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SURVEYING MITES (ACARINA) PHORETIC ON THE SOUTHERN PINE BEETLE (COLEOPTERA: SCOLYTIDAE) WITH STICKY TRAPS

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Abstract

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Sticky traps caught large numbers of mites that adhere tightly or ride in protected places on attacking southern pine beetles and retrieved some of the mites that are loosely attached. Of the 2539 beetles surveyed, only 39.6% carried mites. Seven species of phoretic mites were found; the two most common, *Tarsonemus krantzi* and *Trichouropoda australis*, showed no preference for either beetle sex but preferred to ride on specific parts of the body.

Phoretic mites of the southern pine beetle, *Dendroctonus frontalis* Zimmerman 1868, can be collected in two basic ways: from beetles emerging from infested wood or from those attacking trap trees. The former method is easier and yields a greater variety and number of mites, but the latter may provide a more realistic sample of which mites actually reach the tree. Although 18 species of mites have been recorded as phoretic on the southern pine beetle (Hurlbutt 1967; Lindquist 1971; Lindquist and Hunter 1965; McGraw and Farrier 1969; Moser and Roton 1971; Moser, unpub. data; Smiley and Moser 1970; Woodring 1966; Woodring and Moser 1970), there have been few, if any, mites recorded from flying beetles.

The easiest way to trap large numbers of attacking southern pine beetles is with sticky traps. Although many mites will be lost when the sticky material is harvested, some mites attach more firmly than others to the beetle or are in more protected locations, and the method might give reliable estimates for the more tenacious species. The purpose of this study was to determine if the method has any survey potential for phoretic mites.

Methods and Materials

Traps devised by T. L. Payne and J. E. Coster (personal communication) (Fig. 1) were made from 0.3-m square pieces of hardware cloth coated with Stickem Special[®].¹ They were placed on eight loblolly pines (*Pinus taeda* L. 1753) at heights of 0.6, 2.4, 4.3, and 6.1 m on one side of the tree and at 1.5, 3.3, and 5.2 m on the opposite side. Traps were lowered for examination with pulleys.

Beetles were induced to attack by the hanging of female-infested bolts at 4.8 m for 2 to 3 days until a mass attack began. Bolts were then removed.

Collections were made weekly from 3 June through 28 August 1973. Beetles were manually removed from the traps and placed in vials of kerosene, which dissolved the Stickem adhering to the specimens. A total of 56 vials representing the eight trees and seven heights comprised each weekly sample.

For each beetle found in the study, the following data were recorded: date, height of trap, sex, species, and number and body location of the mites. The data were then summarized for each mite.

Results and Discussion

Only 39.6% of the 2539 beetles surveyed possessed mites. *Tarsonemus krantzi* Smiley and Moser 1974, and *Trichouropoda australis* Hirschmann 1972, the most common species, each rode on more than 23% of the beetles. Neither showed a phoretic preference for either beetle sex. Five other species occurred infrequently to rarely, but they may be found to be more common once a more efficient trap system is developed.

¹Mention of trade name is solely to identify material used and does not imply endorsement by the U.S. Department of Agriculture.

There was no correlation between collection date or height of trap and number or kinds of mites.

Tarsonemus krantzi Smiley and Moser 1974

Moser and Roton (1971) located *T. krantzi* (misidentified as *T. subcorticalis*) in 77% of bolts infested by southern pine beetles.



FIG. 1. Female-infested bolts strapped to a loblolly pine provided initial attraction; attacking beetles are caught by hardware cloth sticky traps.

In the current study, phoretic *T. krantzi* females were located on 23.9% of the beetles; 24.0% of the male beetles and 23.7% of the females carried the mites. Mean number of mites per infested beetle was 4.10 ($S_{\bar{x}} = 0.219$) for males and 3.96 ($S_{\bar{x}} = 0.220$) for females. Maximum for males was 45, and for females it was 18.

