

# Pheromones of click beetles (Coleoptera: Elateridae): sex or aggregation pheromones?



M. Tóth<sup>1</sup>, L. Furlan<sup>2</sup>, J. Vuts<sup>1,6</sup>, T. Toshova<sup>3</sup>, M. Subchev<sup>3</sup>, D.I. Velchev<sup>4</sup>, I. Szarukán<sup>5</sup>

<sup>1</sup>*Plant Prot. Inst., Ctr. Agric. Res. HAS, Budapest, Hungary;*

<sup>2</sup>*Veneto Agricoltura, Agripolis Legnaro (Pd), Italy;* <sup>3</sup>*Inst. Biodiv. & Ecosys. Res., BAS, Sofia, Bulgaria;* <sup>4</sup>*Maize Res. Inst., Knezha, Bulgaria;* <sup>5</sup>*Debrecen University, Ctr. Agric. Sci., Debrecen, Hungary;* <sup>6</sup>*Present address: Dept. Biol./ Chem. & Crop Prot., Rothamsted Research, Harpenden, Hertfordshire, UK.*

28th ISCE Vilnius, 2012



**Plant Protection Institute**  
Centre for Agricultural Research  
Hungarian Academy of Sciences

**July 21, 12**  
**Miklós Tóth**

Wireworms, the larvae of click beetles (Coleoptera: Elateridae) are important soil-dwelling polyphagous pests all over the world.

