Thanasimus formicarius (Coleoptera: Cleridae) : Why a Large Range of Prey for a Specialized Predator ?

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Abstract - *Thanasimus formicarius* (L.) (Coleoptera : Cleridae) is a generalist predator of many scolytid species in spruce, pine and broadleaf stands. We tested here the hypothesis that, having a protracted adult life, the predators must leave pine stands, most favourable for their development and forage in other types of forest stands to find suitable prey during their whole flight period. The results reported here (data from continuous passive trapping of pine, spruce and broad-leaf bark beetles), showed continuous presence of bark beetles in the pine stand, which would allow the predators to remain in pine stands during their whole life. However, we observed changes in species composition and abundance during our two-year experiment, suggesting that uncertainties in prey supply could explain *T. formicarius*' wider range of prey.

I. Introduction

Thanasimus formicarius (L.) (Coleoptera: Cleridae) is one of the most common and best known predators of bark beetles [1]. Adults of *T. formicarius* live 4 to 10 months [2] and respond to bark-beetle pheromones [3,4,5] and to host-tree volatiles [6]. They land on trees that have been attacked by bark beetles, feed on the bark-beetle adults and lay eggs on the bark. Their larvae enter the scolytid galleries and feed on the immature stages of the bark beetles. Finally, pupation occurs in niches in the outer bark.
T. formicarius is known to respond to the pheromones of *Ips typographus*, the spruce bark beetle [3]. In Belgium however, it was very seldom found associated with *Ips typographus* in spruce stands and was rarely caught in traps baited with *I. typographus'* pheromone [7,8,9]. Moreover, *T. formicarius* was trapped in high numbers in pines. Past experiments suggested that bark thickness could be a critical factor limiting pupation of *T. formicarius* on spruce (J.C. Grégoire, in prep.).

T. formicarius feeds on 27 bark-beetle species belonging to 15 genera (*Dendroctonus*, *Dryocoetes*, *Hylastes*, *Hylesinus*, *Hylurgops*, *Hylurgus*, *Ips*, *Leperesinus*, *Orthotomicus*, *Pityogenes*, *Pityokteines*, *Polygraphus*, *Scolytus*, *Tomicus* and *Trypodendron*) which infest coniferous (pine, spruce, larch, Douglas fir, …), and broad-leaved trees (oak, ash, poplar, …) [2,5,10].

We tested the hypothesis that *T. formicarius* develops more successfully on pine but, having a protracted adult life, must move to spruce or to other tree species to find suitable prey during periods corresponding to empty windows in the phenology of pine bark beetles.
We monitored the flight periods of all bark-beetle species in three different types of stand (pines, spruces and broad-leaves) and compared them with the predators' flight period.

II. Material and method

Groups of five window traps were set-up from 22 March to 30 October 2001 and from 8 March to 31 October 2002, in several stands in the South of Belgium -- a pine (*Pinus sylvestris* L.) stand and a spruce (*Picea abies* L.) stand in 2001 and in 2002 and, additionally, an oak and beech stand in 2002. Each group of traps surrounded a pile of freshly cut logs, coming from the same stand. This pile of logs was replaced in the middle of the trapping period. The traps were inspected weekly and all scolytids were identified [11] and counted.

III. Results

There were more bark beetles and *T. formicarius* caught in the pine than in the spruce stand and the oak/beech broad-leaved stand (Table 1). There were also much higher catches in 2001 than in 2002. There were more "large" bark-beetle species (longer than 2 mm) trapped among pines (17) than among spruces (14) or broad-leaves (7).

TABLE I
Total catches of bark beetles and *T. formicarius*

	Bark beetles		*T. formicarius*	
	2001	2002	2001	2002
pines	41,552	14,875	56	24
spruces	7,149	1,814	15	6
broad-leaves	NA	853	NA	0

Bark beetles were caught during the whole flight season in all three stands (Fig. 1). Zero-catches (explained by climatic factors) occurred several times, and were simultaneous in all stands.

