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PERIMETER TRAPPING: A NEW MEANS OF MASS TRAPPING WITH SEX ATTRACTANT OF ANOMALA SCARABS

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Two mass trapping trials were undertaken with traps baited with the sex-attractant of *Anomala vitis* FABR. and *A. dubia* SCOP. (Coleoptera: Scarabaeidae, Melolonthinae), one in a young sour cherry plantation and the other in mature peach orchard. Traps in the 1st and 2nd perimeter rows of the trap grid caught many more beetles on an average than traps in the 3rd or 4th rows. In the mature peach orchard trial, fruit damage was estimated to have been lowered to ca. 5%, a level acceptable for the farmers. The results suggests that the majority of the beetles did not develop from pupae within the plantation but had flown in from neighbouring areas to feed on the fresh leaves or fruit; consequently mass trapping of *Anomala* spp. using perimeter traps might be a viable alternative to insecticides for the control of these pests. In contrast to mass trapping trials with moths, it is the adult stage of these scarab beetles which is economically important and which are caught in these traps, so damage should be reduced in proportion to the population trapped.

Key words: *Anomala vitis*, *A. dubia*, Coleoptera, Scarabaeidae, Melolonthinae, mass trapping, sex attractant

INTRODUCTION

In Hungary, adults of the scarabs *Anomala vitis* FABRICIUS and *A. dubia* SCOPOLI (Coleoptera, Scarabaeidae, Melolonthinae) are known to cause significant leaf damage during outbreaks. The former species is especially important on grapes; although both species feed on many orchard trees and shrubs (JABLONOWSKI 1912, HOMONNAY & HOMONNAYNÉ-CSEHI 1990). Damage caused by these two species has been reported with increasing frequency and importance, not only in vineyards but also in several orchard crops (VOIGT *et al.* 2000, VOIGT & TÓTH 2000). Damage is predominantly caused by adult beetles feeding on either the leaves or fruit or both. When leaf damage occurs in a young orchard or nursery, the growth of the young trees is reduced and they may even be killed. In older orchards, especially in peaches, the beetles prefer to feed on ripening fruits, resulting in low quality fruit, which may be impossible to market.

Damage by these beetles is difficult to prevent as both species have a long flight period, in some years starting towards the end of May and lasting until early August. Because of this long flight period, preventive control can be achieved only by repeated insecticide sprays. These are both costly and leave hazardous residues, so that applications during harvest are unacceptable.

Some years ago, the synthetic compound (2*E*)-2-nonenol was found to be a highly effective sex attractant for males of both *Anomala* species (TÓTH *et al.* 1994). More recently, a high capacity funnel trap has been developed by the Plant Protection Institute, Budapest (TÓTH *et al.* unpubl.) which has proved to be excellent for capturing these two pests in large numbers (VOIGT *et al.* 2000).

In the present paper, we describe preliminary trials for controlling these two *Anomala* species by mass trapping with traps baited with the above sex attractant. The use of these traps could be an excellent alternative control method, as it might reduce damage to below an economically acceptable threshold and, at the same time, is non-toxic, posing no health or environmental risks, and so can be used throughout the harvest period.

MATERIALS AND METHODS

The traps and baits used were standard *Anomala* funnel traps (CSALOMON® VARb2) produced by the Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. Each trap consisted of a plastic funnel (top opening inner diameter of 16 cm, funnel hole diameter 3 cm, height of funnel 19 cm), beneath which was held a round, transparent, plastic catch container (ca. 1 litre in volume) which, in turn, was held in place by a rubber band. The bait dispenser was attached onto the inner wall in the middle of the funnel opening.

Two trials were carried out during the summer of 2000, one in a young sour cherry orchard and the other in a mature peach orchard. The trial in the sour-cherry orchard was carried out in a young plantation planted in 1998 at Vetter Kft., Csengele (Csongrád county, Hungary). Here the traps were placed on tree branches at a height of ca 1.5–2.0 m on May 31, in an 18×15 m grid covering the total area (2.5 ha) of the plantation.