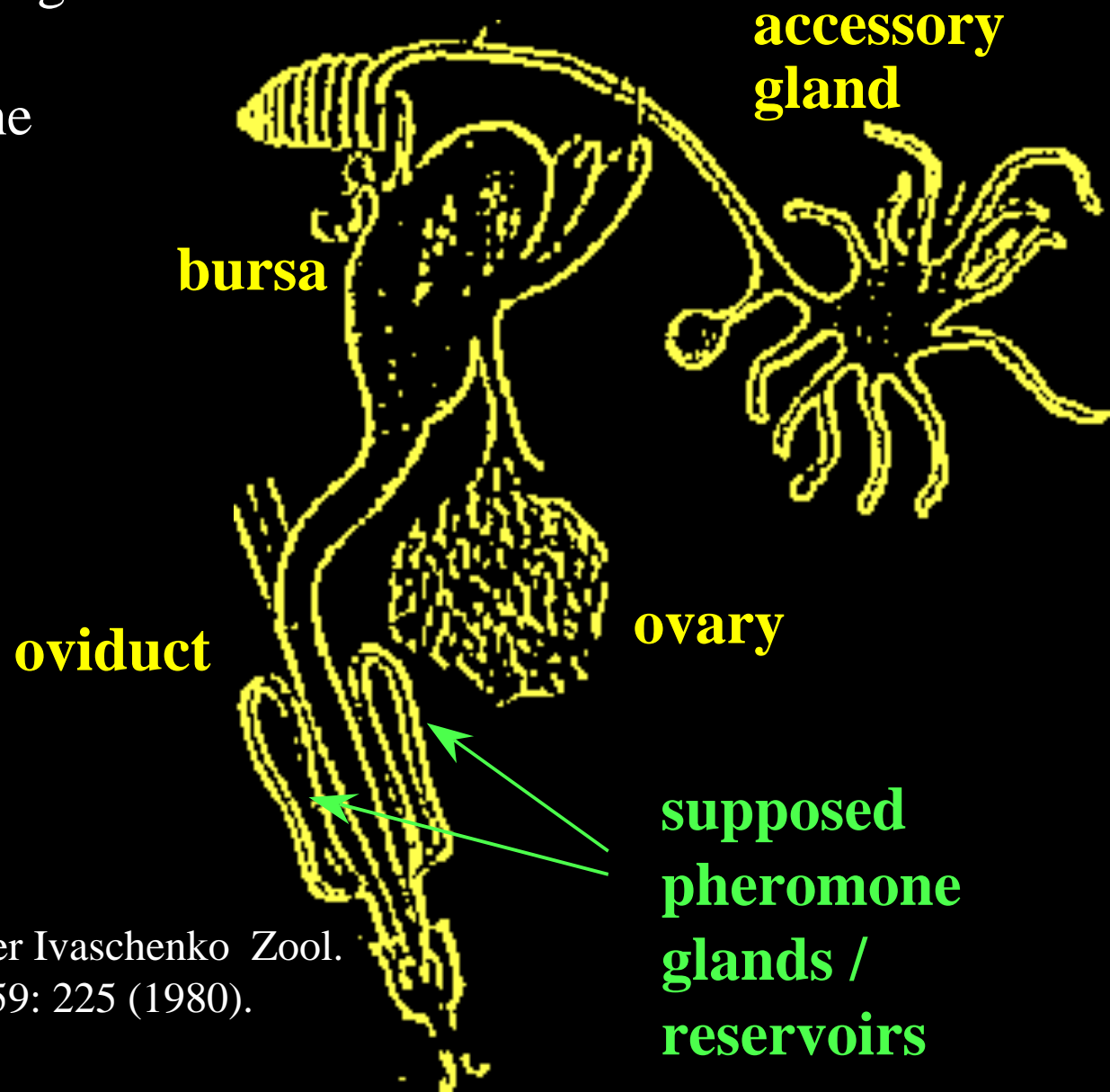


The adults feed on green leaves of several plants or on flowers, they cause no damage.



The female beetles produce a pheromone which attracts male beetles,

This pheromone was categorized into the pheromone type “classical” sex pheromone (which type is especially widespread also among moths).

