THE SHORTLEAF PITCH-BLISTER MOTH, *PETROVA HOUSERI* MILLER

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The shortleaf pitch-blistermoth, *Petrova houseri* Miller, attacks current shoots of shortleaf pine, *Pinus echinata* Miller. As the larva feeds, it forms a blisterlike pitch nodule similar to those formed by several other members of the genus *Petrova*. Since the insect usually kills shoots, it poses a threat to normal tree growth and development.

[1]Located at the Station's East Lansing, Mich., field unit which is maintained in cooperation with Michigan State University. Some observations in this study were made while I was a Research Assistant at the Ohio Agricultural Experiment Station, Wooster, Ohio.

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The existence of *Petrova houseri* has been recognized for only a short time (Miller, 1959). As long ago as 1935 symptoms of its attack were recorded in Ohio, but they were attributed to the pitch twig moth, *P. comstockiana* (Fernald) (Polivka and Houser, 1936). In the study reported here, the insect is shown to occur in Ohio, West Virginia, and Georgia (fig. 1). It will very likely be reported from many other areas when its infestation symptoms are better known to forest insect observers. The present paper summarizes some observations on the biology of this pitch-blister moth made at various times from 1952 to 1958, chiefly in Ohio.

Like its close relatives, the *Petrova houseri* larva also has the bifurcate spinneret, and 4 setae in the SV group on the ventral prolegs—characters which distinguish blister moth larvae from all other olethreutid larvae (MacKay, 1959).

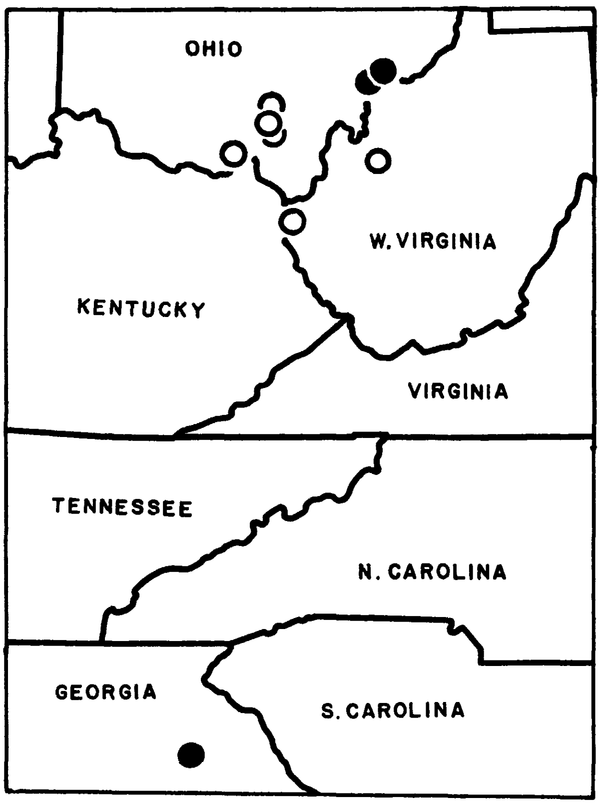

FIGURE 1. Distribution of records for *Petrova houseri*. Solid circles represent adults which I reared or saw. Open circles represent blisters which I encountered on shortleaf pine.

LIFE CYCLE AND FEEDING HABITS

The shortleaf pitch-blister moth produces one generation per year in Ohio. Twenty moths emerged in 1953, 1954, and 1956 from June 14 to July 2 in outdoor cages containing infested twigs.

Shortleaf pine seems to be the only species affected. The insect was not found on other pines growing in mixture with shortleaf, including pitch, *Pinus rigida* Miller; Virginia, *P. virginiana* Miller; and loblolly *P. taeda* Linnaeus. To be sure, these other pines often contain pitch blisters nearly identical in appearance with those of *Petrova houseri,* but their makers are different species, each occurring on its particular host pine and no other (Miller and Neiswander, 1956; Miller and Altmann, 1958; unpublished observations).

