Overview and evaluation of traps to monitor WCR

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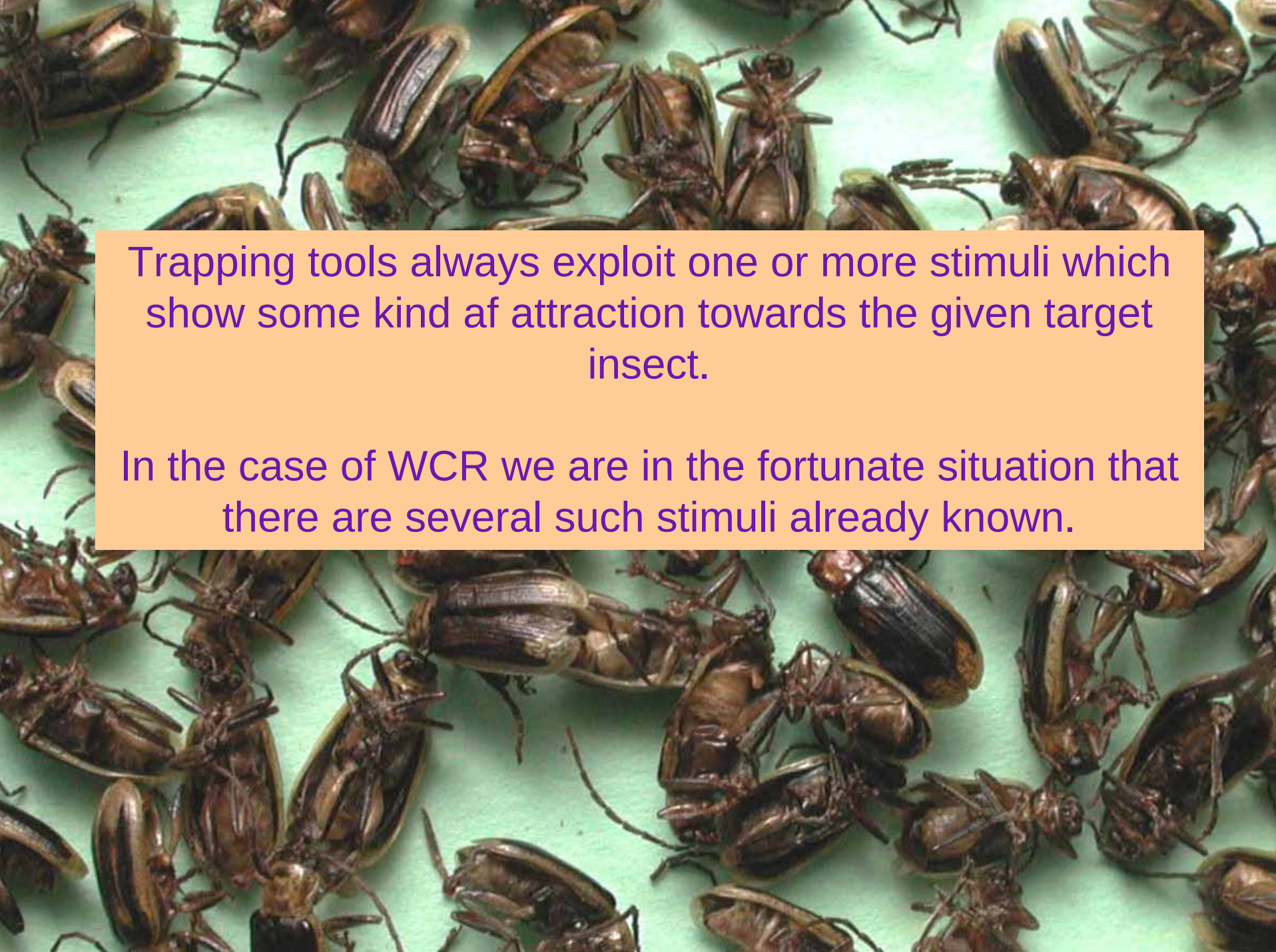


Trapping tools always exploit one or more stimuli which show some kind af attraction towards the given target insect.

In the case of WCR we are in the fortunate situation that there are several such stimuli already known.

Colour sensitivity:

Yellow sticky sheets

Several hues of bright yellow colour are known to be attractive towards WCR.

Sticky sheets painted these yellow hues can be used as simple monitoring tools.

