Efficiency of Different Types of Pine Trap Trees

Artūras GEDMINAS, Jurate LYNIKIENE
Lithuanian Forest Research Institute, Girionys, 4312 Kaunas, Lithuania

Abstract. The experiment was conducted in 2003 in pine stands of southern Lithuania that were damaged by *Panolis flammea* (2000-2001). Under increased abundance of pine stem pests, trap trees of different types were placed in these stands: pine trees with crowns, pine trees without crowns, and standing artificially weakened pine trees. The aim was to ascertain which of these trap trees is more efficient in capturing pine stem pests.

I. Introduction

At present, protection of pine stands against stem pests is based on pheromone traps of various types, selective sanitary cuttings and trap trees. The following pine stem pests predominate in Lithuania: *Tomicus piniperda, T. minor, Phaenops cyanea, Acanthocinus aedilis, Ragius inquisitor, Pissodes pini and Monochamus galloprovincialis*. Until now there has been no uniform opinion on what trap trees are the most efficient in capturing pine stem pests. Most frequently, 2-3 m long pine logs, piled up at 5-10 units, are used for this purpose[1,2]. To increase the efficiency of trap trees, dispensers with the required attractant are fastened to each pile. Very often such trap trees are treated with contact insecticides [3,4]. To a large extent the efficiency of trap trees is predetermined by the selection and application of optimal terms for the placement of trap trees, their removal and treatment with insecticides.

The work was aimed to ascertain which of the newly chosen trap trees is more efficient in capturing pine stem pests.

II. Methods

In 2000-2001, in pine stands of southern Lithuania damaged by *Panolis flammea* larvae, 4 plots were established in zones with 20, 50, 70 and 100% defoliation . Three different trap trees were placed in the selected pine stands on 20 March 2003: pine trees with crown; pine trees without crown; and standing artificially weakened pine trees. The location of trap trees is presented in Figure 1.

The inventory of trap trees xylofauna was done on 26 June 2003. From each trap tree five 30 cm wide palettes were taken. For each palette, the area of the palettes, their location on the tree, insects in different stages of their development, maternal paths, larval paths, mating chambers and flight openings were counted. In addition, the location of different pests on the whole length of pine trees was recorded. The material collected was analysed in the Forest Protection Laboratory of the Lithuanian Forest Research Institute.

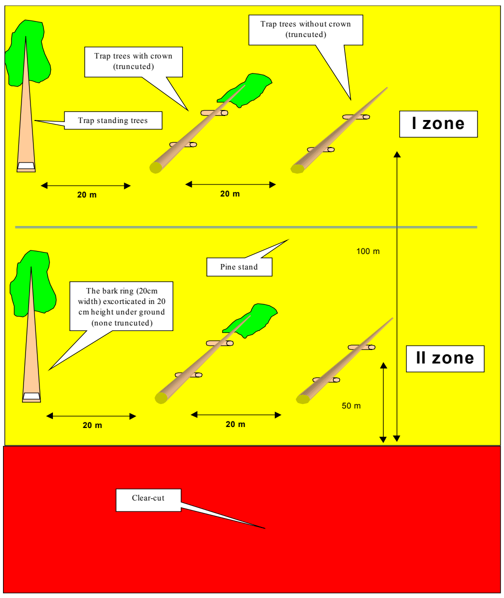

Fig. 1.

Table 1. Effect of defoliation on abundance of xylofauna.

Insect pest	Defoliation %	M±m	T** test	p
Tomicus minor	20	0.11±0.11	t_{1-2}=2.624	0.02
	50	2.24±0.8	t_{1-3}=1.615	*
	70	1.25±0.69	t_{1-4}=3.547	0.01
	100	6.61±1.83	t_{2-3}=0.936	*
			t_{2-4}=2.189	0.05
			t_{3-4}=2.743	0.02
Tomicus piniperda	20	3.56±0.91	t_{1-2}=1.285	*
	50	5.21±0.92	t_{1-3}=1.061	*
	70	4.97±0.98	t_{1-4}=1.297	*
	100	5.54±1.23	t_{2-3}=0.178	*
			t_{2-4}=0.211	*
			t_{3-4}=0.358	*
Total of *Tomicus*	20	4.24±1.34	t_{1-2}=1.906	*
	50	9.23±2.25	t_{1-3}=2.192	0.05
	70	10.4±2.24	t_{1-4}=2.429	0.02
	100	14.9±4.16	t_{2-3}=0.359	*
			t_{2-4}=1.192	*
			t_{3-4}=0.915	*
Acanthocinus aedilis	20	0.66±0.24	t_{1-2}=2.983	0.01
	50	3.96±1.08	t_{1-3}=3.214	0.01
	70	3.76±0.93	t_{1-4}=4.366	0.01
	100	8.68±1.82	t_{2-3}=0.139	*
			t_{2-4}=2.228	0.05
			t_{3-4}=2.401	0.05