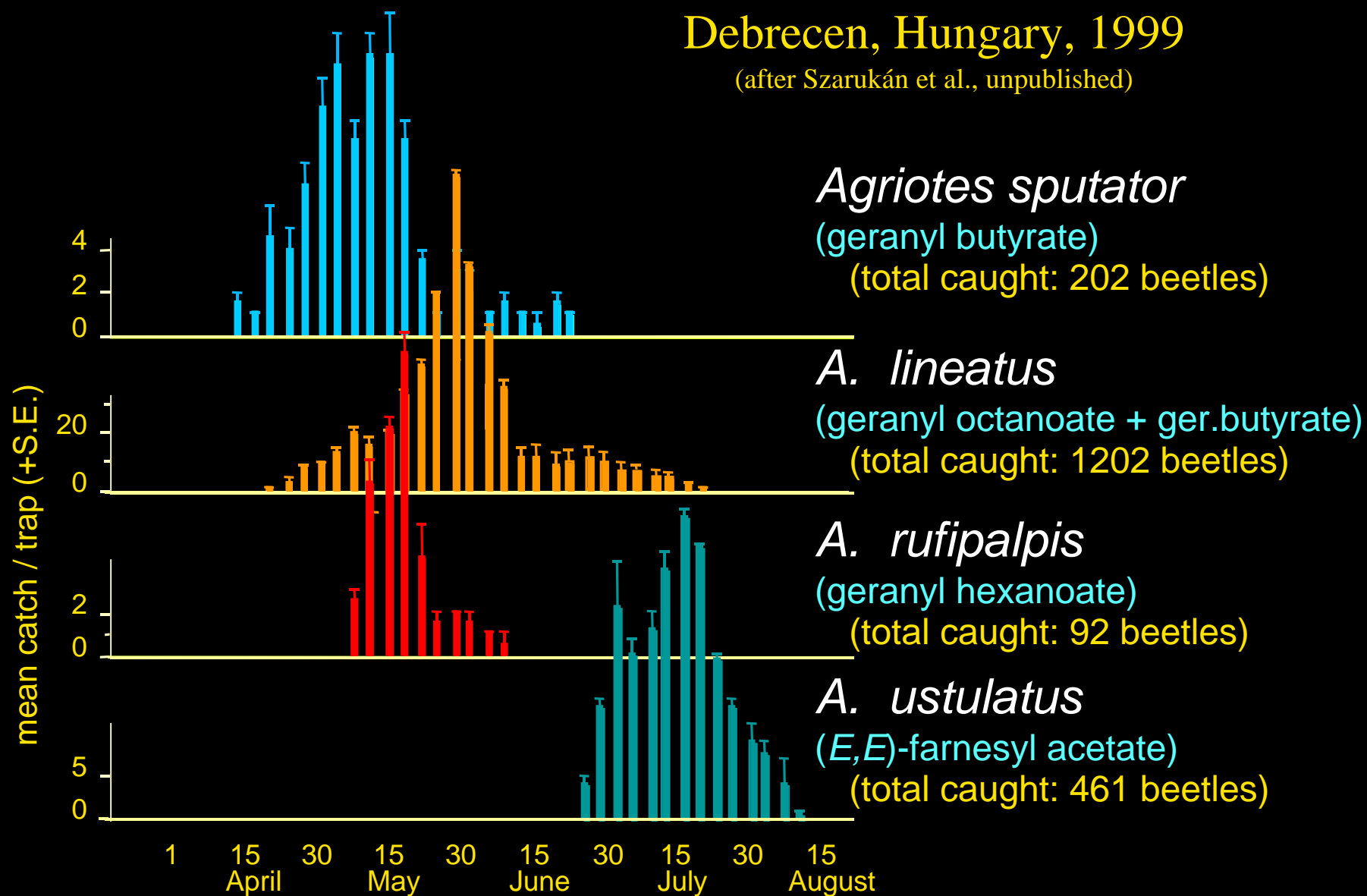


(After Ivaschenko Zool.  
Zh. 59: 225 (1980).

Traps baited with synthetic pheromone of the respective species can readily be used for detection or monitoring.

## Debrecen, Hungary, 1999

(after Szarukán et al., unpublished)



However, in some species, users reported on the presence of females in the catch of pheromone traps.

The phenomenon most frequently was reported in:

*A. sordidus* and *A. brevis* –  
Lorenzo Furlan, Italy

*A. ustulatus* – István Szarukán,  
Hungary



The “YF” (=YATLOR funnel) click beetle trap (Furlan et al., 2001)

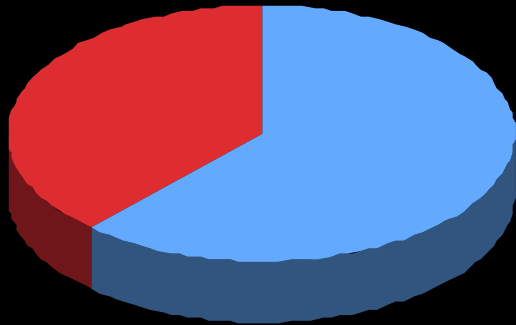
On closer scrutiny, beetle catches in pheromone baited traps indeed contained a sizeable proportion of female beetles in several species!

