to the end of its flight period, the few individuals seen in striking contrast to the swarms present earlier in the season. In contrast, *Desmia* did not seem less numerous than before, though its numbers were always much less than those of *Calocalpe*. Neither of these species came to the water in the road all evening.

4. PUMPING ACTIVITY. Unfortunately no accurate timing device was available. Both species, *Dyspteris* and *Drepana*, had roughly the same rate of dripping, the average interval between drops being slightly more than one second. The position adopted by the two species when pumping is, however, very different, as already intimated. *Dyspteris* holds its wings erect, appressed or nearly so, the antennæ usually waving, the abdomen entirely visible. *Drepana*, on the other hand, had its wings flattened and horizontal, the fore wings retracted so far to the rear that the costæ were in line; the abdomen completely covered by the hind wings and hidden from dorsal view. *Dyspteris*, at least, had no objection to actually standing in the water, several having been so observed. One individual deserves special mention. The trickle of water in the road flows out onto a small plank bridge and through a hole in this bridge to the stream below, the water forming a flowing film over the vertical sides of the hole. Early in the evening a *Dyspteris* was seen perched, head up, on the vertical side of this hole, the film of water actually flowing over and around its "feet." It, too, was pumping, the ejected drops falling freely to the water about two feet below. At intervals all evening we observed an individual in this same place and position: presumably the same one.

The pumping moths, incidentally, showed no apparent reaction to light. Shining car lights or lantern full upon them did not seem to alter their behavior in the slightest: yet they were not drugged or sluggish at all and would rapidly fly off if touched.

The question that comes immediately to mind is: what is the purpose of this pumping activity? If but a single individual were seen engaged in a peculiar or unusual pursuit we could dismiss it (rightly or wrongly) as an idiosyncrasy of the particular specimen or a response to an infrequent combination of circumstances. At all events it would not press too much for an explanation. Here, however, we have what must be at least a major part of the local population of a species (referring specifically to *Dyspteris*), all engaged in an activity which clearly occupies them for a large share (if not all) of their active hours.

A behavior so time-consuming may well have something to do with nutrition. Though it is only a guess it is possible that there is some needed substance in the water, occurring at such a low concentration that a large volume of the water must be passed in order to extract the amount required. This presupposes an efficient, rapid, and probably rather unusual extracting mech-

anism. It is possible, too, that the unusually cool and humid summer has in some way influenced the appearance of this behavior.

It seems unlikely that such an activity would be confined to a single area. Yet I know of only one other published account of it: that of GUPPY (*Lepid. News* 6: 43; 1952), who observed (presumably near Wellington, B. C.) an individual of the small holarctic geometer, *Venusia cambrica* Curt., engaged in what his clear description shows to be the same activity as that here under discussion. The specimen was perched head down inside a pail partly filled with water. On the occasion of the recent Congress of Entomology at Montreal I discussed the activity with a number of veteran moth collectors, of both Europe and North America, who surprisingly declared it to be quite new to them. A few observations on butterflies so engaged have been made (but so far as I know not published). Professor W. T. M. FORBES recalled having seen a small butterfly in South America behaving similarly; and my colleague, Dr. ARTHUR TWOMEY, Curator of Birds at the museum, has several times seen various *Papilio* performing the same activity, in at least one instance the liquid being ejected forcibly. In each case, however, only single individuals or at most a very few were involved, rather than the mass assembly seen in *Dyspteris* and *Drepana*.

Clearly we need to know much more about this unusual phenomenon. Is it world-wide, or confined to certain regions only? Is it limited to certain groups, and if so, to which ones (and what species)? Is it usual, or is it only manifested during unusual climatic conditions?

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In obtaining data in connection with the list of Florida Lepidoptera I frequently encountered in the literature the ambiguous definition of the range of certain species. An example of this is "Maine to Florida." When there are other, definite Florida records, everything is serene, but where it has not been possible to dig out any actual record for the species in Florida, the question arises, just what did the author mean? Did he know of a Florida record, or did he mean that the species was taken in Georgia, and so could be recorded as far south as the Florida boundary? In several instances this has proved to be the case. From living authors it has been possible to find out the meaning, but with those who are no longer with us, we have to use our own judgment. It is my suggestion, therefore, that in future, authors be specific when giving the range of a species and always state "Maine to Florida, inclusive," or "New York to Illinois, inclusive." Naturally there may be gaps in between whence there are no records, just as the statement "General throughout the state" does not mean that there is a record from every county, but it does mean that there are records from enough counties in all parts of the state to make the assumption. LUCIEN HARRIS tells me he encountered the same problem in working on his "Butterflies of Georgia."

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