Note: *- differences are not significant
**- 1- 20% defoliation, 2 – 50%, 3- 70%, 4 – 100%

III. Results and Discussion

The percent composition of the xylofauna recorded during the inventory of trap trees was: *Tomicus piniperda* 29.9%, *Acanthocinus aedilis* 25.1%, *Pityogenes chalcographus* 15.4%, *Scolytidae* sp. 14.4%, *Tomicus minor* 12.1%, *Thanasimus formicarius* 2.5%, *Ips sexdentatus* 0.6%. This xylofauna composition differed in each variant of the experiment.

The data collected was analysed according to study zones, plots with different levels of crown defoliation and trap tree types. Comparison of the results has revealed that the abundance and diversity of xylofauna in trap trees is independent of how far from the cutting area they were placed in the forest. It can be explained by the fact that the main pine xylophagans accumulate not in cutting residues (stumps, branches), but in the stand itself. On average in 1000 cm² size palettes we found 5.3 *Tomicus piniperda*; 4.0 *T. minor*; 9.6 maternal paths of other *Scolytidae* sp.: 5.8 *Acanthocinus aedilis*; and 1.3 *Thanasimus formicarius* 1.3 specimens.

Comparing plots with different levels of damaged pine needles, it was found that the control (20% defoliation) plot reliably differs from other plots with 50%, 70% and 100% defoliation (Table 1).

In plots with higher defoliation, total abundance of xylofauna in trap trees did not differ and was 2.7 times higher than in the control stand.

The abundance of *Tomicus piniperda* was almost the same in different plots. It can be stated that pine defoliation level had no major significance on the abundance of this beetle. This factor was more important to *Acanthocinus aedilis* and *Tomicus minor* (Table 1).

Acanthocinus aedilis prefers strongly weakened pine trees and those already attacked by *Tomicus piniperda*. Therefore, its abundance in the100% defoliation plot was 2.2 times higher than in 50-70% plots and 13.1 times higher than in the control stand. Changes in the abundance of *Tomicus minor* in stands with different defoliation levels is similar to that of *Acanthocinus aedilis.*

The abundance of *Tomicus piniperda* was similar in all studied types of trap trees (Table 2).
Tomicus minor and *Acanthocinus aedilis* were least abundant in standing trap trees. *Acanthocinus aedilis* was most abundant (6.27 spec./1000 cm²) in lying trap trees without crowns. This shows once again, that this beetle attacks weakened trees.

Tomicus minor mostly prefers lying trap trees with crowns. It is understandable, since trees with crowns stay viable for a longer time, providing suitable conditions for the development of *Tomicus minor*.

Xylofauna inventory support the statement found in the literature that *Acanthocinus aedilis* larvae can additionally feed on *Tomicus piniperda* larvae and pupae. Under higher abundance of *Acanthocinus aedilis* and *Thanasimus formicarius* larvae, the abundance of *Tomicus piniperda* significantly decreases. Based on the number of maternal paths of *Tomicus piniperda*, we predict that about 250 offsprings should develop per 1000 cm². During our inventories, *Acanthocinum aedilis* (5.8 spec./1000 cm²), *Thanasimus formicarius* (1.3 spec./ 1000 cm²) and diseases killed about 96% of *Tomicus piniperda* offspring of the new generation.

Tomicus piniperda is efficiently captured by standing artificially weakened trap trees. Such trap trees successfully attract the adults of *Tomicus piniperda* (8.3 spec./ 1000 cm²). However, high resin content in these trap trees has completely stopped the development of the new generation.

IV. Conclusions

1. According to the amount of attracted xylofauna, the most efficient were lying trap trees with crowns, followed by lying trap trees without crowns.
2. During the experiment *Acanthacinus aedilis* (5.8 spec./ 1000 cm²), *Thanasimus formicarius* (1.3 spec./ 1000 cm²) and diseases killed 96% of *Tomicus piniperda* offsprings of the new generation.
3. Crown defoliation level did not influence the attraction of *Tomicus piniperda* and *Tomicus minor* to trap trees but trapping *Acanthocinus aedilis* is best in stands with 90-100% crown defoliation.

References

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