The KLP+ (’hat’) trap, a non-sticky, attractant baited trap of unusual design for catching selected beetle pests

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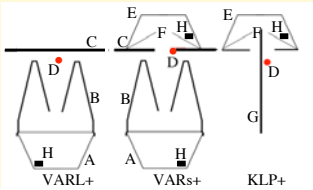

Fig 1. Diagrams of cross view of non-sticky trap designs. A = lower catch container (transparent plastic); B = plastic funnel; C = plastic lid; D = bait dispenser; E = upper catch container (transparent plastic); F = cone (transparent plastic); G = crawl-up plastic panel (yellow); H = small piece of anti-moth strip.

Introduction

In the past couple of years in our laboratory special emphasis was put on the development of non-sticky pheromone trap designs, since the common disadvantage of all sticky traps is that due to gradual changes in the effective sticky surface in time, they are not suitable for the study of quantitative aspects (i.e. accurate measurement of changes in population density, establishment of threshold values, etc.) (Wall, 1989).

To overcome difficulties in the use and maintenance of the sticky "cloak" traps (PAL and PALs) widely used in Europe for detection and monitoring of the western corn rootworm (WCR) (*Diabrotica v. virgifera* Le Conte) (Coleoptera: Chrysomelidae) (Tóth et al., 1996, 2003b), recently a non-sticky modified funnel trap, the VARs+ has been developed (Tóth et al., 2000a,b). However, this trap desing is quite complicated and is relatively difficult to set up (Fig 1A). Also, through direct observation of WCR coming to the VARs+ trap, we found that although WCR had a very strong urge to run upwards along any vertical surface, beetles found it hard to get to the upper catch container as there was no continuous physical substrate which would lead them directly into this catch container. In designing the new KLP+ ("hat") trap design we tried to correct these shortcomings of the VARs+ funnel trap, by preserving the upper container part but replacing the lower funnel and catch container by a vertical panel along which insects could crawl up directly into the upper container and get caught. Since the most widespread and sensitive trap designs for capturing WCR are the sticky PAL and PALs, the performance of the KLP+ trap was compared to theirs in the present study.

Since cabbage flea beetles (*Phyllotreta* spp.) (Coleoptera: Chrysomelidae) belong to the same family and show some similarities in behaviour to WCR (they also prefer to crawl upwards along vertical surfaces), the new KLP+ trap design was tested also on this group of insects. Formerly the funnel trap VARL+ was found to be suitable for the capture of flea beetles (Tóth et al., 2004), so in this group of insects the performance of the KLP+ trap was compared with that of the VARL+ trap.

Materials and Methods

Field trapping tests were run at several sites in Hungary and Italy. All trap designs used were members of the CSALOMON® trap family (Plant Prot. Inst., Budapest). Fig 1 shows cross-section diagrams of non-sticky trap designs. WCR pheromone baits contained racemic 8-methyl-2-decyl propanoate as active ingredient (Guss et al., 1982; Tóth et al., 2003b), on rubber dispensers. WCR floral baits consisted of 4-methoxy-cinnamaldehyde and indole (Metcalf et al., 1995) in polyethylene bag dispensers. In the tests with cabbage flea beetles polyethylene dispensers (0.7 ml polythene vial with lid; No. 730, Kartell Co., Italy) loaded with allyl isothiocyanate were used. This compound has been described as an attractant for several *Phyllotreta* spp. (i.e. Görnitz, 1953; Vincent & Stewart; 1984, Pivnick et al., 1992; Tóth et al., 2003a and others).

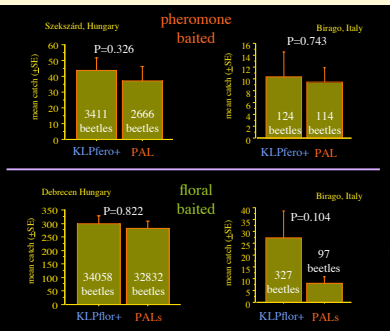

Fig 2. Mean catches of WCR in KLP+ ("hat") traps and sticky cloak PAL (transparent) or PALs (yellow) trap designs baited with pheromone or with floral bait. P values derive from Student *t* test. Test sites: Birago, Cobiago, Milano district, Lombardy, Italy, August 19 - September 2, 2004; Szekszárd, Tolna county, Hungary, July 1 - September 3, 2004; Debrecen, Hajdú-Bihar county, Hungary, June 29 - October 8, 2004. Numbers in columns show total catch in resp. treatment.

Results – WCR catches

In traps baited with pheromone, mean catches in KLPfero+ or PAL traps were not significantly different (Fig 2). When the seasonal distribution of catches was studied (Fig 3), catches throughout all the season showed similar trends and did not show any seasonal differences between the two trap designs.

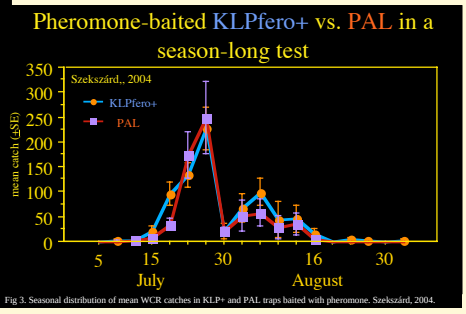

Fig 3. Seasonal distribution of mean WCR catches in KLP+ and PAL traps baited with pheromone. Szekszárd, 2004.

