

Two-Component Sexual Attractant for Male *Batrachedra pinicolella* (Zell.) (Lepidoptera: Batrachedridae)

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Contrary to an earlier report, male *B. pinicolella* are shown to respond to synergistic blends of (Z)-5-decenyl acetate with its corresponding alcohol analogue. Four other, decenyl or dodecenyl, compounds are reported as potent trapping inhibitors. This pattern of pheromonal attraction and inhibition conforms with that found in some species groups of Coleophoridae, supporting the view of a close phylogenetic origin of the two families.

The Batrachedridae are a small group of gelechioid moths showing morphological affinities to Momphidae, Cosmopterygidae and Coleophoridae [1–5]. Pheromone identifications have not yet been reported from this family, but Willemse *et al.* [6] mentioned attraction of male *Batrachedra* (*Eustaintonia*) *pinicolella* (Zell.), a European species infesting coniferous trees, to (Z)-5-decenyl acetate (Z5-10:Ac). Here I present data showing that this species uses a synergistic, rather than single-component, attractant system. Attraction inhibitors will also be reported and pheromonal affinities to certain species groups of Coleophoridae pointed out.

(Z)-5-Decen-1-ol (Z5-10:OH) and its acetate analogue (Z5-10:Ac) have been established as sex-attractant components for a number of spp. of this latter family [5–12]. Whilst evaluating combinations of these two compounds for attractiveness towards certain spp. of *Coleophora*, substantial captures of male *B. pinicolella* were regularly noted in trapping tests conducted, during mid summer, near stands of Norway spruce (*Picea abies*), the main host of the species in central Europe. Responses were generally highest for the 100/100 mixture and lower for other mixture ratios, with the single chemicals alone revealing poor if any captures (Table I). This is in apparent contrast to Willemse *et al.*'s statement of Z5-10:Ac alone being attractive to this species

(based on records from a single trap containing 1000 µg of this chemical [6]).

The sex-attractant system of *B. pinicolella* was studied further with traps placed within infested spruce forests, using technical procedures as in field work on other Microlepidoptera [10, 13]. Particular attention was given to potential modifying effects of compounds known to have pheromonal functions in other gelechioid families [12]. These, and selected structural analogues, were tested mainly as third components added to the attractive mixture of 100 µg Z5-10:Ac + 100 µg Z5-10:OH.

Four compounds, viz. (Z)-3-decenyl acetate (Z3-10:Ac), (Z)-7-decenyl acetate (Z7-10:Ac), (Z)-7-dodecenyl acetate (Z7-12:Ac), and (Z)-7-dodecen-1-ol (Z7-12:OH), were thus defined as highly potent attraction-inhibitors for male *B. pinicolella* (Table II). Other compounds, including (*E*)-5-decenyl acetate (*E*5-10:Ac) and (Z)-7-decen-1-ol (Z7-10:OH), had a weaker lowering effect, whereas most proved inert with respect to modifying of male attraction.

Single cell recordings have not yet been made from male *B. pinicolella*, but the response pattern established in the field tests points to a pheromone receptor system composed of six different types of receptor cells, specific to Z3-10:Ac, Z5-10:Ac, Z7-10:Ac, Z7-12:Ac, Z5-10:OH and Z7-12:OH, respectively. The weaker modifying effects obtained for some further compounds may be attributable to partial stimulatory effects on these cell types, rather than the presence of additional ones.

The results presented indicate a close pheromonal relationship between *Batrachedra* and *Coleophora*. In this latter genus too, test spp. using (Z)-5-decenyl attractant components have been found to be highly

Table I. Trap captures of male *Batrachedra pinicolella* with different mixture ratios of (Z)-5-decenyl acetate and (Z)-5-decen-1-ol. Seewiesen/Starnberg, June 10 to July 12, 1982, and June 26 to August 5, 1985; three replicates per treatment.

Amount [µg/trap] of		No. <i>B. pinicolella</i> caught	
Z5-10:Ac	Z5-10:OH	1982	1985
100	—	0	1
100	10	97	31
100	100	211	89
10	100	71	40
—	100	2	0

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Table II. Effect of third components<sup>a</sup> on trap captures of male *Batrachedra pinicolella* with 100 µg (Z)-5-decenyl acetate + 100 µg (Z)-5-decen-1-ol. Seewiesen/Starnberg, 1985 to 1989; No. replicates given in brackets; —, not tested.

Additive, µg	No. <i>B. pinicolella</i> caught			
	1985 (3)	1987 (3)	1988 (4)	1989 (4)
None	89	144	111	235
Z3-10:Ac, 10	—	—	45	40
100	8	7	0	3
Z3-10:OH, 100	79	—	131	—
E5-10:Ac, 10	—	—	98	—
100	—	32	49	—
E5-10:OH, 10	—	—	127	—
100	—	153	101	—
Z7-10:Ac, 10	—	—	—	60
100	—	4	9	13
Z7-10:OH, 10	—	—	—	211
100	—	99	72	169
Z5-12:Ac, 100	74	119	—	—
Z5-12:OH, 100	60	151	—	—
Z7-12:Ac, 10	—	—	9	21
100	1	0	1	3
Z7-12:OH, 10	—	—	24	37
100	3	3	5	4
Z9-12:Ac, 100	—	139	—	—
Z9-12:OH, 100	—	161	—	—

<sup>a</sup> For abbreviations see text.

sensitive to “inhibition” by (Z)-3- or (Z)-7-decenyl and (Z)-5- or (Z)-7-dodecenyl analogues [5, 10, 11, 14]. Together with morphological characters, this pheromonal conformity provides further support for a close phylogenetic origin of *Batrachedridae* and *Coleophoridae* [1–5].

A role for the “inhibitory” analogues in reproductive species isolation, suggested for some subgroups of *Coleophora* [5, 9–11, 14], is not apparent for *Batrachedra* which in central Europe is represented by only two species, differing in habitat and host plant. Alternatively, potential intraspecific functions of low (“subinhibitory”) amounts of these analogues cannot yet be excluded from the present trapping data alone. This points to the need for identifying the actual pheromone blend released by calling *B. pinicolella* females, combined with a detailed behavioural analysis of male responses to modified synthetic blends.

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