These traps usually pretty non-discriminative - they catch many non-target insects, and relatively few WCR, because the effect of the colour is not very strong as compared to other stimuli.

Despite these drawbacks, especially in very high populations, such yellow sticky sheets may be useful. In lower population densities catches tend to be too low to allow for meaningful conclusions.

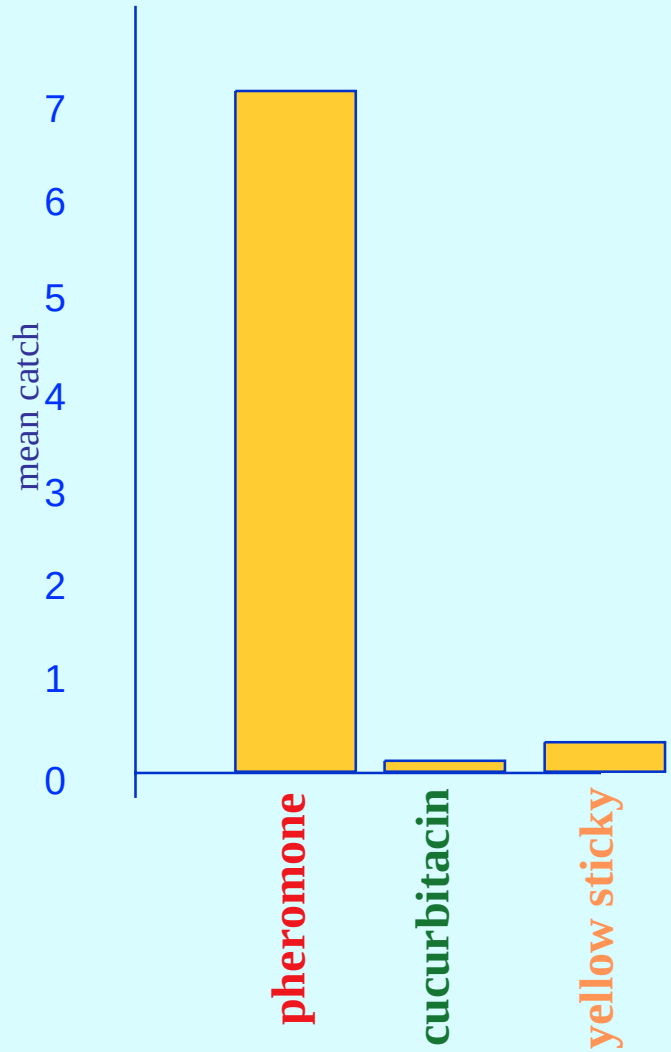
Chemical attractants

Chemical stimuli which can be used for a monitoring trap are basically either of sex pheromonal, or food attractant (floral lure) activity.

In some high population areas the so-called "cucurbitacin traps" were also used. These are small tubes with dry plant material plus insecticide inside, and the plant material comes from Cucurbita spp., rich in cucurbitacin. This compound is a feeding stimulant for WCR, so it keeps the beetles arriving to the trap there, but DOES NOT ATTRACT them.

