Effect of Aerial Sprays on the Abundance of Litter Insects

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Abstract

The research objectives were to determine the species composition and seasonal dynamics of pine litter arthropods and examine the effect of insecticide treatments on non-target organisms associated with pine beauty moth (*Panolis flammea* Schiff.*)* outbreaks. Representatives of beetles (*Coleoptera*) were the dominant arthropods collected (65.6% of 20,500). The average numbers of arthropods captured per trap were as follows: 37.03 ± 7.16 in Foray 48 B sprayed plots; 30.45±1.66 in Arrivo sprayed plots; 24.10±3.78 in control (unsprayed) plots.

Keywords: *Panolis flammea*, aerial sprays, insecticides

Introduction

Damage caused by defoliating insects usually expands over large areas and in many cases may cause extensive tree dieback in pine forests. Chemical or biological insecticides are often applied to prevent defoliation. Arthropods are very important in the self-regulation of forest ecosystem processes; spiders and other arthropods can efficiently control insect pest abundance in the forest litter (8B28=>20 1985). However 40% of beneficial insects were impacted by aerial treatment of forests with pyrethroids, 15% of them being entomophagous species (Žiogas 1995). Therefore, investigations of the impact of aerially applied chemical and biological insecticides on non-target organisms during area-wide pest suppression programs are always of high importance.

In May, 2001, 3150 ha of pine forests were sprayed with Foray-48B and 1547 ha with Arrivo to control the pine beauty moth (*Panolis flammea* Shiff.) in 2001. The research was conducted to evaluate the impact of these forest protection treatments (aerial spray) on the abundance of pine litter arthropods.

Methods

The research was carried out in pine beauty moth (*P. flammea*) outbreak populations in Druskininkai, Varėna forest enterprises and Dzūkija national park pine forests. Litter arthropods were captured in pitfall traps (150 ml, 6.5 cm diameter plastic cups) filled with 10% formalin. Traps were installed two weeks before spraying was conducted and emptied once or twice each month between May and October. 24 traps were placed in forest plots sprayed with Arrivo (conventional pyrethroid), 24 traps in plots sprayed with Foray 48B (microbial pesticide), and 24 traps in a forest plot designated as an untreated control. Traps were placed in 2x2 m rectangle design with three replications; the distance between replications was 20 m (Фасулати 1971). Trap results were calculated for 20-day periods in order to compensate for irregularities in collecting dates between treatments.

Results

Approximately 20,500 arthropods were collected and identified in the study plots. Beetles (Coleoptera) dominated the collections and represented 65.6% of all collected arthropods. Within the Coleoptera, the three dominant families were as follows: Carabidae (ground beetles) 70.8%; Curculionidae (weevils) 13.2%; Staphilinidae (rove beetles) 9.6%. Other groups captured included Aranei (mites) 11.7%, and Hymenoptera (11.7%) (Table 1).

Table 1.—Pitfall trap captures in pine beauty moth plots

Order	Abundance	Family	Abundance
Coleoptera	65.6%	*Carabidae*	70.8%
Diptera	1.1%	*Elateridae*	1.3%
Hymenoptera	11.7%	*Scarabaeidae*	3.4%
Lepidoptera	1.1%	*Curculionidae*	13.2%
Aranei	19.9%	*Staphilinidae*	9.6%
Other insects	0.6%	*Silphidae*	0.8%
		Other beetles	0.9%

The number of arthropods in Foray 48B sprayed plots averaged 37.03±7.16 specimens per trap. In Arrivo sprayed plots the average number was 30.45±1.66, and in the control (unsprayed) it was 24.10±3.78. The increased abundance of pine beauty moth larvae in outbreak areas had a positive influence on the number of litter insects captured. The abundance of litter arthropods essentially increased after treatment with Arrivo; in June-July the catch was over two times greater than in May (Table 2). These differences were statistically significant. A similar increase in trap captures was observed in Foray 48B treated plots, where catches after treatment increased from 38.15±9.42 to 65.78±6.32. This difference can be explained by the large number of pine beauty moth larvae that dropped from the forest canopy after treatment; this created a vast food supply which was attractive to entomophagous arthropods (spiders and ground beetles in particular) from surrounding stands.

Table 2.—Effect of different treatments on arthropod abundance

Month	Abundance in different treatments, number/trap/20 days		
	Arrivo	Foray 48B	Control
May	23.25 ± 2.54 a	38.15 ± 9.42 ac	33.19 ± 5.10 ab
June	53.44 ± 2.41 b	28.56 ± 2.67 b	17.42 ± 2.14 bc
July	55.17 ± 2.51 b	65.78 ± 6.32 a	33.80 ± 2.82 a
August	8.15 ± 78 c	42.42 ± 6.72 a	15.51 ± 1.86 c
September	26.09 ± 0.63 a	39.87 ± 6.01 ab	40.92 ± 5.90 a
October	8.81 ± 1.11 c	8.54 ± 0.83 c	12.86 ± 4.86 c
Average	**30.45 ± 1.66**	**37.03 ± 7.16**	**24.10 ± 3.78**

Values followed by same letter do not significantly differ (Student t-test, p=0.90)

The seasonal dynamics of ground captures/trap in the Foray 48B plot as compared to the unsprayed control can be explained by the slower action of the biological preparation (Žiogas 1995). The number of arthropods captured in the pyrethroid sprayed plots increased immediately after treatment (June), however in the Foray 48B treated plots, this increase came later (July-August) and was not as large. Three months after treatment (September) there was no significant difference in the average abundance of litter insects among the treatment and control plots.

Conclusions

1. The representatives of the order *Coleoptera* (beetles) dominated the pitfall trap captures and represented 65.6% of all collected arthropods.

2. Number of arthropods per trap in the Foray 48 B sprayed plots was 37.03±7.16 in Arrivo sprayed plots 30.45±1.66, and 24.10±3.78 in the control plot (unsprayed).

3. After treatment with Arrivo, the abundance of litter arthropods increased significantly for two months (June-July) and later decreased to the same level as in the control plots.

4. After treatment with Foray 48B, there was a slower increase in the abundance of litter arthropods however the average number/month was higher.

References

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