The trial in ripening peaches was performed in an orchard at the Bóka-Mangó family farm, Zákányszék (Csongrád county, Hungary; cultivars: Red June, Early Redhaven, Flavortop). Here the traps were set out at a height of 1.8–2.0 m in the crown of the trees on June 14, in a 15×20 m grid, covering 1.4 ha of the total orchard area of 2.4 ha. At this time, it was observed that the neighbouring orchards with early-ripening cultivars (i.e., Springcrest, etc.) already had large numbers of both *Anomala* spp.

In both trials, the traps were inspected at fortnightly intervals and the number of captured beetles was recorded.

The capture data were transformed to $(x+0.5)^{1/2}$ and were analysed by ANOVA. Treatment means were separated by the Games-Howell-test. All statistical procedures used the software packages StatView® v4.01 and SuperANOVA® v1.11 (Abacus Concepts, Inc., Berkeley, USA).

Damage assessment in the peach orchard was by observing 100 randomly selected fruits per tree at the time of harvest.

RESULTS AND DISCUSSION

In the young sour-cherry plantation, leaf damage was negligible, suggesting a low overall pest density. Despite the relatively low numbers of beetles captured, the same trends were observed at all inspection dates: the traps at the perimeter usually captured more *Anomala* than those within the plantation (Fig. 1). Thus, of the total of 285 beetles caught, 94% were in the traps in the 1st and 2nd rows of the grid (1st row: 63%; 2nd row 31%), significantly more than was caught in the 3rd or 4th rows (Fig. 3). These results suggest that the majority of the beetles were not emerging from pupae within the plantation, but were flying in from neighbouring areas to feed on the fresh leaves of the young sour-cherry trees. If so, traps placed at the perimeter of plantations might be able to reduce the damage by trapping out a significant percentage of immigrating beetles.

In the peach orchard, the trends were similar to those in the sour-cherry plantation, with the traps at the perimeter catching more than those inside the grid (Fig. 2). Thus, of the total of 3754 beetles caught, 92% were in the traps in the 1st and 2nd rows of the grid (1st row: 65%; 2nd row 27%), again significantly more than catches in the 3rd or 4th rows (Fig. 3). The level of fruit damage was assessed at not

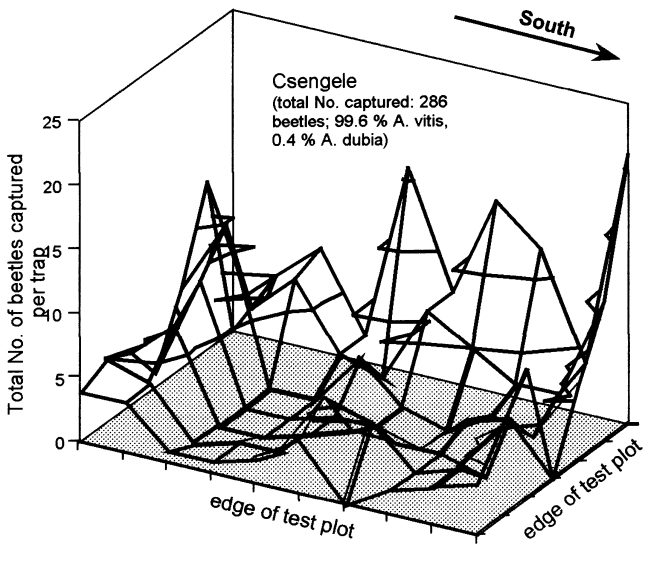

Fig. 1. Distribution of catches in the test orchard at Csengele. Surface graph shows total catches of *A. vitis* and *A. dubia* at the position of each trap

more than ca. 5% at harvest, a level acceptable to the farmer. Although no direct comparison of damage levels was made with orchards without traps, neighbouring farmers were complaining of ca. 20% damage, despite of insecticide sprays.