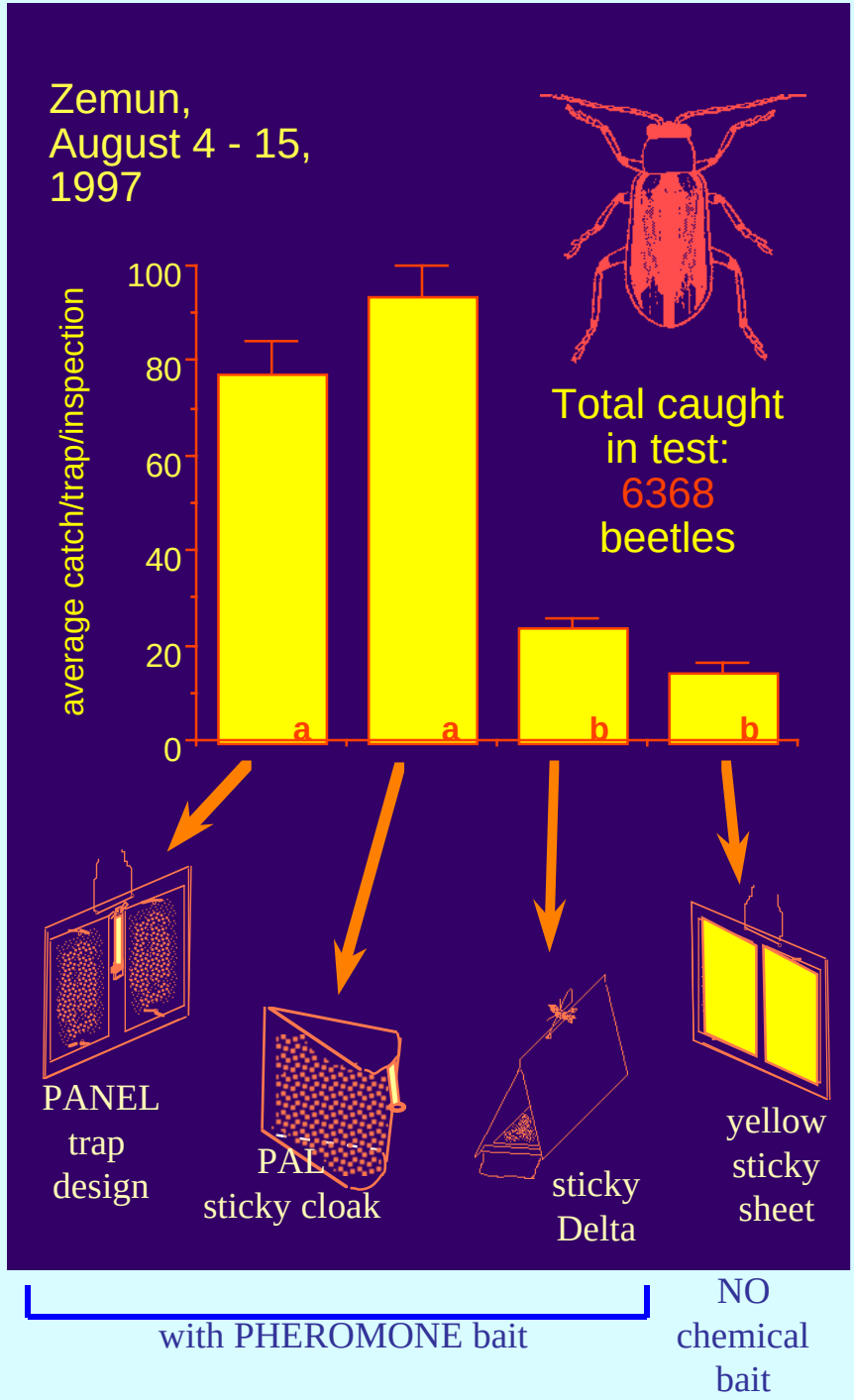
In usual populaton density situations "cucurbitacin traps" are of very low sensitivity

After Zlof, V. IWGO Newsletter, 16:16-17, 1996



Sex pheromone:

Female WCR emits a pheromone by which she attracts the males for mating. The pheromone is available in synthetic form, and can be used as a bait. Pheromone baited traps catch only males, but they are of very high sensitivity. Such traps are the ideal tools for detection purposes.
Conventional sticky Delta trap designs are not suitable for catching WCR, instead, trap designs with open sticky surface are optimal.