Almost all (99.6%) of the 2455 mites collected rode under the elytra. When only a few mites were present, they usually congregated in or near the cupped device where the elytra attaches to the body. When mites were present in greater numbers, they were found anywhere under the elytra. Only 10 mites were located on the exposed body surface, but the low number is misleading, as they were easily detached. Many were present in the kerosene, and others undoubtedly were lost in the sticky traps.

Trichouropoda australis Hirschmann 1972

T. australis is phoretic only as a deutonymph, gluing itself to beetle adults by means of an anally-secreted pedicel. Moser and Roton (1971) recorded this mite in 77% of bolts infested by southern pine beetles. They also established that it would ride on practically all southern pine bark beetles and associated insects.

Deutonymphs were found on 23.3% of the beetles. Mean number of mites per infested beetle was 4.92 ($S_{\bar{x}} = 0.350$) for male beetles and 5.09 ($S_{\bar{x}} = 0.377$) for females. Maximum numbers for males and females were 64 and 41, respectively, indicating that *D. frontalis* can support at least a 20% additional load in weight during flight (Moser 1976).

Deutonymphs were cemented to practically all parts of the exposed body surface, but 87% of the 2951 deutonymphs collected cemented themselves to the apex of the abdomen; 4.2% were at the apex of the elytra, 0.3% on the dorsal surface of the thorax, 6.8% on the ventral surface of the thorax and coxae, 0.9% on the legs, and 0.9% on the head. None was found under the elytra. Since the deutonymphs were attached rather tightly, only an estimated 5% of the total were lost in the sticky material and kerosene.

Anoetus varia Woodring and Moser 1970

The phoretic stage of *A. varia* is the hypopus, an unusually hardy modification of the deutonymph that lacks mouthparts. Many of these hypopi were still alive and swimming in the kerosene after 3 days.

Moser and Roton (1971) found *A. varia* in 19% of bolts infested by the southern pine beetle. It apparently rides all bark beetles and other insect associates on *Pinus* spp.

Hypopi were seen on 1.2% of the beetles. About 1% of the male beetles and 1.4% of the females carried the mite. Mean number of mites per infested male was 1.59 ($S_{\bar{x}} = 0.132$); for infested females it was 1.14 ($S_{\bar{x}} = 0.14$). Maxima for males and females were 4 and 3, respectively. Since hypopi are easily dislodged from the body surface, these figures must be regarded as conservative.

Twenty-nine of the 43 hypopi were seen under the elytra. Twelve were found on the ventral surface of the abdomen, one was found on the thoracic venter, and one fell from an undetermined part of the body during handling.

Digamasellus neodisetus Hurlbutt 1967

Moser and Roton (1971) found *D. neodisetus* in every bolt infested by the southern pine beetle, but in the present study deutonymphs were found on only 0.8% of the beetles. A single mite was collected from 0.7% of the male beetles and from 0.9% of the females.

Although this mite frequently rides under the elytra of larger subcortical beetles such as cerambycids, *Temnochila*, and *Hylobius* (Moser and Roton 1971), it showed

no preference for that location on the southern pine beetle. A total of 20 mites were collected from most areas of the body: one each was found under the elytra, on the elytra, on the dorsal surface of the thorax, and on the head; two were on the legs; three were on the ventral surface of the thorax; and 10 were dislodged from undetermined parts of the body. Mites were easily detached from the beetles during handling. Large numbers were found in the kerosene, and a great many were probably lost in the sticky material. Hence, the tally of 20 is unrealistically low.

Tarsonemus ips Lindquist 1969

Only two females of *T. ips* were found on two females of *D. frontalis*, one under the elytra and one on an undetermined part of the body. *T. ips* was recorded as common by Moser and Roton (1971) because 97% of bolts infested by the southern pine beetle had the mite. According to Lindquist (1969), females may ride the elytral declivity of numerous species of *Ips*, *Pityokteines*, and *Orthotomicus*.

