imply that secondarily formed metabolites II and/or III might play a behavioral role as a part of a male pheromone in their courtship sequence, and also potentially function as an allomone against predators. Rigorous work will be needed to clarify the ecological significance of the phenylpropanoid – fruit fly association.

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The clerid beetle, *Thanasimus formicarius*, is attracted to the pheromone of the ambrosia beetle, *Trypodendron lineatum*

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Summary. Sticky traps containing (+)-lineatin, the pheromone of the ambrosia beetle, *Trypodendron lineatum*, attracted the predator *Thanasimus formicarius* to about the same extent as traps baited with ipslure, the pheromone blend used for mass-trapping *Ips typographus*. The results indicate that *T. lineatum* is an important prey for *T. formicarius* early in the season before the main prey becomes active. Addition of *exo*-brevicomin to ipslure and ethanol and/or α-pinene to (+)-lineatin did not significantly influence the catches of the predator.
Key words. Predator/prey relationship; bark beetles; *Thanasimus formicarius*; *Trypodendron lineatum*; kairomone; (+)-lineatin; ipslure.

In the extensive review by Gauss[1], it is reported that the clerid beetle *Thanasimus formicarius* (Coleoptera: Cleridae) is a predator on at least twenty species of bark beetles which belong to the genera *Ips, Pityogenes, Tomicus, Polygraphus, Hylesinus, Hylastes* and *Scolytus*. However, no species of *Trypodendron* was considered as a prey for *T. formicarius*. In a later review[2] it is suggested that *T. lineatum* might be a prey for this clerid predator. It was therefore interesting to find by electrophysiological studies that *T. formicarius* has numerous olfactory receptor cells specifically responding to (+)-lineatin, the pheromone of *T. lineatum*[3]. It was proposed that *T. lineatum* might be a prey for *T. formicarius*, especially early in the spring before more important species of prey (e.g. *Ips typographus*) become active.

The present field study was made in order to find out whether or not (+)-lineatin is attractive to *T. formicarius*. Since ipslure*, the pheromone blend of *I. typographus*, is a well-known attractant to this predator[4], the present field experiments were carried out in a manner that made it possible to compare the attraction of (+)-lineatin with that of ipslure. Furthermore, the influence of ethanol and α-pinene on the attraction of *T. formicarius* to (+)-lineatin was tested as well as the effect of *exo*-brevicomin on the attraction to ipslure. These mixtures were studied since ethanol and α-pinene synergize the attraction of *T. lineatum* to (+)-lineatin[5] and *exo*-brevicomin influence the attraction of *I. typographus* to ipslure[6,7].

As test areas six fields of Norwegian spruce were used (in Malvik, Klæbu and Trondheim), four of which had been clearcut the preceeding winter. The same type of sticky traps as previously reported[6] were used. These were baited with the following test compounds; (+)-lineatin (L), (+)-lineatin plus α-pinene (L + α-p), (+)-lineatin plus both α-pinene and ethanol (α + α − p + et), ipslure (I) and ipslure plus *exo*-brevicomin (I + *exo*-B). In some replicates (carried out in 1985) two concentration levels of ipslure (I) and ipslure plus *exo*-brevicomin (I + *exo*-B) were tested. Here I (10 cm) and I (50 cm) mean 10 respectively 50 cm of the 100 cm plastic strip dispenser used for mass-trapping of *I. typographus*. In these replicates the *exo*-brevicomin dispenser (a polyethylene cap) contained respectively 9 mg (B (9 mg)) and 60 mg (B (60 mg)) of *exo*-brevicomin. Each replicate included one control trap (C) without dispenser. The traps were placed in a line, 40 m from the edge of a forest or from lumber of spruce logs. The distance between each trap was 15 m, except for the traps containing the high amount of compounds (I (50 cm) and I (50 cm) + *exo*-B (60 mg)) where the distance between the traps as well as the distance to the edge of the forest was 50 m. In 1984 the mounting of the traps was completed on May 5, in 1985 on May 15 and in 1986 on May 12. The traps were emptied four times about every 10th day and the total number of *T. formicarius* caught in each trap was counted.