### *A. brevis*

pheromone components:  
(*E,E*)-farnesyl butyrate +  
geranyl butyrate

Veneto, Italy, 2001

Total caught: 1173 beetles

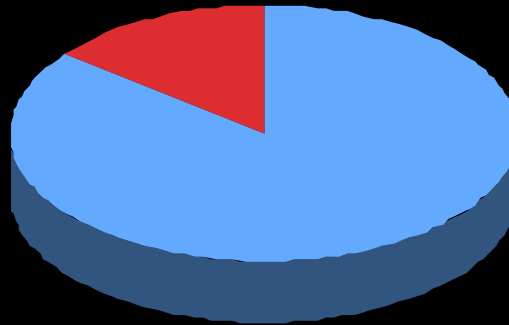


### *A. sordidus*

pheromone component:  
geranyl hexanoate

Berton-Greggio, Italy, 2001

Total caught: 367 beetles

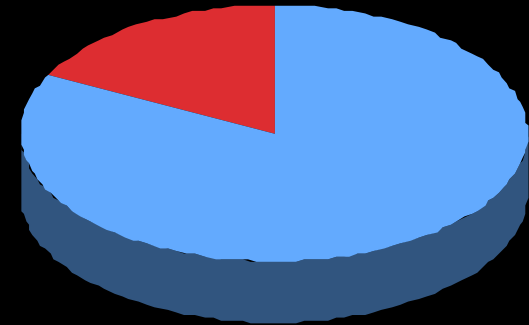


### *A. ustulatus*

pheromone component:  
(*E,E*)-farnesyl acetate

Eraclea, Italy, 2000

Total caught: 114 beetles



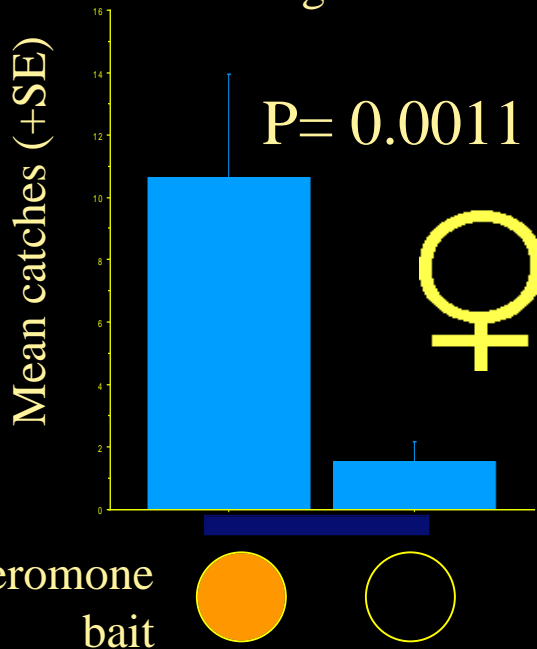
Female catches in pheromone baited traps were significantly higher than in unbaited traps.