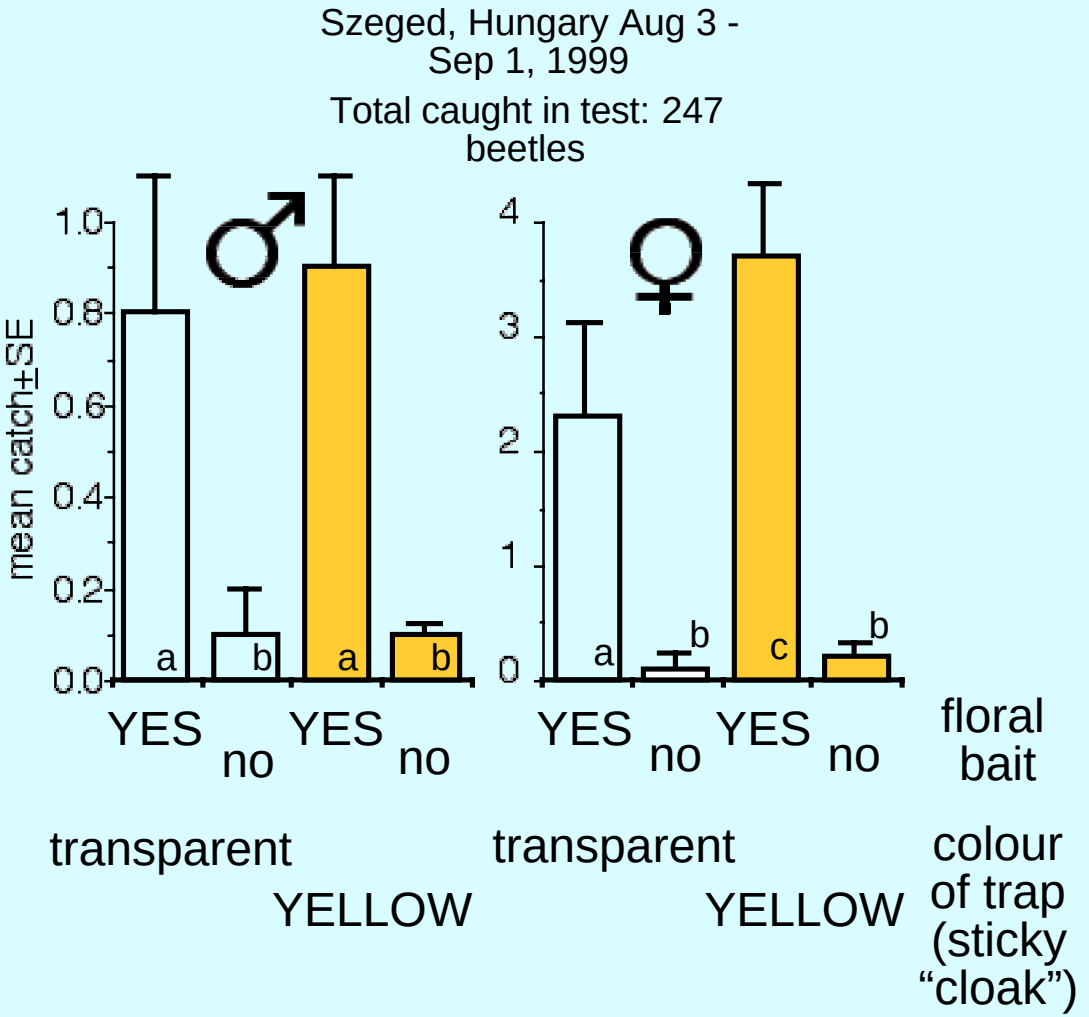
The most widespread pheromone trap used in Europe today is the CSALOMON® PAL (sticky cloak) trap. Information on the spread and occurrence of WCR in European countries has largely been collected by using PAL traps in the past decade. The EU-research project DIABROTICA (QLK5-CT-1999-01110) recommends to use PAL traps baited with pheromone as the standard detection tool for *Diabrotica v. virgifera* in Europe.
In recent years similar pheromone traps became available from other manufactureres also (i.e. Serbios, etc.)
It is disadvantageous to make such sticky traps yellow, because this will increase non-target insect captures and practically will not significantly increase WCR captures.

Floral lure:

