1977

Distribution of Some Predators and Parasites of the Southern Pine Beetle in Two Species of Pine

Jack E. Coster

Catherine Stein

Follow this and additional works at: https://scholarworks.sfasu.edu/forestry

Part of the Forest Sciences Commons

Tell us how this article helped you.

Repository Citation
Coster, Jack E. and Stein, Catherine, "Distribution of Some Predators and Parasites of the Southern Pine Beetle in Two Species of Pine" (1977). Faculty Publications. 332.
https://scholarworks.sfasu.edu/forestry/332

This Article is brought to you for free and open access by the Forestry at SFA ScholarWorks. It has been accepted for inclusion in Faculty Publications by an authorized administrator of SFA ScholarWorks. For more information, please contact cdsscholarworks@sfasu.edu.
Distribution of Some Predators and Parasites of the Southern Pine Beetle in Two Species of Pine

CATHERINE R. STEIN AND JACK E. COSTER
School of Forestry, Stephen F. Austin State University, Nacogdoches, TX 75962

ABSTRACT

Southern pine beetle, Dendroctonus frontalis Zimmerman, and its natural insect enemies were reared from infested loblolly pines, Pinus taeda L., and shortleaf pines, P. echinata Mill. Southern pine beetle broods were most dense during spring (Mar.–May) and least dense in late summer. Populations were higher in late winter than in midsummer. There were no differences in beetle densities between the pine species. Twelve predators and 9 parasites comprised ca. 99% of the natural enemy complex. Total density of the 12 predators did not vary with either season or tree species. Total parasite density, however, was highest in midsummer, lowest in late winter, and was significantly higher in shortleaf pine. Species diversity of predators and parasites was highest during spring and summer seasons and varied significantly between tree species.

The Veldman (1967) AVAR 23 program for analysis of variance, utilizing unequal-sized groups and subgroups, was used to determine the effects of season, sample height, and tree species on insect abundances. Because no infested bolts were obtained...
Southern pine beetle varied significantly with season ($P < .01$).
Means of brood density were:

<table>
<thead>
<tr>
<th>Season</th>
<th>Brood density/dm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>41.4</td>
</tr>
<tr>
<td>II</td>
<td>57.7</td>
</tr>
<tr>
<td>III</td>
<td>26.4</td>
</tr>
<tr>
<td>IV</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Southern pine beetle emergence density also varied significantly with season ($P < .01$). Highest mean density (27.0 beetles/dm$^2$) occurred in season II while lowest mean density (7.0 beetles/dm$^2$) occurred in season IV (Fig. 1).

Effect of Height.—Neither southern pine beetle brood densities nor emergence densities showed a significant difference among their means for the 3 sample heights when height alone was considered ($P < .05$). Similar results were reported by Stephen and Taha (1976), although Mayyasi et al. (1976) found variations in southern pine beetle density with sample height. The samples taken by Mayyasi et al. included the upper and lower extremes of the infested bole height, whereas our samples were limited to the infested bole between 3–9 m. The interaction of height and tree species, however, had a significant effect on the abundance of emerged beetles. Mean southern pine beetle emergence density decreased with increasing height in shortleaf pine while it increased with increasing height in loblolly (Fig. 2). This height-species interaction was significant ($P < .05$).

Effect of Tree Species.—Mean southern pine
not significantly different between shortleaf and loblolly pine \( (P < .05) \).

**Predators and Parasites**

Eleven predatory species of Coleoptera, 2 Diptera, and 2 Hemiptera predators, and 11 species of Hymenoptera parasitic on southern pine beetle were identified. A total of 11,165 predators and 3137 parasites were collected. For statistical analysis, the most abundant species of known or suspected predators and parasites were selected. They represented 99\% of the predator-parasite population and included the following 12 predators and 9 parasites:

**HEMIPTERA**

Anthocoridae: *Lycocoris stallii* (Reuter), *Scoloposcelis* sp.

**COLEOPTERA**


Trogostidae: *Temnochila virescens* (F.)

Cleridae: *Thanasimus dubius* (F.)

Colydiidae: *Aulonium tuberculatum* LeConte, *Lasconotus referendarius* Zimmerman

Tenebrionidae: *Corticeus glaber* LeConte

**DIPTERA**

Dolichopodidae: *Medetera* sp.