To learn the feeding pattern of the larvae, infested twigs were minutely examined at intervals from soon after hatching till the end of the larval period. Up to 4 needle clusters were always injured at or near new pitch blisters. A round hole the size of a newly hatched larva was found in one or two needle sheaths on about 20 per cent of newly infested shoots. From this evidence it was concluded that the larva feeds first at needle bases.

Feeding progressed next to the inner bark. In a few shoots, there was a small tunnel between an injured needle and the inner bark. For most of the remaining summer, the larva mined this tissue (fig. 2).

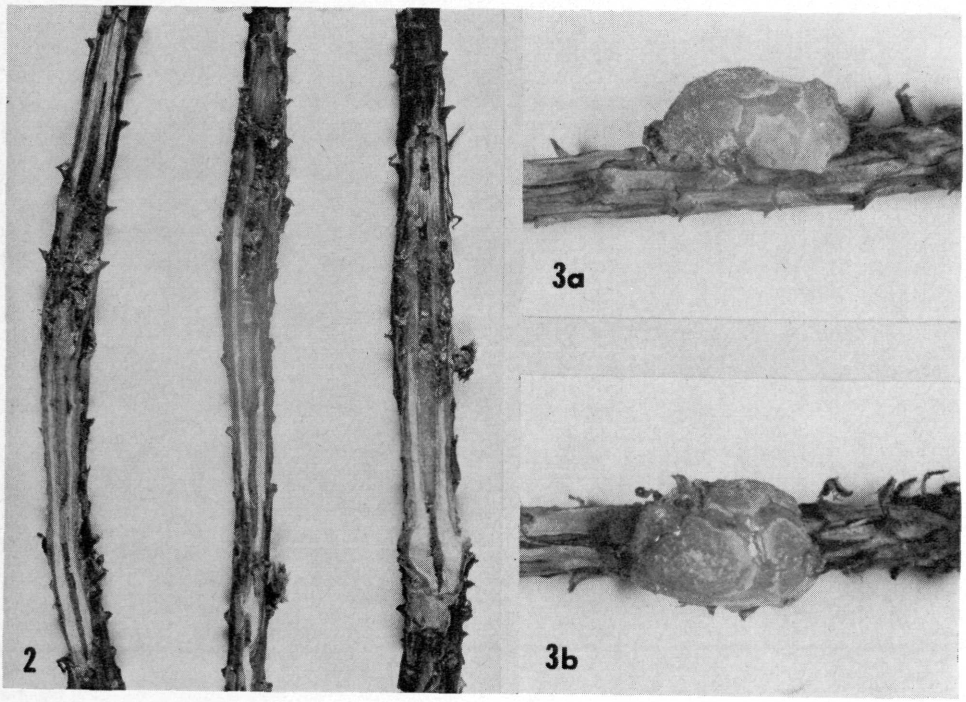

FIGURE 2. Shortleaf pine shoots sectioned longitudinally to show *Petrova houseri* feeding areas beneath the bark (upper part of shoots) and in the pith. (Photo courtesy of Ohio Agricultural Experiment Station).

FIGURE 3. Mature *Petrova houseri* pitch blister on a shoot from which needles have been removed: *a*, side view; *b*, top view. (Photos courtesy of Ohio Agricultural Experiment station.)

Soon after beginning to feed in the inner bark, the larva excavated a hole through the outer bark and spun the silk superstructure for the pitch blister. On this framework it deposited droplets of resin, frass, and other material. Pitch blisters were thus formed and enlarged. The larva usually girdles the shoot with its inner bark feeding. A slight swelling of the shoot often occurs at the mined area (fig. 2).

Toward the end of the summer, the larva bored down to the pith of the twig.

Some feeding occurred there before winter, but most took place the following spring (fig. 2). At the onset of winter the larva is about half-grown.