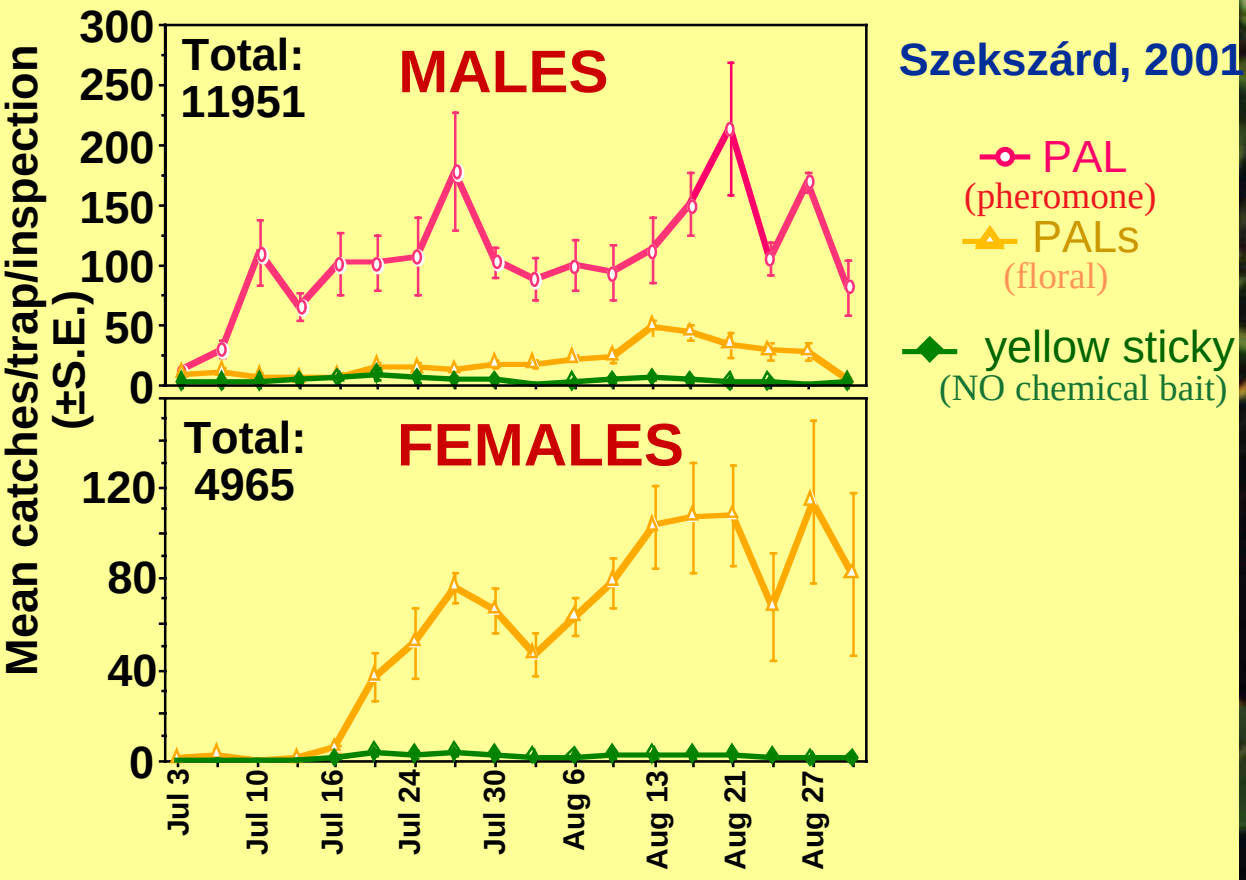
In the case of WCR it was also known that certain floral compounds isolated from pumpkin flowers exerted strong attraction towards both sexes of adult beetles. This bait was tested in transparent and yellow sticky “cloak” traps, and it appeared that the presence of yellow colour as visual cue was more important for females than for males, increasing female catches significantly. Therefore it is advantageous to have the sticky surface in yellow colour in sticky traps baited with the floral lure.

Effect of yellow colour on WCR captures in traps baited with the floral bait

after Tóth, M., Sivcev, I., Ujváry, I., Tomasek, I., Imrei, Z., Horváth, P., Szarukán, I. 2003. Development of trapping tools for detection and monitoring of Diabrotica v. virgifera in Europe. Acta Phytopath. Entomol. Hung. 38:307-322



Sticky “cloak” traps baited with the floral lure in most situations are not as sensitive as sticky traps baited with the pheromone. The great advantage of such traps is that they catch predominantly females, and to a lesser extent also males.



The basic requirement for a sampling tool (i.e. trap) used for the study of quantitative aspects (i.e. estimation of population density, threshold catch levels, etc.) is that it should sample constantly the same proportion of the population over time (= its efficiency should remain constant).
Although very sensitive in detection, sticky traps have the inherent deficiency that their efficiency will constantly change over time (due to meteorological and many other factors), which makes them unsuitable for the study of such quantitative aspects. The development of non-saturating, non-sticky traps may be an answer.

The first non-sticky type available in Europe was the CSALOMON® VARs+ trap, which could be baited with both the pheromone and floral lures.