## *A. brevis*

pheromone components:  
(*E,E*)-farnesyl butyrate +  
geranyl butyrate

Eraclea, Italy, 2000

Total caught: 194 beetles

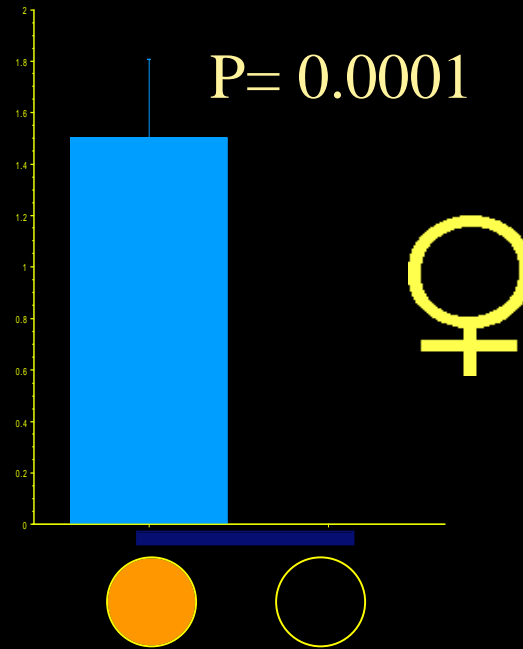


## *A. sordidus*

pheromone component:  
geranyl hexanoate

Berton-Greggio, Italy, 2001

Total caught: 42 beetles

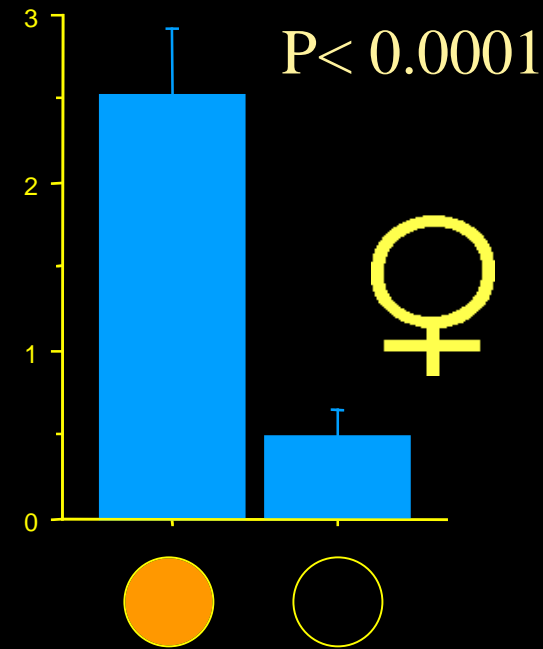


## *A. ustulatus*

pheromone component:  
(*E,E*)-farnesyl acetate

Debrecen, Hungary, 2003

Total caught: 116 beetles

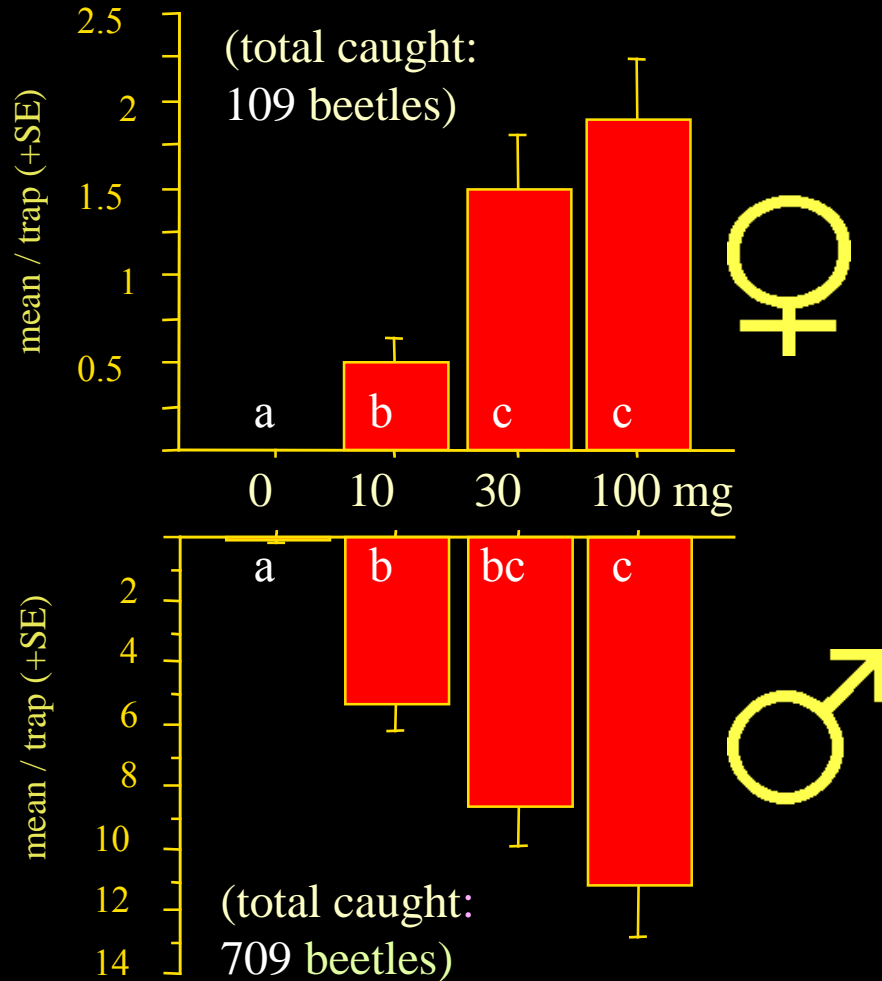




Female catches in pheromone baited traps showed dose dependence, similar to catches of male beetles.