The results are summarized in the table, showing the mean number of catches for each type of trap. For all traps the number of beetles was low. This is, however, due to the low population of *T. formicarius* in these areas which was observed in parallel during the years 1983–86, using the standard ipslure traps for mass-trapping *I. typographus*. Meanwhile, in the replicates of the present study the (+)-lineatin sticky traps caught as many beetles of *T. formicarius* as the ipslure traps. By further comparison of trap catches it was

T. formicarius. The mean number of beetles caught by the traps with different dispensers; I = ipslure, I + *exo*-B = ipslure plus *exo*-brevicomin, L = (+)-lineatin, L + α-p = (+)-lineatin plus α-pinene, L + α-p + et = (+)-lineatin with addition of both α-pinene and ethanol and control without dispenser. The catches each year followed by the same letter are not significantly different (Mann Whitney U-test; 5% significant level).

Type of dispensers	1984 Mean of catches	SD	Number of traps	1985 Mean of catches	SD	Number of traps	1986 Mean. of catches	SD	Number of traps
I (10 cm)	3.0^{a}	1.4	2	2.4^{ac}	0.54	5	2.0^{a}	1.0	3
I (50 cm)				4.0^{b}	0.81	4			
I (10 cm) + *exo*-B (9 mg)				1.6^{a}	0.54	5			
I (50 cm) + *exo*-B (60 mg)				4.0^{b}	0.0	4			
L	3.0^{a}	1.0	3	3.7^{abc}	2.0	6	3.0^{a}	1.0	3
L + α-p	5.0^{a}	4.5	3	2.3^{ac}	0.6	3			
L + α-p + et	5.0^{a}	2.8	2						
Control	0^{b}	0.0	5	0.2^{d}	0.4	9	0^{b}	0.0	3

found that addition of α-pinene and ethanol to (+)-lineatin or *exo*-brevicomin to ipslure did not significantly influence the capture of *T. formicarius*. This is in accordance with electrophysiological data which showed no specific receptor cells for α-pinene, ethanol and *exo*-brevicomin in this species[3]. An expected increase of catches with larger amount of compounds occurred for ipslure and ipslure plus *exo*-brevicomin. Although statistically significant, this increase was small, which can be ascribed to the general low number of *T. formicarius* caught and their low population in these areas.

The present results confirm the suggestions made previously that the pheromone of *T. lineatum* is an olfactory cue (kairomone) for *T. formicarius*, which may thus use adult *T. lineatum* as prey, especially early in the season before the main prey, e.g. *Ips typographus*, appears. In Scandinavia the flight periods of both *T. formicarius* and *T. lineatum* are early, in late April and early May, whereas *I. typographus* is flying about three weeks later[8,9]. In the laboratory *T. formicarius* feed on *T. lineatum* when these are available.

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* The standard dispenser (ipslure) used for mass-trapping *I. typographus* is a 100-cm plastic strip containing 1500 mg 2-methyl-3-buten-2-ol, 70 mg *cis*-verbenol and 15 mg ipsdienol made by Borregaard Industries Ltd., Norway. The lineatin dispensers (Borregaard) contain 2 mg (+)-lineatin.

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Why do parent birds swallow the feces of their nestlings?

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Summary. Goldfinches *(Carduelis carduelis)* consume the feces of their nestlings until the digestive efficiency of nestlings and adults is nearly equal. With increasing nestling age from the first day onwards, the energy content of the nestlings' feces decreases. The percentage of fecal pellets swallowed by the adults during the course of the nestling period is negatively correlated with their energy content. It may be concluded that adults use the feces of their young as an energy source.
Key words. Goldfinch; feces consumption; nestling; energy.

Passerine nestlings produce feces enclosed in gelatinous sacs. Adults normally eat the feces of the young nestlings, but those of older ones are normally carried away and dropped at some distance from the nest or deposited by the nestlings on the rim. The aim of this paper is to point out that, by swallowing the feces of its nestlings, a female goldfinch *(Carduelis carduelis* L.) may gain a considerable amount of energy by recycling them. The consumption of feces stops when it becomes inefficient from an energy point of view. This suggests that at least in seed-eating finches, where the female has to brood the young in the first days and is fed by the male, it is beneficial for her to swallow the droppings of the chicks as an additional source of energy.

The consumption of feces is supposed to have the following functions: a) Nest sanitation[1,2]; perhaps stimulated by an agreeable taste of the feces[1]. b) Gain of water; as the young usually discharge a product of lower solute concentration than the adults, the latter may gain some free water by feeding on the fecal sacs[3]. For the mountain white-crowned sparrow *(Zonotrichia leucophris oriantha)*[4] and the roadrunners *(Geococcyx californianus)*[5] the water from the fecal sacs may add a significant amount of water to the daily