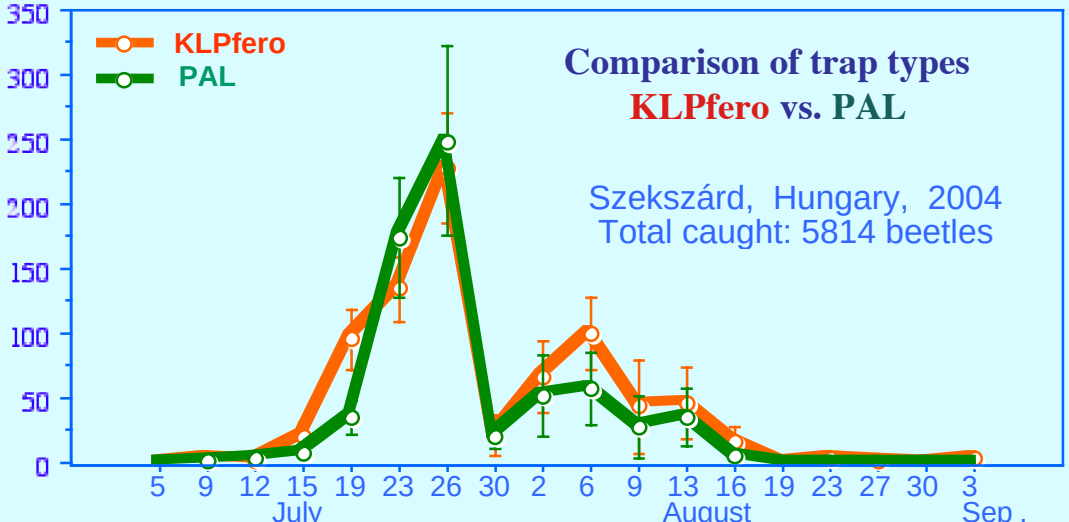
The VARs+ trap worked very nicely, but it was quite complicated. An improved, simplified version, the new KLP (“hat”) trap was recently introduced. The trap can be used either with the pheromone, or with the floral bait (or the two baits together).

"**KLPfero+**"

- it is highly sensitive for detection of occurrence and monitoring;
- it is baited with the synthetic sex pheromone;
- it catches only male insects;
- it has high catch capacity (5-6000 beetles);
- (it is highly selective;
- simple design, easy-to-use, no more sticky fingers!

"**PAL**"

- it is highly sensitive for detection of occurrence and monitoring.
- it is baited with the synthetic sex pheromone
- it catches only male insects;
- sticky sheet is transparent;
- it has a catch capacity of 3-400 beetles;
- it is of simple design