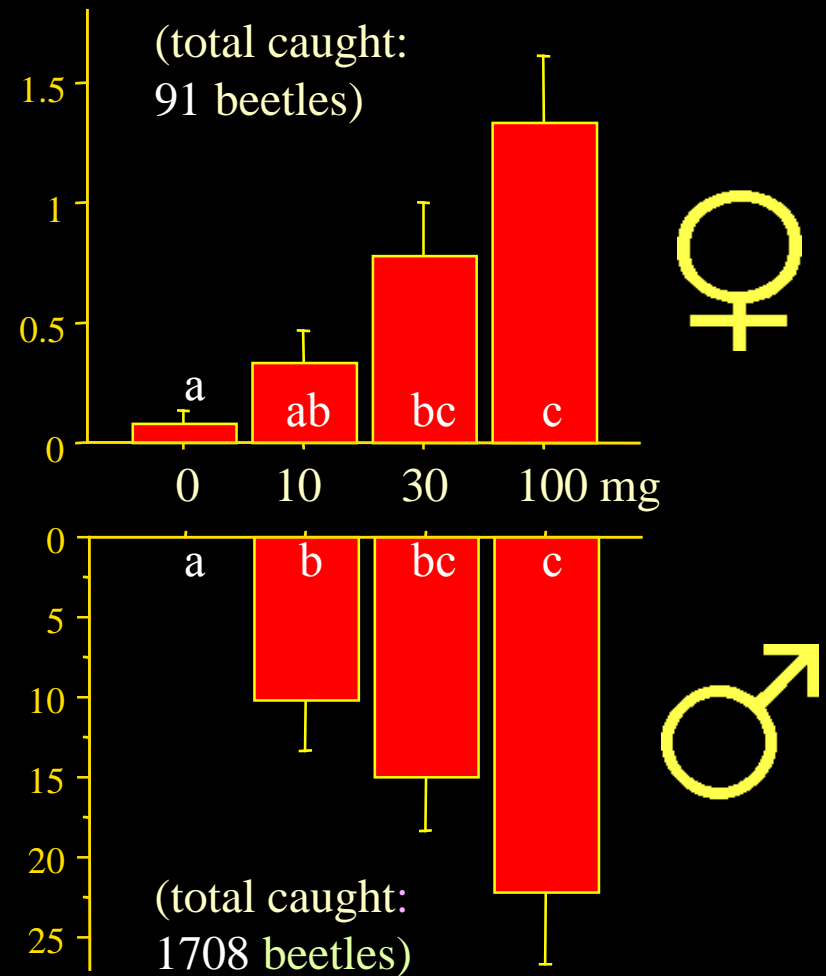
## *A. sordidus*

Berton-Greggio, Italy, 2001

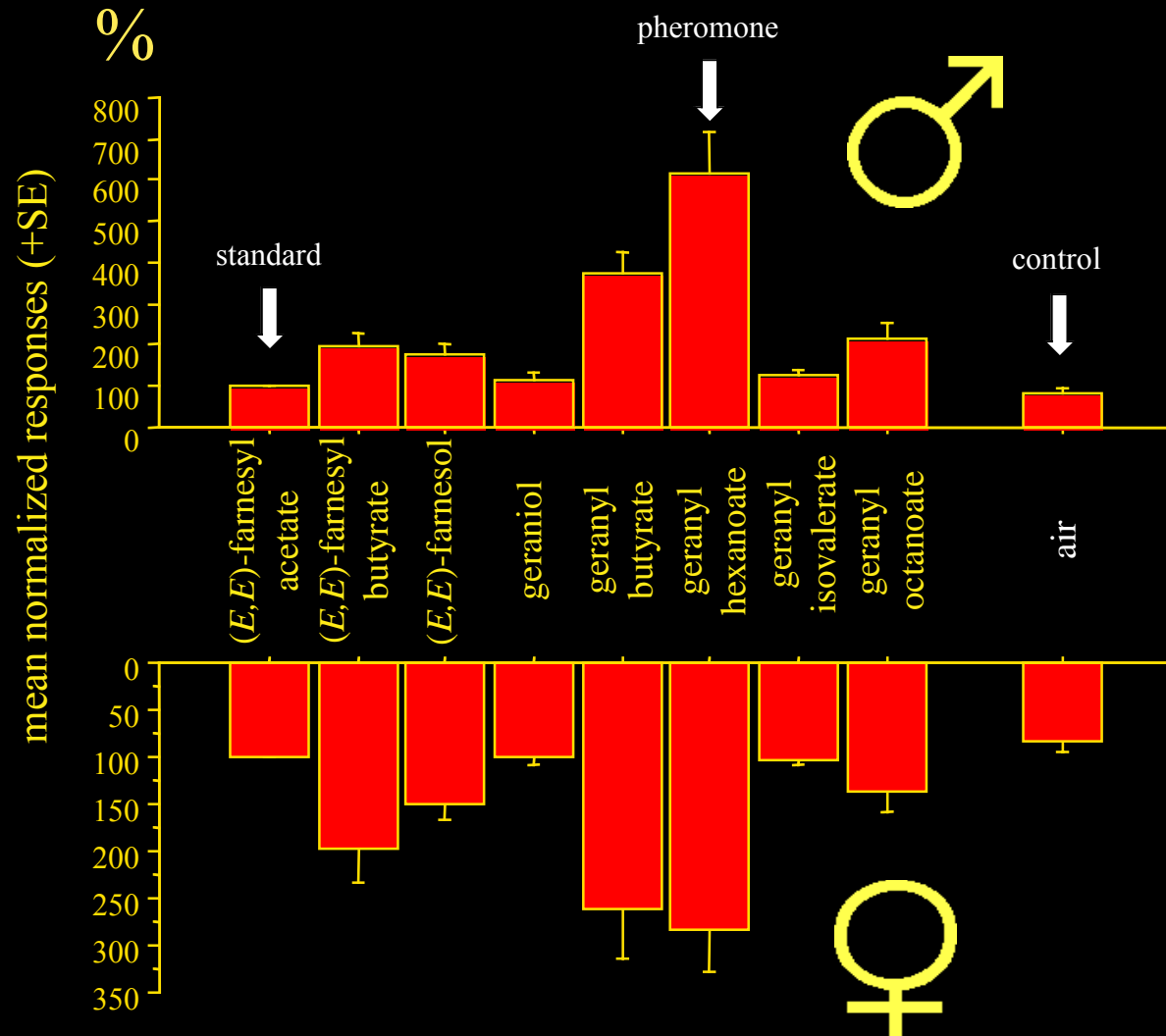


## *A. ustulatus*

Cessalto, Italy, 2003



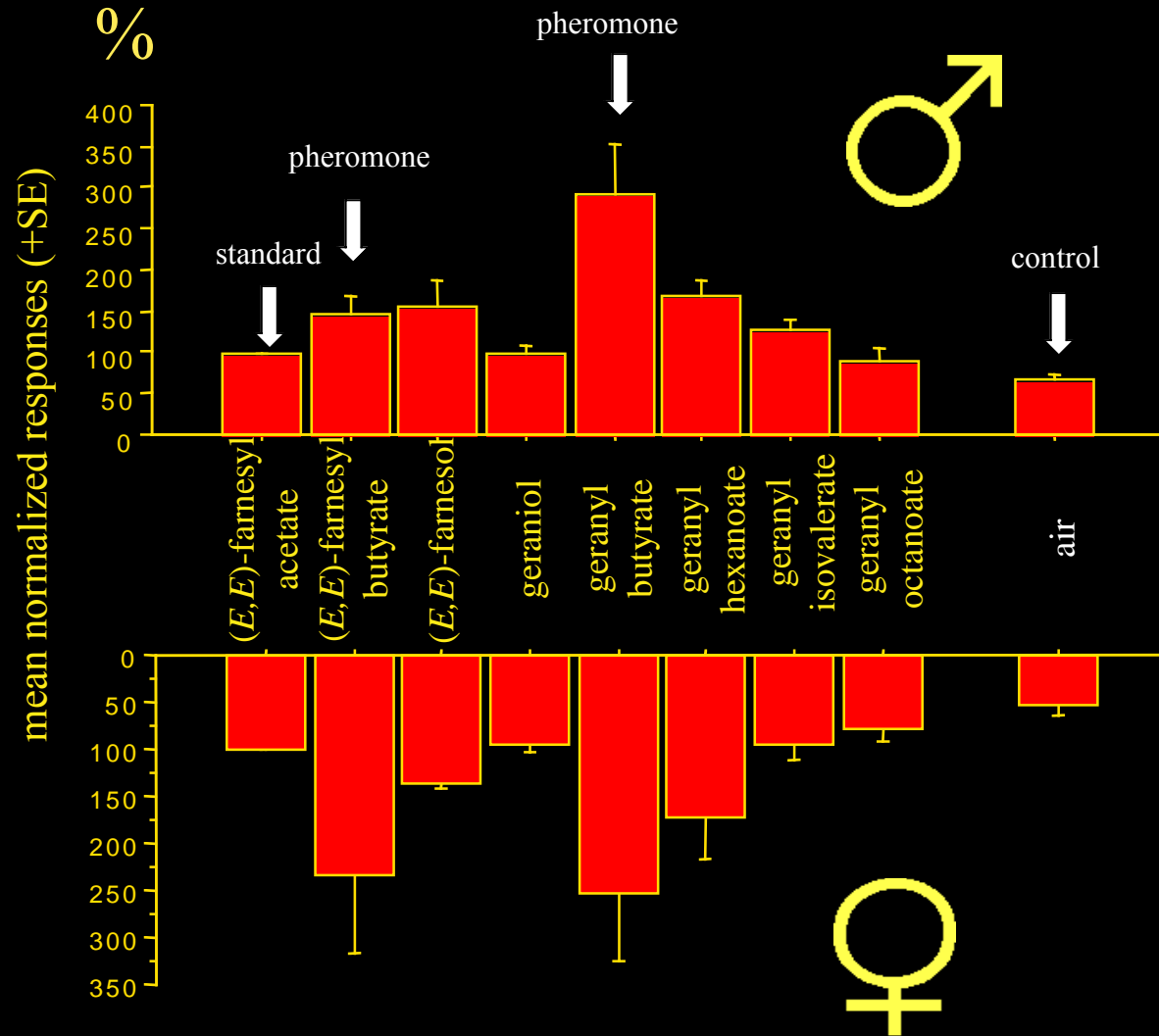
In EAG screenings of synthetic pheromone compounds described in click beetles, female antennae showed similar response spectra as male antennae, responding best to the respective pheromone component.



