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AN ELEGANT HARNESS FOR TETHERING LARGE MOTHS

Like many an enthusiastic young lepidopterist, I used to tie soft strings around the "waists" of large female silkmoths and then set the captives out overnight to lure mates. Sometimes the results were positive, but only too often complications defeated me. If a moth decided to fly after dark, she might become badly entangled in her hopelessly twisted tether. On other occasions she would attempt to worm her way through the constricting belt, either succeeding in escaping or else becoming stuck half way through. In the latter case her abdomen was badly deformed and mating never occurred.

In recent years (slightly wiser and immeasurably older) I have realized that the "waist"—junction of thorax and abdomen—is not the optimum site for placing a belt, since that region remains permanently soft. A firm, strongly chitinized zone (after a moth has fully hardened) would be preferable. The best intersegmental cleft meeting that requirement lies between the meso- and metathorax. A tether should therefore pass between the fore and hind wings, and between the second and third pairs of legs.

In dealing with those smaller anatomical parts, I found that ordinary string was too coarse. Twelve-pound test nylon casting line looked ideal, but I was afraid it would cut into the moth's thorax when she began her evening efforts to fly. To avoid twisting of the line, I decided to use a swivel, just as fishermen do for the same reason. It remained to find a way to fit the moth comfortably into a harness of this material.

At a hobby shop I found short lengths (ca. 30 cm) of thin brass tubing, imported from Belgium, and used by model airplane builders. Outside diameter was 2.25 mm, bore about 1.75 mm. These were the only moderately expensive items in my kit. Even so, I cut a single tube into 4 cm sections to give me pieces for seven harnesses. Probably one can obtain plastic tubing of similar size that is cheaper. The rest of my outlay included a small bag of beads, such as are used to adorn Indian moccasins, sewing needles, a package of spring clothespins, a box of small flat-headed nails, and a few old rusty paperclips.

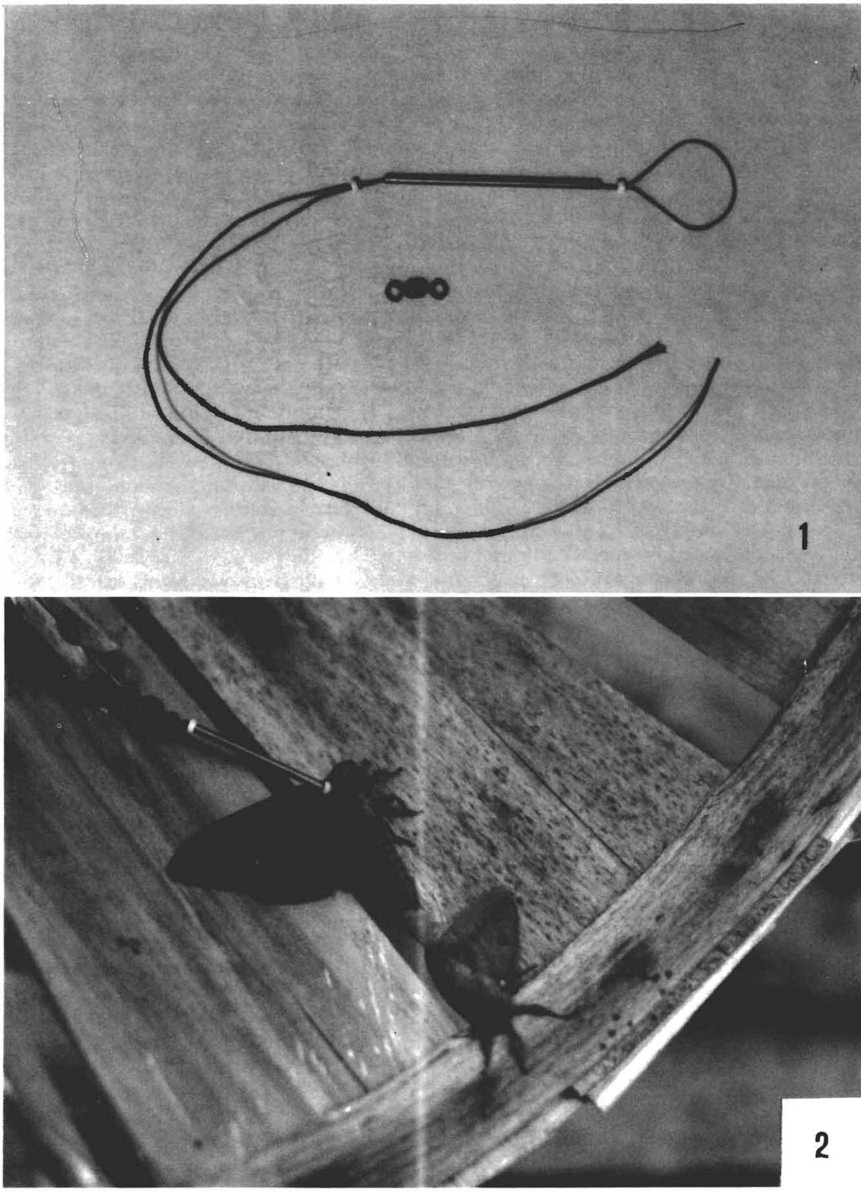
To prepare a harness, I had first to thread a needle with the casting line. That was the hardest part, because the needle must be small enough to pass through both the brass tube and the beads, yet with a large enough eye to accommodate the line. The procedure then was as follows. Thread a bead on the line, pass the needle through the tube, thread another bead on the line. Now reverse the process. Pass the needle back through the second bead (making sure not to pull the loop through, thus undoing all this work!), back through the tube, and back through the first bead. The harness was now ready, as shown in Fig. 1.

