yellow. Suranal shield paler than prothoracic shield, with three longitudinal, cream or pale-yellow lines. Mid-dorsal band varying from pale yellow-fawn to dark smoky-brown. Subdorsal area consisting of a median band concolorous with or somewhat paler than mid-dorsal band, and marginal lines of pale yellow. Supraspiracular area concolorous with median band of subdorsal area. Spiracular band pale yellow, cream or sometimes almost white; often a pale smoky-brown line through middle of spiracular band. Suprapodal area pale-yellow or pale greyish-yellow. Mid-ventral area usually paler than suprapodal area. Spiracles with dark-brown or black rims. Thoracic legs varying from dull yellow to orange-brown, variably suffused with dark smoky-brown.

Head width: 1.72 ± 0.11 mm (23 larvae).

Duration of stadium: 5.1 ±1.2 days (40 larvae).

Pupa (Figs. 2, 9, 10). Spiracles borne in shallow depressions of the cuticle. Spiracular sclerites narrow. Anterior marginal areas of abdominal segments 5, 6 and 7 conspicuously pitted. Proboscis terminating at or slightly anterior to apexes of wings. Cremaster consisting of two rather short setae borne on a peculiarly shaped prolongation of the tenth abdominal segment; prolongation of the tenth segment truncated in profile and usually flattened on the ventral surface.

Length from anterior end to posterior margin of fourth abdominal segment: 6.17 ± 0.39 mm (25 pupae).

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PROTECTIVE FUNCTION OF SOUND PERCEPTION AND GREGARIOUSNESS IN *HYLESIA* LARVAE (SATURNIIDAE: HEMILEUCINAE)

While in residence at the Tropical Science Center field station on the Osa Peninsula of Costa Rica (1.8 miles west of Rincon), I was able to make some observations on a colony of *Hylesia* larvae which suggested a very probable function for their gregarious behavior and ability to perceive sound.

I first discovered a large aggregation of these larvae (approximately 330 individuals) in an oval mass on the trunk of a medium-sized tree, *Trema micrantha* (Linnaeus), on 3 April 1971. The mass was located on the north side of the tree about 1 m above the ground and was about 60 cm in length vertically and 18 cm in width. I accidentally became aware of the ability of the larvae to perceive sound when I shouted in their direction from a distance of about 10 meters. I was amazed to see the entire surface of the mass "jump." Each of the larvae responded to the sound of my voice

at the same instant and in the same manner, a violent jerking of the anterior third of the body, so that the head, thorax and anterior portion of the abdomen were arched upward or sideward.

I tested this reaction numerous times and ways by altering the pitch and loudness of my voice and determined to my satisfaction that the action was due to sound and not to air movement. The larvae reacted only to very sharp and relatively high pitched sounds of high intensity. Normal conversation did not cause any movement. I further tested the response by playing music (Strauss waltzes) from a tape recorder in the immediate vicinity of the mass (within 1 meter) and noted that the larvae responded in the same manner to loud, sharp portions of the music.

I observed the mass for 5 days. Each day I noted fewer individuals until the 8th of April, at which time there were no longer any present. Several larvae at the beginning had freshly molted, apparently transforming from the penultimate to the final instar. On several occasions during the day, larvae were seen on the ground crawling away from the tree, apparently in search of pupation sites or possibly food. The mass was present on the tree trunk only during the day, migrating at night to another place which was never determined.

This jerking behavior of gregarious lepidopterous larvae in response to sound has been observed and recorded by only a few authors. Minnich (1936, *J. Exper. Zool.* 72: 439–453) studied the reaction in the larvae of *Nymphalis antiopa* and records several other species of Lepidoptera which have been noted to behave similarly. None of these accounts, however, offers an explanation for the function of the behavior. Some additional observations which I made on this occasion suggested to me that sound perception coupled with the massing of these larvae served as a protection from parasites.

The larvae were being parasitized by two species, a yellow and black chalcidine wasp and a tachinid fly. The former, on approaching the mass and hovering over it prior to landing and oviposition, elicited the jerking movement. The anterior portions of the caterpillars being thrown dorsally had the effect of warding or fending off the approaching wasps. The denseness of the hairs of the richly branched scoli furnished a barrier to the penetration of the parasites. The larvae in the center of the mass were especially well protected since their flanks were not vulnerable to lateral attacks. The tachinid flies did attempt to approach the larvae from the side by crawling along the bark but were warded off in a similar fashion by lateral jerking. When approaching the mass from above, these flies also elicited the dorsal arching. The high pitched whining of the wings of the approaching or hovering parasite seemed to be of the correct quality and intensity to elicit the jerking response. The effectiveness of this defensive maneuver is enhanced by the fact that the larvae are densely grouped and heavily clothed with spines and hairs. This behavior would offer much less protection to individual larvae than to larvae en masse.

This protective behavior was not completely successful, however. I observed oviposition by the chalcidine wasps numerous times. Still, the attacking females experienced great difficulty in gaining access to the host's skin through the hair and spine network and violent defensive movements of the mass.

The spines of the scoli are highly urticating to human skin and may also function more effectively in inhibiting attacks from vertebrates by being forced into the skin through this same jerking motion.

A cinematographic record of these observations is on file with Alan Landsburg Productions, Hollywood, California (Production 1106–02, rolls 157, 158 and 166a). My thanks are extended to that organization for the opportunity to be in the study area and to Julian P. Donahue for assistance in identifying the caterpillars. Unfortunately it was impossible to determine the species of *Hylesia*; several are common at the site.

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