**HYMENOPTERA**


Torymidae: *Roptrocerus eccoptogastri* (Ratzeburg)

Pteromalidae: *Cecidostiba* sp., *Nr. Dinotiscus* sp., *Heydenia unica* Cook and Davis, *Rhopolus pulchripennis* (Crawford)

Although they were the most abundant species, the 21 predators and parasites were not necessarily present in all samples.

The abundance of the predators in decreasing order were *C. glaber*, *A. tuberculatum*, *Scoloposcelis* sp., *L. referendarius*, *T. dubius*, *Medetera* sp., *Platysoma* spp. (*P. attenuata*, *P. cylindrica* and *P. parallellum*), *Plegererus* sp., *L. stalli* and *T. virescens*. The parasite species in decreasing order of abundance were *R. eccoptogastri*, *D. sulcatus*, *H. unica*, *C. pissodis*, *R. pulchripennis*, *S. pallidus*, *Cecidostiba* sp., *nr. Dinotiscus* and *M. hypophloei*. Because the specimens could not be determined to the species level at the time of collection, the 1st 3 species of Histeridae were grouped, referred to as *Platysoma* spp. and treated as one taxon in the statistical analyses.

The predator and parasite species were treated individually in the statistical tests, except where results are identified as "Total predators and parasites" (21 species), "Total predators" (12 species), or "Total parasites" (9 species).

Abundance of Predators and Parasites

Effect of Season.—Abundance of total predators and parasites varied significantly with season \( (P<.01) \) lagging behind that of southern pine beetle and peaking one season later (Fig. 1).

Total predator emergence density did not vary significantly with season; however, changes in total parasite density with season were highly significant \( (P<.01) \) (Fig. 3). Parasite density ranged from a high of 3.1 insects/dm\(^2\) in season III to a low of 0.2 insects/dm\(^2\) in season I. Insect associates were most abundant in the spring at trees attacked by *Dendroctonus brevicomis* LeConte (Stephen and Dahlsten 1976), although *D. brevicomis* has only 2 discrete generations/yr in contrast to 5-7 overlapping generations for southern pine beetle.

Five predators differed significantly in abundance among seasons (Fig. 4); the remaining 7 predators did not. Three predators (*Plegererus* sp., *Scoloposcelis* sp., and *Platysoma* spp.) increased in number as the southern pine beetle populations decreased. Abundance of *T. dubius* and *C. glaber*, however, increased and decreased in the seasons following increase or decrease in southern pine beetle. This may be expected of *T. dubius*, because it feeds primarily on bark beetles. Mignot (1966)\(^*\) reported that under lab conditions, clerids starved to death if no bark beetles were provided. Why abundance of *C. glaber* followed that of southern pine beetle is uncertain, because it is thought to be a facultative predator (Moser et al. 1971).
FIG. 5.—Seasonal emergence of 4 hymenopterous parasites of the southern pine beetle from shortleaf and loblolly pine bolts. Seasons: I = Feb., II = Mar. and May, III = June-Aug., and IV = Sept.

Bole allowed more successful parasitism of the bark beetles. Research with other Dendroctonus species has shown that higher levels of parasite activity are common in the thinner-barked, upper sections of beetle-infested trees (Dahlsten and Stephen 1974, Stephen and Dahlsten 1976, Ryan and Rudinsky 1962). The different results may be due to the smaller size of our sample trees. The trees sampled by Thatcher averaged 27 m in height and 38 cm DBH—much larger than those in the present study. Bark thickness may be suitable over a greater length of the smaller trees.

Height and tree species interaction had a significant effect on the abundance of the predator Medetera sp. (P<.05) (Fig. 2). In shortleaf pine, its emergence was similar at 3 m and 6 m levels but increased at 9 m; in loblolly pine, its emergence decreased with increasing height and there was no

FIG. 4.—Seasonal emergence of 5 southern pine beetle predators from shortleaf and loblolly pine bolts. Seasons: I = Feb., II = Mar. and May, III = June-Aug., and IV = Sept.

Four Hymenoptera parasites varied significantly in their mean emergence densities with changes in season (P<.01) (Fig. 5). R. eccoptogastri and R. pulchripennis were least abundant in season I and most abundant in season II, while D. sulcatus and H. unica were least abundant in season I and most abundant in season III (Fig. 5). Research in Georgia showed that, in Ips infestations, R. eccoptogastri was most abundant in June and Aug. when trees were sampled in Mar., June, Aug., and Oct. (Berisford and Franklin 1972).