Although the present results are preliminary and only cover a single season, they suggest that mass trapping of *Anomala* spp. using perimeter traps might be a viable alternative to insecticides in the control of these pests. When using these traps, the methodologies will vary depending on whether the aim is to reduce damage to the leaf (as in sour-cherry plantation) or to the fruit (as in the peach orchard). When attempting to reduce leaf damage, the traps should be set out before the flight period starts (usually late May in Hungary), and should then be left out until the end of flight period (end of July in Hungary). As the longevity of the sex attractant bait in the trap exceeds this period and, since the CSALOMON® VARb2 funnel traps have a catch capacity of ca. 3–4000 beetles/trap, it is unlikely that there will be a need to replace traps within the season.

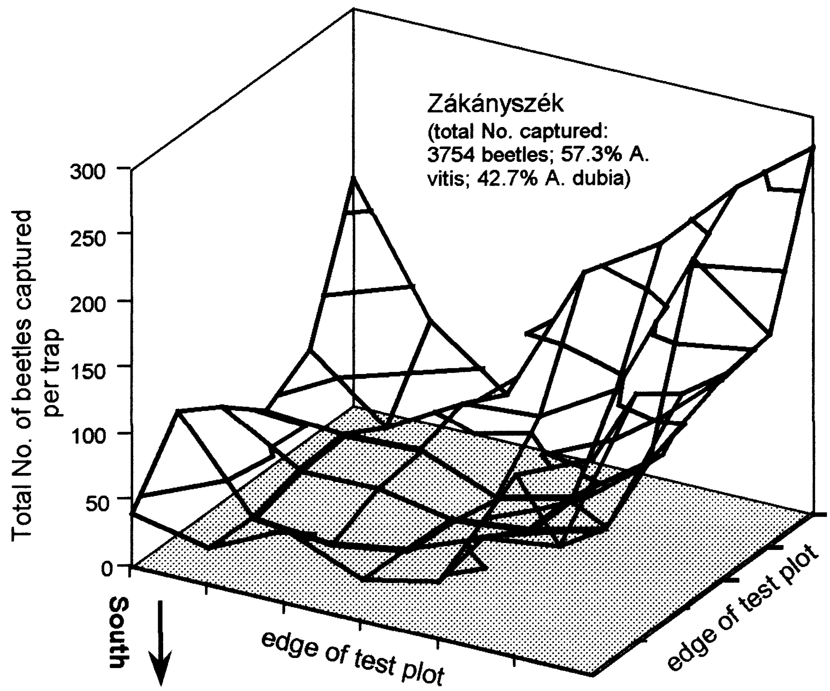

Fig. 2. Distribution of catches in the test orchard at Zákányszék. Surface graph shows total catches of *A. vitis* and *A. dubia* at the position of each trap

On the other hand, when attempting to reduce fruit damage, it is sufficient to set out the traps about 10 days before the ripening period of the cultivar in question. Our results suggest that placing the traps around the perimeter of orchards not larger than 3–4 ha may give sufficient protection. In this case, the traps should be positioned sufficiently high in the crown of trees where most damage would be expected. However, care must be taken to hang the traps from branches with little or no fruit, because those beetles which fail to enter the traps can congregate nearby, feeding on any available fruit or leaves (VOIGT & TÓTH unpubl.).

With Lepidoptera, reduction of pest populations through mass trapping with attractant-baited traps has been conducted with variable success (see reviews by BAKKE & LIE 1989, LANIER 1990). However, in the case of moths, it is the adult stage which is removed through mass trapping and this is not usually the life stage that causes the damage, so that the main benefits to be obtained by a removal of the individuals trapped is a reduction in the reproductive potential of the population. In contrast, it is the noxious stage of the *Anomala* spp. itself, which is removed by trapping, and thus the damage will be reduced in proportion to the percentage of the population trapped out.

