

PREFERENCE OF DENDROPHAGOUS INSECTS FOR FOREST BORDERS

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INTRODUCTION

Numerous investigations have shown that forest insect outbreaks usually occur in specific habitats. Frequently these outbreaks do not generally extend to other territories occupied by these same host trees. Moreover, in every stand subjected to an outbreak, both slightly undamaged plots and heavily damaged plots are found. Perhaps some plots are initially more resistant to insect attack, and insect distribution within forest ecosystems may have a mosaic pattern. Therefore investigation of the relation between dendrophagous insect distributions and initial heterogeneity of ecosystems may help us to understand the nature of forest stand resistance. This question lends interest to the peculiarities of dendrophagous insect distribution in relation to forest borders because borders and different glades are important factors in forest ecosystem heterogeneity.

INSECT DISTRIBUTION WITHIN STANDS

There is no large body of information on this question in the literature. I have used the available information on different species from several natural zones and considered the distribution of 180 species belonging to 33 families of six insect orders. Insect distribution was analyzed only at the main feeding stages.

Table 1 shows the majority (73.3 percent) of the species considered to prefer the forest border and its analogues (single growing trees or low-density stands).

Distribution of insects within a forest stand may depend on two main factors: 1) the presence of available food; and 2) microclimatic conditions. It is known that availability of food is more important for xylophagous insects than for phyllophagous ones. On the other hand, microclimatic conditions are more important for phyllophagous free-living species than for xylophagous ones. Thus it is necessary to analyze the distribution of both these insect groups separately. My analysis showed the forest border and its analogues to be preferable for the majority of species from both groups: 59 percent of xylophages and 66 percent of phyllophages. Thus these stations may satisfy different requirements (food and climate, among others) of the majority of dendrophages.

Table 1. Preferred distribution of 180 phytophagous insect species over different forest parts

Habitats	Number of species	
	Total	%
Forest borders and their analogues		
Isolated trees (A)	3	1.7
A + B	5	2.8
Forest borders (B)	18	10.0
B + C	46	25.6
Open, low-density stands (C)	49	27.2
A + B + C	11	6.1
Forest thickets and their analogues		
Closed, high-density stands (D)	29	16.1
C + D	7	3.9
Uncertain distribution		
A + B + C + D	4	2.2
B + C + D	1	0.5
Uncertain	7	

Climatic conditions are different in every natural zone, however, and the insect species areas may occur over several bioclimatic zones. Therefore dendrophage distribution in relation to forest borders may be different. Dispersal from one natural zone to another provide ample evidence that insect species exchange one kind of habitat for another. We should take this principle into account in our strategies for controlling insect species epidemics, but for our present purposes it is more interesting to consider dendrophage distribution within different zones, such as forest and steppe regions.

My data analysis again showed the majority of species to prefer the forest border and its analogues: 84 percent the forest zone and 71 percent the steppe. So these "border" habitats are assumed to have an advantage over forest thickets and their analogue for insects.

There is data indicating some abundant species use the forest borders as a refuge between outbreaks. Moreover, the initial outbreak areas often coincide with these refugia. At the same time, my analysis showed both outbreak and nonoutbreak insect species (81 percent and 79 percent respectively) to prefer forest borders. We may say, then, forest borders not only function as refuges for abundant species, but are preferred habitats for the majority of nonoutbreak species as well. The question is why?

EXPLAINING HIGH BORDER PREFERENCE

Let us consider some possible reasons why forest insects prefer forest borders. Forest border habitats are characterized by a great variety of 1) microsites and 2) tree and shrub species. For these reasons, rich insect species communities occur in these habitats. The existence of species variety is impossible within narrow local microclimatic conditions. However, since the forest borders are characterized by maximal amplitudes of microclimatic parameter fluctuations, they allow for the coexistence of insect species with different microclimatic requirements.

It might be thought that all these factors relate only to phyllophages because xylophages depend on microclimatic conditions to a lesser degree and for them the availability of food is more important. Only the tree borders are subjected to strong winds and other unfavorable influences, however, and that circumstance makes for constant renewal of the food base by xylophagous insects.

It is necessary, finally, to account for the preference of forest borders by cone and seed insects. Unlike the trees in forest thickets, border trees such as conifers may produce cones between "yield years." As a rule, only border and single-growing trees produce cones every year. Consequently, border habitats become refugia for cone and seed insects. This may also be a factor in the preference for forest borders by dendrophages.

Thus we may conclude that: 1) forest borders and their analogues are preferable habitats for a great number of dendrophagous insects; 2) forest borders and their analogues are strategic sites for control of abundant forest insect species; and 3) forest borders may be used expressly for the analysis of fauna of dendrophagous species in certain forest ecosystems.