Effect of Height.—None of the predators and parasites of the southern pine beetle differed significantly in emergence abundance among the 3 sample heights. Moore (1972) and Thatcher (1971) found that parasite abundance increased with increasing height in southern pine beetle infested trees. Thatcher suggested that parasite abundance increased in height in the tree because the thinner bark of the upper
emergence at the 9 m level. In both pine species, emergence of southern pine beetle was least at tree heights where emergence of Medetera sp. was high, and high where the latter was lowest.

Effect of Tree Species.—Tree species did not significantly affect total predator density, but significantly more total parasites emerged from shortleaf pine (2.1 insects/dm³) than from loblolly pine (1.0 insects/dm³) \( (P<.05) \). Since southern pine beetle density did not vary significantly with tree species, the hymenopterous parasites were apparently reacting to tree host as well as to the southern pine beetle populations. A similar reaction to tree host has been exhibited by parasites of Ips engravers in southern pines (Borisford and Franklin 1972) and in western pines (Ball and Dahlsten 1973). With the southern Ips, however, the degree of parasitism was higher in loblolly pine.

Four predators exhibited significant differences in abundance between the 2 tree species (Fig. 6). Plegaderus sp. occurred more abundantly in loblolly pine (0.17 vs. 0.06 beetles/dm³) \( (P<.05) \). Platysoma spp., Medetera sp. and Scoloposcelis sp. were more abundant in shortleaf pine (0.18 vs. 0.06 beetles/dm³, 0.34 vs. 0.09 insects/dm³, and 1.18 vs. 0.41 insects/dm³, respectively) \( (P<.01) \).

The abundance of L. referendarius, Scoloposcelis sp., Platysoma spp., and Plegaderus sp. differed significantly with the interaction of tree species and season \( (L. \text{ referendarius}, P<.05; \text{others } P<.01) \). In shortleaf pine, lowest emergence density for the 4 predators occurred in season I and highest density occurred in season IV. But in loblolly pine, the seasons of lowest and highest emergence differed for each predator (Fig. 6).

Among the parasites, only H. unica showed a significant difference in mean occurrence between tree species, with 0.34 insects/dm³ in shortleaf compared to 0.11 insects/dm³ in loblolly \( (P<.05) \). H. unica also showed a significant difference in mean occurrence when the effects of tree species and season were combined \( (P<.05) \). In shortleaf pine the mean densities for H. unica for seasons I through IV were 0.0, 0.20, 1.17, and 0.11 insects/dm³. In loblolly pine the mean densities for seasons I through IV were 0.0, 0.18, 0.27, and 0.0 insects/dm³.

It is difficult to explain the apparent effect of tree species on the individual predators and parasites, because some were more abundant in shortleaf while one was more abundant in loblolly pine. Different factors may have affected each insect species, causing their abundances to vary between tree species. Difference in a tree characteristic, such as the chemical composition of bark, could have directly affected the insects. Perhaps only one insect species was directly affected, while its abundance affected that of the other 3 predators and parasites.

**Diversity of Predators and Parasites**

Diversity indices for the 55 bolts ranged from 0.579–3.352 and diversity did not vary significantly with either height of sample or tree species.
bark of beetle-infested trees. Increase in diversity of species associated with single generations of *D. brevicomis* was noted by Stephen and Dahlsten (1976).

Season apparently had the strongest influence on the density of parasite and predator populations, perhaps due to seasonal variation in beetle abundance. Or, southern pine beetle populations could have been reacting to a seasonal fluctuation in parasites and predators.

Apparently, tree species influenced parasites more than it did predators. Height within infested trees seemed to have an effect only when it interacted with tree species, and even then, only one predator, *Medetera* sp., was affected.

**Acknowledgment**

We thank the following for determination of insect specimens: J. L. Herring (Anthocoridae), J. M. Kingsolver (Histeridae, Colydiidae), P. M. Marsh (Braconidae), F. C. Thompson (Dolichopodidae), G. Gordh (Torymidae, Pteromalidae), and T. J. Spilman (Tenebrionidae). Susan Gray drafted the figures. R. Goyer, F. M. Stephen, and G. K. Stephenson provided helpful comments on an early version of the manuscript. Two reviewers for the journal also gave useful suggestions.

**REFERENCES CITED**


Overgaard, N. A. 1968. Insects associated with the southern pine beetle in Texas, Louisiana, and Mis­sissippi. J. Econ. Entomol. 61: 1197–201.