When floral-baited traps (KLPflor+ vs. PALs) were compared, again there was no apparent difference neither in mean catches (Fig 2) nor in the seasonal distribution of catches (Fig 4), as far as unsexed catch data were concerned. However, when the female ratio of the catches was analysed, the KLPflor+ traps caught females in a signficantly higher ratio than the PALs traps (Fig 4). When ratio of females were compared at each inspection date throughout the season (normalized against female ratio in catches by PALs traps at the given date), female ratios were in most cases higher in KLPflor+ traps than in PALs traps (Fig 5), corroborating the evaluation of mean ratios / trap / inspection (Fig 4).

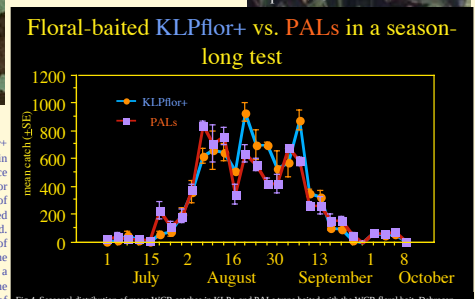

Fig 4. Seasonal distribution of mean WCR catches in KLP+ and PALs traps baited with the WCR floral bait. Debrecen, 2004.

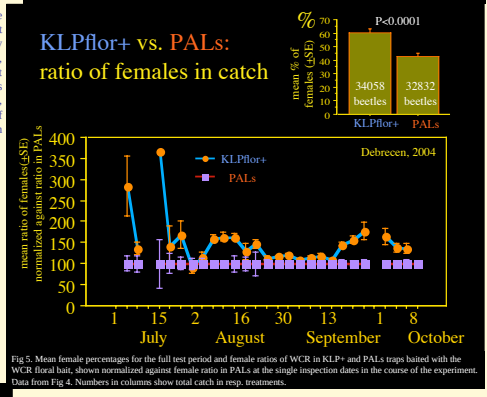

Fig 5. Mean female percentages for the full test period and female ratios of WCR in KLP+ and PALs traps baited with the WCR floral bait, shown normalized against female ratio in PALs at the single inspection dates in the course of the experiment. Data from Fig 4. Numbers in columns show total catch in resp. treatments.

Generally KLP+ traps were catching far less non-target insects, than the sticky PAL and PALs designs, since the open sticky surface of these latter captured randomly many flying insects apart from WCR.
In conclusion, the non-sticky KLP+ traps were not inferior to the sticky trap designs, neither in sensitivity nor in catch capacity, no matter whether they were baited with pheromone or floral baits of WCR. On the other hand, the KLP+ traps with floral bait seemed to be more suitable for the capture of females than the sticky PALs design. This suggests that the KLP+ trap design is especially suitable for the capture of females. Female selectivity could be enhanced by the development of more female selective bait compositions than the present-day commercial WCR floral bait. First results on an improved female WCR bait have recently been reported (Hammack, 2001).

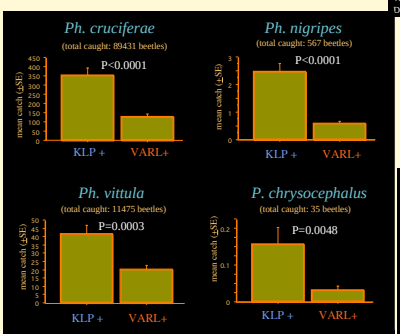

Fig 6. Mean catches of *Phyllotreta* spp. and *Psylliodes chrysocephalus* in KLP+ and VARL+ traps baited with allyl isothiocyanate bait. (Pusztazámor, Fejér county, Hungary, March 31 - September 22, 2005)

Results –cabbage flea beetle catches

In the test sizeable numbers were caught from the following flea beetle species: *Ph. cruciferae* Goeze, *Ph. vittula* Redtenbacher, *Ph. nigripes* Fabr., and the closely related *Psylliodes chrysocephalus* L. The mean catches in all four spp. caught were significantly higher in the KLP+ traps than in the VARL+ traps (Fig. 6).
When catches at each inspection date were compared throughout the period of the test, in all three *Phyllotreta* spp. captures in KLP+ traps were generally higher than those in VARL+ traps on the wast majority of inspection dates (Fig 7).

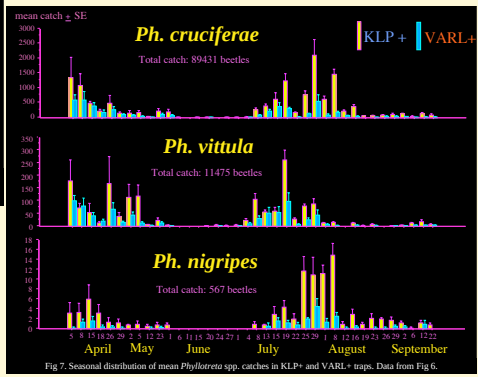

Fig 7. Seasonal distribution of mean *Phyllotreta* spp. catches in KLP+ and VARL+ traps. Data from Fig 6.

Conclusions

In conclusion, the new KLP+ trap design proved to be advantageous for use for the trapping of both WCR and cabbage flea beetles tested in the present study. It may prove to be suitable also for the capture of other beetles, provided an attractant is available for the given species. Tests on selected weevils, nitidulids and other Coleoptera are underway and will be reported on in the near future.

References

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