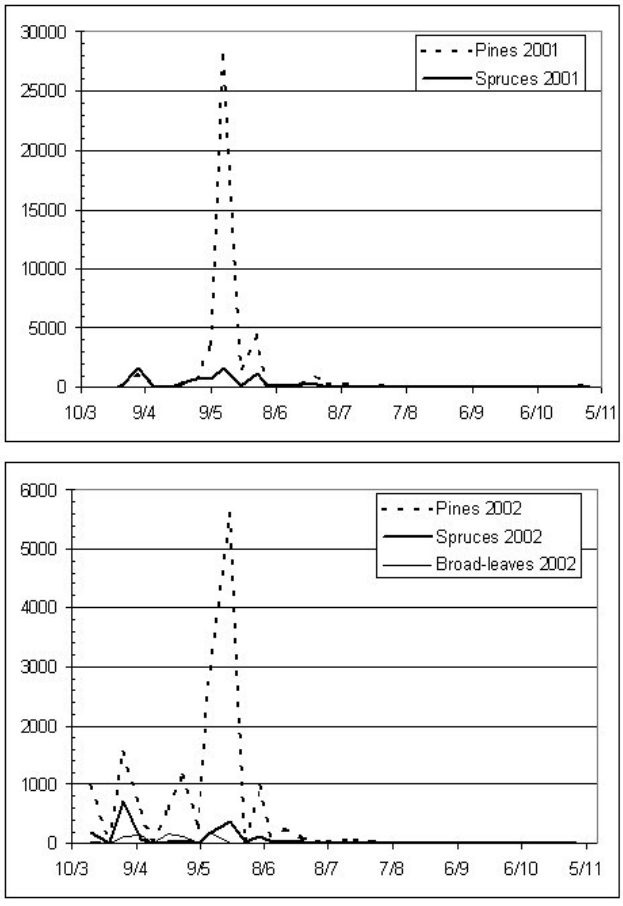

Fig. 1. Bark-beetle total catches during 2001 (a) and 2002 (b)

Among pines, the bark-beetle species composition showed a similar trend during the two years: a main species (*Hylastes attenuatus*) and a secondary species (*Hylastes ater*). In spruces, in 2001, four species were mainly trapped (*Dryocoetes autographus*, *Hylurgops palliatus*, *Trypodendron lineatum* and *Hylastes ater*), whilst in 2002, *Hylurgops palliatus* represented half of the catches. From one year to the next, there were major changes in bark-beetle species composition. Some new bark-beetle species appeared, whilst several species were absent during the second year.

T. formicarius began to fly one month earlier in pines than in spruces, while *Tomicus piniperda* and *Hylurgops palliatus* were trapped at the same period respectively in the pine stand and in the spruce stand.
All through the flight period of *T. formicarius*, bark beetles were trapped in the pine stand. Absence of prey in the pine stand could thus not explain by itself the presence of *T. formicarius* in the spruce stand. Changes of bark-beetle abundance in the traps of all stands could be explained by inappropriate flight conditions (temperature too low, rain, wind, …).

IV. Discussion

Thanasimus formicarius was trapped in higher numbers in the pine stand than in the spruce stand. These results confirm its' preference for pines, reflecting its' supposedly weak reproductive success on spruces.

The decrease in catches between 2001 and 2002 could be partly explained by climatic influences. These differences in catches between the two years was also observed for other Coleopteran families (Staphylinidae, Cerambycidae, …).

Thanasimus formicarius was trapped one month earlier in the pine stand than in the spruce stand, although prey were present in the two stands. This difference might be at least partly due to the fact that *T. formicarius* mostly originates from the pine stands. The young adults were probably under the bark of pines, ready to take off as soon as the temperature allowed, and first started to forage within the pine stand.

V. Conclusion

These experiments conducted under natural conditions show that temporary absence of prey in the pine stands cannot explain why *Thanasimus formicarius* would have shifted to spruce stands. However, scolytid species composition varied from year to year -- some bark-beetle species appeared or disappeared in the different stands. We cannot exclude therefore that, some years, prey is temporarily lacking in the pine stands, thus explaining the predators' need for a wider range of prey attacking several host-tree species.

Acknowledgements

The experiment was performed in the Wellin forest district. We thank Ir. J. Gilissen for allowing us to trap; Mr. P. Corbeel for support in the field, and Gaetan Daine, Sylvain Blomart and Alain Drumont for help during the trap inspections.
NW is a doctoral fellow of the Fonds pour la Formation à la Recherche dans l'Industrie et dans l'Agriculture (FRIA). She also gratefully acknowledges the financial support of the Fonds National de la Recherche Scientifique (FNRS) and the Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique which allowed her to participate to the IUFRO Kanazawa 2003 meeting.

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