Leptus sp.

Larval mites of the genus *Leptus* are typically parasitic on adult arthropods; such was the case of the two larvae collected from two beetles trapped on 7 August at a bole height of 5.2 m (Fig. 2). They were firmly attached to the elytra with their chelicerae, but they were not engorged. The association of this mite with the beetle adult probably represents a combination of phoresy and parasitism. This is the first record of a *Leptus* associated with the southern pine beetle, although Moser and Roton (1971) recorded larvae attached to *Dendroctonus terebrans* (Olivier) and to several other pine insects.

Macrocheles boudreauxi Krantz 1965

Moser and Roton (1971) listed *M. boudreauxi* as a common mite, occurring in 74% of bolts infested by the southern pine beetle. The phoretic stage is the female, which appears to ride most bark beetles and their insect associates of southern pines.

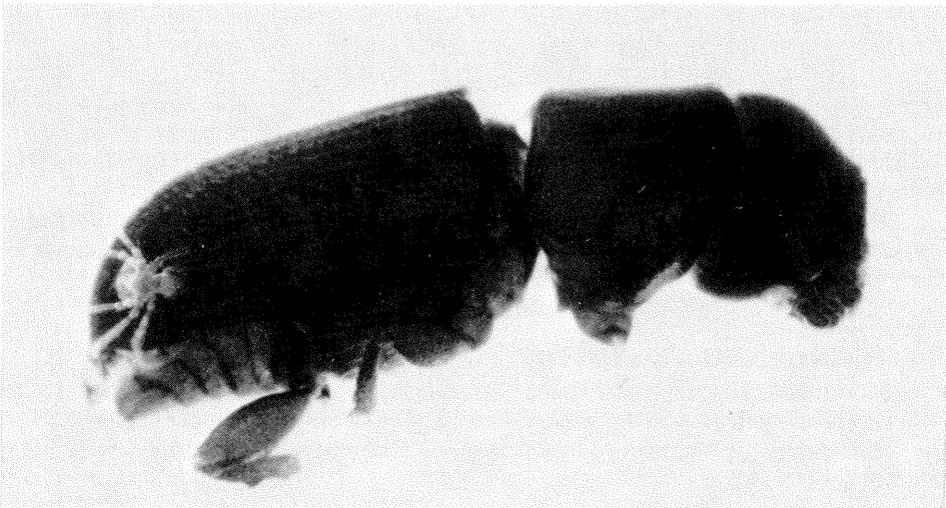


FIG. 2. Larva of *Leptus* sp. attached to elytron of southern pine beetle.

In the present study, only one female mite was seen on a female beetle. The location of attachment was not determined. The actual percentage of infestation was undoubtedly much higher since many specimens were seen in the kerosene. Many must also have been lost in the sticky material.

Other Species

Proctolaelaps hystericoides Lindquist and Hunter 1965, *P. xyloteri* Samsinak 1960, *Anoetus conjuncta* Woodring and Moser 1970, *Histiogaster arborsignis* Woodring 1963, *Pygmephorous bennetti* Cross and Moser 1971, and *Ereynetoides scutulis* Hunter 1964 were also found in the kerosene. Moser and Roton (1971) recorded all these mites as associates of the southern pine beetle and the latter three as phoretic on adult beetles. In the current study, the presence of small numbers of *Ips*, histerids, and other beetles in the kerosene made it impossible to ascribe definite phoretic associations of these mites to the southern pine beetle.

Conclusions

Sticky traps provide a convenient method of surveying mites phoretic on attacking southern pine beetles. They enable the researcher to obtain many, if not most, of the mites that ride in protected places (e.g., *Tarsonemus krantzi*) or of those that adhere tightly to the beetles (e.g., *Trichouropoda australis*). In addition, though many of the loosely attached mites are lost during harvesting, enough remain so that a qualitative list of the common phoretic mites can be obtained with this technique.

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