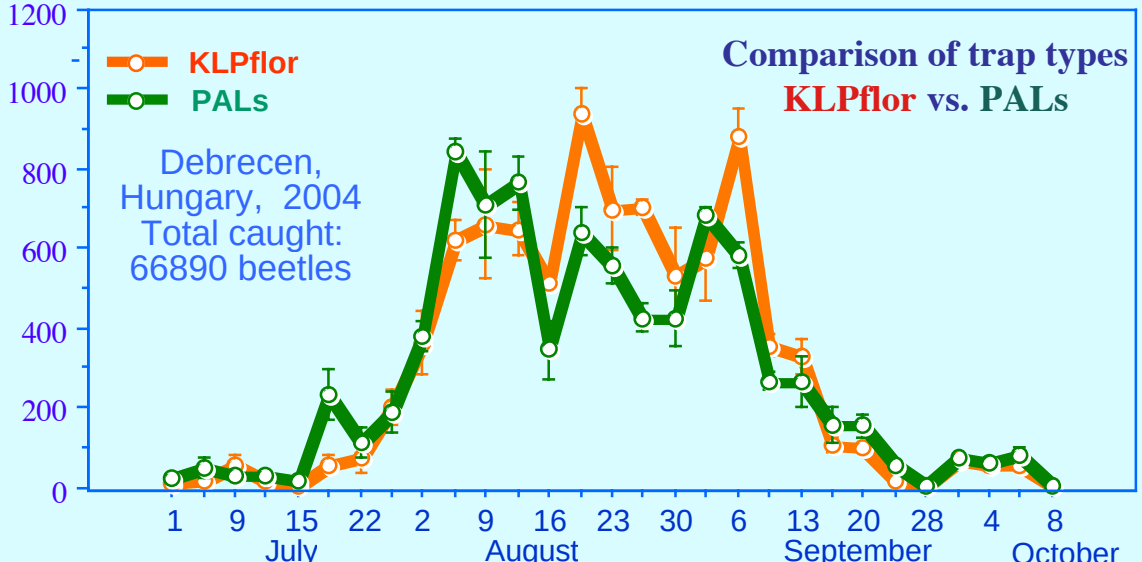


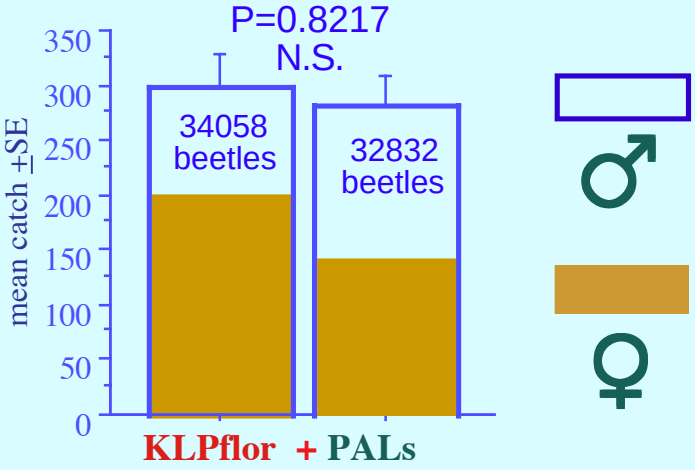
"**KLPflor+**":

- it is of the same design as "KLPfero+", but:
- it is baited with the **floral** lure;
- it catches mainly **females** – to a lesser extent also males);
- especially suitable for detecting the occurrence of females);
- it is highly **selective**).

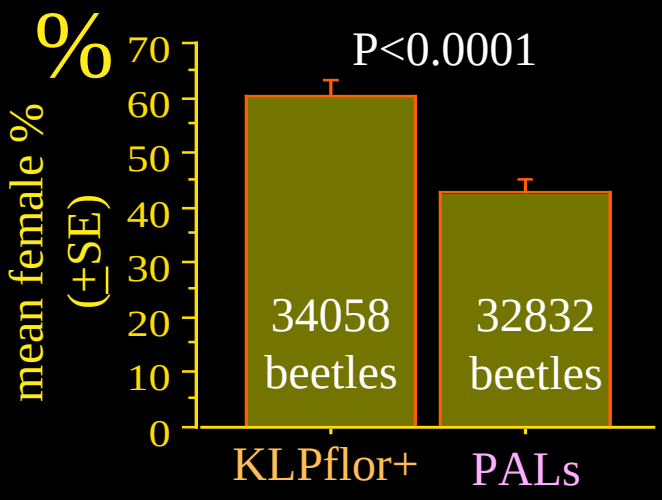
"**PALs**"

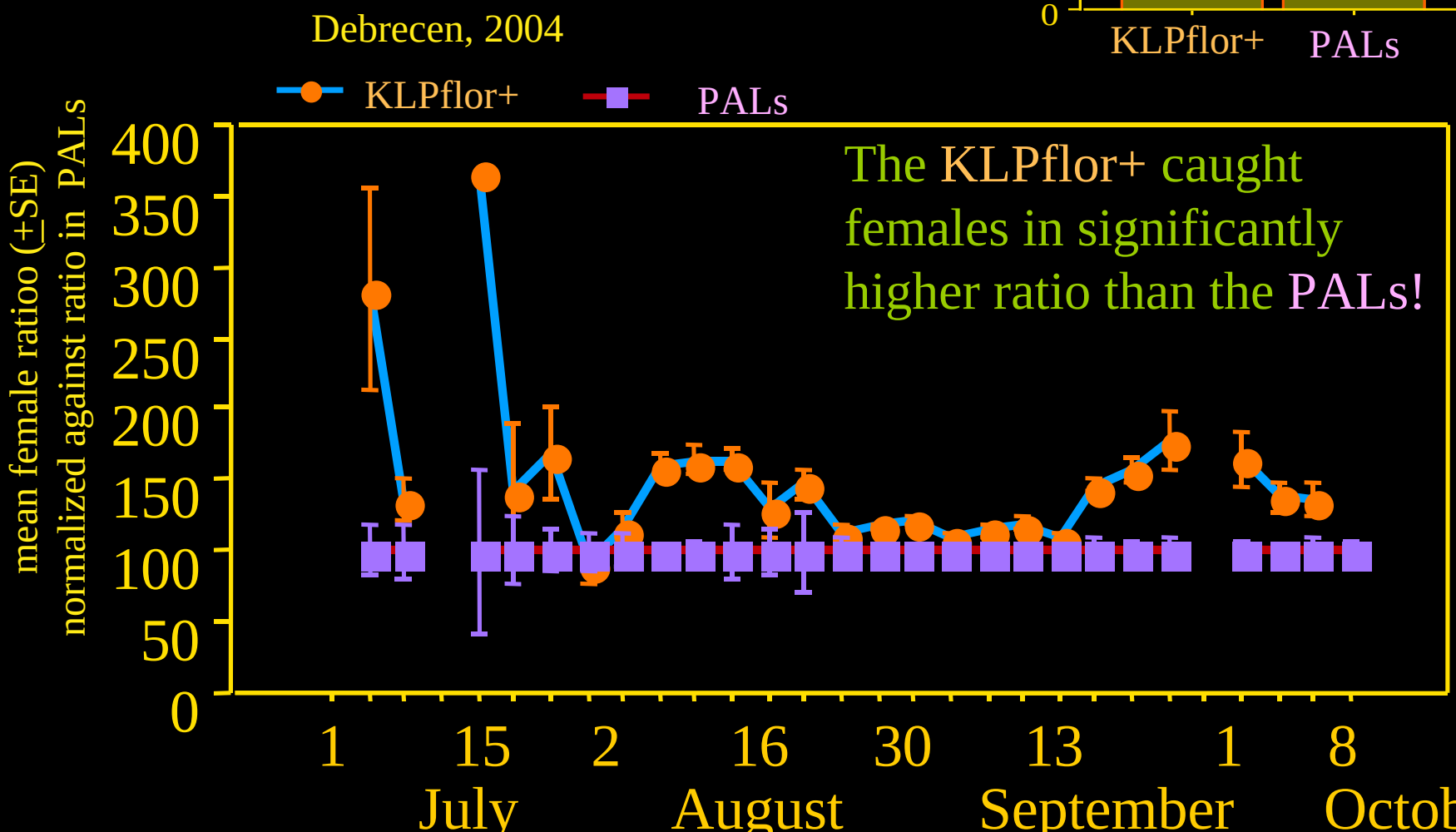
- it is of similar design as the "PAL", but the sticky sheet is yellow;
- it attracts by the synergistic combination of chemical (floral bait) and visual (yellow) stimuli;
- it catches females and also males;
- its use is recommended in areas where populations of *Diabrotica* have already been established.