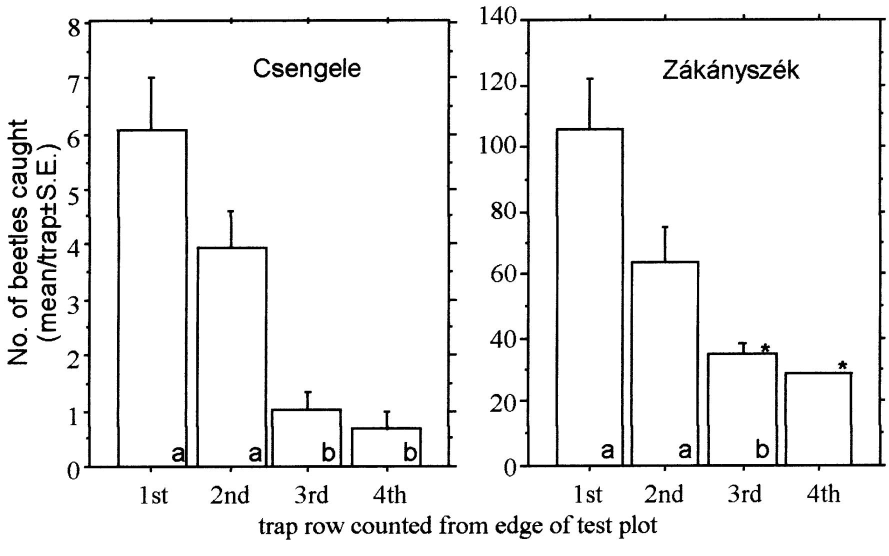

Fig. 3. Numbers of *A. vitis* and *A. dubia* caught at each trap position in the sour-cherry orchard at Csengele and Zákányszék. Columns with same letter within one diagram are not significantly different at P=5% by ANOVA followed by Games-Howell-test. At Zákányszék, the columns with an asterisk do not differ significantly from the catch in a single trap in the 4th row (29 beetles) by one-sample *t*-test

However, one difficulty could be that the bait used is attractive only towards males (TÓTH *et al.* 1994), leaving the females unaffected. No study on the actual sex ratio of the *Anomala* populations was attempted at our test sites in this study. The method could be made more efficient by introducing supplementary attractants capable of also attracting the females. Efforts to chemically define such an attractant for the two *Anomala* spp. are underway. Plant-derived attractant substances are already described for a number of scarabs (see for review LEAL *et al.* 1994). For example, with the Japanese beetle (*Popillia japonica* NEWMAN), a close relative, the synthetic sex pheromone attracted only males but, when applied together with a mixture of the food lure phenethyl propionate, eugenol and geraniol, catches of both sexes were maximized (LADD & KLEIN 1986). With regard to *Anomala* spp., there was a clear synergistic effect with *Anomala rufocuprea* MOTSCHULSKY when the food-type lure methyl anthranilate was combined with the synthetic pheromone (IMAI *et al.* 1997), while a combination of synthetic pheromone plus a mixture of food-plant derived volatile compounds significantly increased captures of *Anomala octiescostata* BURMEISTER as compared to the pheromone alone (LEAL *et al.* 1994).

Mass trapping of scarab pests has been successful in some species. Traps for mass trapping the Japanese beetle are marketed commercially and are frequently seen on urban properties in the U.S. Three years of mass trapping on Nantucket Island, MA, was reported to have reduced the *P. japonica* population by 50% (HAMILTON *et al.* 1971).

In Japan, traps baited with the floral lure 2-phenylethanol (IMAI pers. comm., cited in LEAL 1999) are used for reducing the population of *Hoplia communis* F. on golf courts. Adults of this species, which normally feed on whitish flowers, are highly attracted to any whitish surfaces, especially T-shirts of golf players, and become a nuisance in the main flight period in May.

Apart from the Carpathian Basin, *A. vitis* is present in almost all temperate and Mediterranean regions of Europe, from Spain to the Black See, while *A. dubia* is even more widespread, from England to the Caucasus and from south Scandinavia to Italy (HURPIN 1962). Attempts for reducing their numbers through perimeter trapping as suggested in the present study may be useful also in these areas.

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