Why the beads and the tube? Perhaps the beads weren't really necessary, but they made the harness flexible by providing moveable joints. I incorporated them mainly to avoid friction against the cut edge of the tubing. The beads' smooth surfaces protected the line against damage when a moth became active.

The tubing was also a protective piece. Whatever part of the harness might snarl when a moth attempted to fly must be beyond the extent of her wing tips. With the tube attached to a swivel at that point, the moth could gyrate indefinitely without becoming fouled. A length of four or five cm gives adequate clearance.

The only remaining need was to attach the swiveled tether to some fixed point. If I had simply passed a string through the other end of the swivel, I would still have had the problem of tying the string to something else. As a matter of fact I did have a number of pre-chosen fixed points that I wanted to use repeatedly. These were inverted peach baskets, hung strategically from various trees and outbuildings on my farm in Eldora, Cape May County, New Jersey. A wooden spring clothespin was suspended from the center of each. One side of the clothespin was pierced by a small flat-headed nail. Before setting out a tethered moth, I passed a paper clip through the far end of her swivel. When the other end of the paper clip became engaged by the nail in the clothespin, it could not possibly be pulled out by a struggling moth.

After a bit of practice I was able to prepare a harness in only a minute or two and to apply it to a moth in an equally brief time. Moths appear to adapt to this form of



FIGS. 1, 2.

restraint without undue resistance. I have used it successfully with a long series of *Citheronia regalis*, *C. sepulcralis* and *Eacles imperialis*. The photograph (Fig. 2) depicts one of those matings.

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NOTES ON *GRACILLARIA ELONGELLA* (GRACILLARIIDAE) WITH A DESCRIPTION OF THE LARVAL MOUTHPARTS

Since the hostplant records for *Gracillaria* (=*Gracilaria*) help form the basis for the taxonomy of the genus (Forbes, 1923, Cornell Univ. Agric. Expt. Sta., Mem. 68: 1–729) these records should be completely and precisely catalogued. Therefore, it is noteworthy that *Gracillaria elongella* (Linn.) has been reared from yellow birch, *Betula alleghenensis* (=*Betula lutea*) at the Hubbard Brook Experimental forest in Grafton Co., New Hampshire, because Forbes (loc. cit.) previously recorded alder as its only host.

The adult was needed for positive species identification so only the cast skin of the larva was used to draw the figures, instead of material preserved in alcohol. Forbes (1910, Ann. Entomol. Soc. Amer. 3: 94–125) stated that this method will produce satisfactory material for descriptions with the obvious advantage of associating a known adult with a larval skin. Four individuals were examined. All drawings were done under a compound microscope.

The hypopharyngeal complex is shown in Fig. 1 with terminology of Godfrey (1972, USDA Tech. Bull. No. 1450, 256 p.) and DeGryse (1915, Proc. Entomol. Soc. Wash. 17: 173–178). A pair of stipular setae are present. The proximomedial area bears a single row of ten stout blades flanked by smaller spines on either side. The distal spines cross the medial transverse cleft into the proximolateral region. The spinneret is blunt. DeGryse (loc. cit.) pictured an unidentified *Gracillaria* larva (from alder) which had a blunt spinneret and blades also. However, in contrast to *Gracillaria elongella*, that individual had the first three blades much reduced, not subequal (Fig. 1). Whether this represents intraspecific variation or another species is not known. MacKay's studies (1972 Can. Entomol. Mem. No. 88, 83 p.) on *Gracillaria syringella* showed a "broad spinneret, with silk pore dorsal at the apex."

The mandible (Fig. 2) has four sissorial teeth. The inner ridge bears an associated tooth also. A pair of lateral mandibular setae are present. The mandibles can provide useful specific characters in some cases (Forbes, 1910, loc. cit.), but they can change throughout the life of the larva (Embree, 1958, Can. Entomol. 40: 166–174; Fracker, 1915, Ill. Biol. Monogr. 2(1): 1–166). Dimmock (1880, Psyche 3: 99–103) stated that the mandible of *Gracillaria syringella* retained the same general form throughout larval life in contrast to the variability known in other species.

The chaetotaxy of the adfrontal area is shown in Fig. 3 with terminology after Hinton (1946, Trans. Roy. Entomol. Soc. Lond. 97: 1–37) who mentioned the position of the adfrontal (AF) setae as a useful specific character. Most *Gracillaria* have AF1 and AF2 well-separated (Forbes, 1910, loc. cit.), so *Gracillaria elongella* may be unusual in this respect, since it has the above two setae fairly close together. Unfortunately, the frontal setae group was damaged. The clypeal setae are subequal and arranged as shown.

The labrum is shown in Fig. 3 with nomenclature after Forbes (1923, loc. cit.). The chaetotaxy is shown on the left and the distribution of microspines on the right. L2 is slightly larger than L1 or L3. The medial group appears to have all setae subequal.

No information is available on the chaetotaxy of the thorax and abdomen although their size is definitely not minute, as stated by Fracker (1915, loc. cit.). MacKay (1972,