As it feeds in the pith the following spring, the larva enlarges the blister and also packs unwanted materials in it. It always maintains a passageway from the pith to near the surface of the blister. This passageway later serves as the adult exit. The pith tunnel is progressively excavated toward the base of the shoot. In 12 twigs where larvae had completed feeding and pupated, pith tunnels averaged 1.0 inch long, of which 0.7 inch was toward the base of the twig from the center of the blister. At the end of the pupal period, the pupa penetrated the blister wall by wriggling. With the pupa protruding, the moth emerged.

The blisters of 12 emerged moths measured from 0.44 to 0.69 inch long and from 0.25 to 0.44 inch wide, averaging 0.52 by 0.33 inch. The height of the mature blister is similar to its width (fig. 3).

PARASITES

Parasites were observed to mature on *Petrova houseri* only near the end of the moth generation. All fed upon the larval stage. The degree of parasitization is shown by the following samples taken in June of 1953 and 1954 in two infestations in Washington Co., Ohio:

Sample	No. blisters	Percentage with parasites
1	19	48
2	17	48
3	41	54

The most abundant parasite was *Agathis pini* (Muesebeck) (Braconidae) which caused about two-thirds of parasitization. Other parasites were *Exeristes comstockii* (Cresson) (Ichneumonidae), *Hyssopus benefactor* (Crawford) (Eulophidae), and an unidentified wasp with a braconidlike cocoon. This list of parasites is similar to that of the pitch twig moth (Miller and Neiswander, 1956). Information about some of the parasites can be found in the papers by Miller (1953, 1955).

CHARACTERISTICS OF INFESTATIONS

I observed *Petrova houseri* only in naturally reproduced stands. The absence of blisters in the few planted stands checked could have been due merely to chance. However, Polivka and Houser (1936) likewise found no blisters in planted shortleaf pine.

Blisters were seen in trees ranging from 3-ft saplings to mature timber. Their density and distribution were investigated in the spring in two infestations by sampling trees in the 5- to 15-ft height class. The infested stands were of medium density, the crowns of the sampled class usually not touching. The results were as follows:

Item	Stand No. 1	Stand No. 2
No. trees sampled	20	60
Mean no. blisters per tree (with standard deviation)	0.9 ± 1.2	0.3 ± 0.2
Coefficient of aggregation	2.2	1.2
Percentage trees infested	55	25
Percentage of trees with leaders infested	5	0

The blisters occurred in a nonrandom fashion among sample trees as shown by the low coefficients of aggregation (Waters, 1959).

Infested shoots usually contained only one blister, as illustrated by sample counts of 19 out of 20 and 31 out of 32 infested shoots containing one blister. The remaining shoots contained two blisters. Blisters were characteristically situated away from branch nodes, as were 31 out of 32 in one of the above samples.

Attacked shoots usually die and eventually break off. The detailed condition of 88 infested shoots examined in June, near the end of the blister moth generation, was as follows:

Condition	Percentage
Broken off	40
Dead, but intact	33
Dead, fallen over	6
Fallen over, but still growing	6
Growing normally	15
	100

Dead shoots are reddish brown beyond the blister, and the presence of dead shoots on trees is commonly called "flagging." In spring, some blister moth infestations were discovered when these conspicuous "flags" were spotted from a rapidly moving automobile. Dead shoots were often found on the ground under larger trees where they had fallen from crowns high above.

Breakage of the shoot apparently does not harm the insect. Severing was always observed to take place just beyond the blister toward the shoot tip, leaving the blister intact on the stub. Also, at the season breakage occurs, the larva is feeding at the base of the pith tunnel.

The dead and dying shoots were attractive to bark beetles, and the following four species developed in many of them: *Pityophthorus pulicarius* Zimmerman, *Pityophthorus* sp., *Stephanoderes* prob. *georgiae* Hopkins, and *Conophthorus* sp. (Scolytidae).

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