KLPflor+ vs. PALs: female % in catch





Consequently the most effective tool for catching females is at present the **KLPflor+** trap (which is baited with the floral WCR bait).

An interesting new approach is when the WCR Diabrotica bait is placed into click beetle pheromone traps (Yf design, with for example *Agriotes ustulatus* pheromone bait), in the hope that such a dual-baited trap may be suitable for the monitoring of both pests at the same time. This tool is still at the experimental stage of its development, but the first results are encouraging, and we can only hope that this new variety will prove to be a useful addition to the rather wide array of monitoring tools for WCR.

Summarising the characteristics of main WCR trap types

Trap type	Sticky yellow sheets i.e. Pherocon AM, Multigard etc.	Sticky, pheromone i.e. PAL, Serbios etc.	Sticky yellow, floral baited i.e. PALs, etc.	Non-sticky pheromone baited i.e. KLPfero+	Non-sticky floral baited i.e. KLPflor+, CRW Trécé
Bait	no chemical bait	pheromone	floral	pheromone	floral
Sex caught	both sexes	males	females & males	males	females & males
Sex ratio	more females	>99% males	more females	>99% males	mostly females
How selective	very many non-target insects	many non-target insects	many non-target insects	high selectivity	high selectivity
How sensitive	not sensitive	very sensitive	medium sensitive	very sensitive	medium sensitive
Catch capacity	4-500 beetles	4-500 beetles	4-500 beetles	>5-6000 beetles	>5-6000 beetles
Design	simple, sticky	simple, sticky	simple, sticky	more complicated	more complicated
Maintenance	dirty, sticky	dirty, sticky	dirty, sticky	clean	clean
Killing agent	glue	glue	glue	insecticide has to be added	insecticide has to be added

Applicability of main WCR trap types for different purposes

Trap type	Sticky yellow, no bait.	Sticky, pheromone baited	Sticky yellow, floral baited	Non-sticky, pheromone baited	Non-sticky, floral baited
Detection, new introductions, very low popul. density	not suitable	YES	maybe	YES	maybe
Monitoring, flight dynamics, established populations	not suitable	YES	YES	YES	YES
Capture of females for different purposes	not suitable	not suitable	YES	not suitable	YES
Capture of live specimens for different purposes	not suitable	not suitable	not suitable	YES	YES
Establishment of threshold values, corrrelation w. damage	maybe (very high popul. dens.)	maybe (in lower popul. dens.)	maybe	YES	YES
Mass trapping for decreasing populations	not suitable	not suitable	not suitable	maybe	maybe