*Agriotes sordidus*

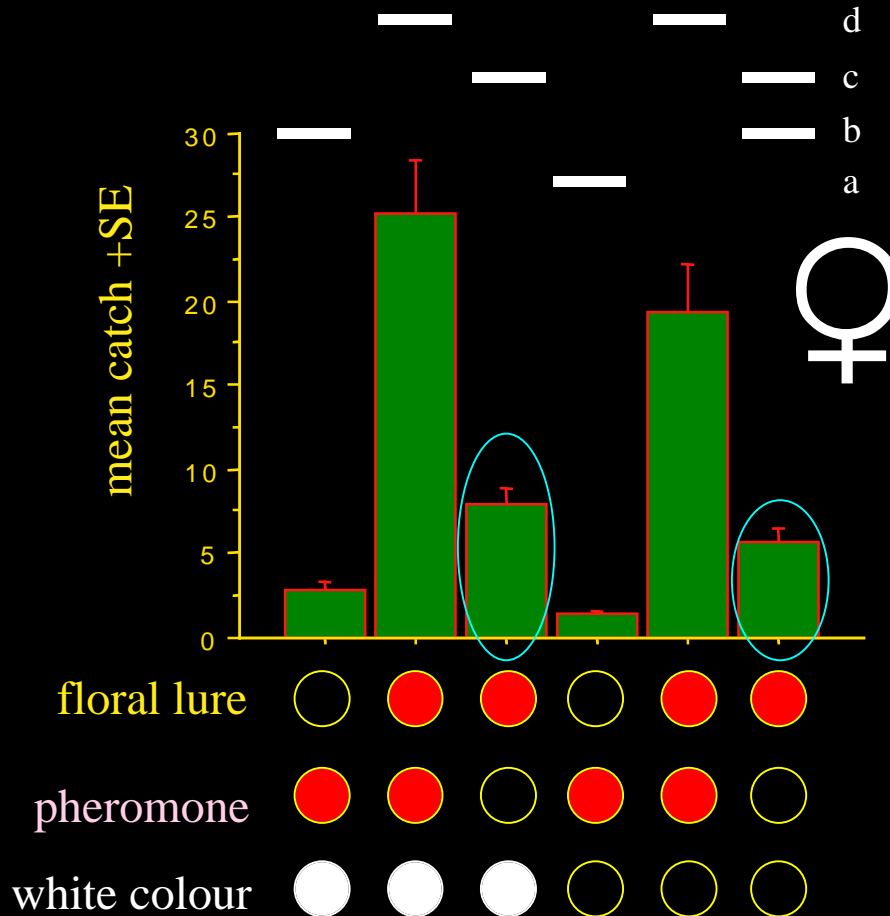
This suggested that females were capable of detecting their respective pheromone components.

*Agriotes brevis*

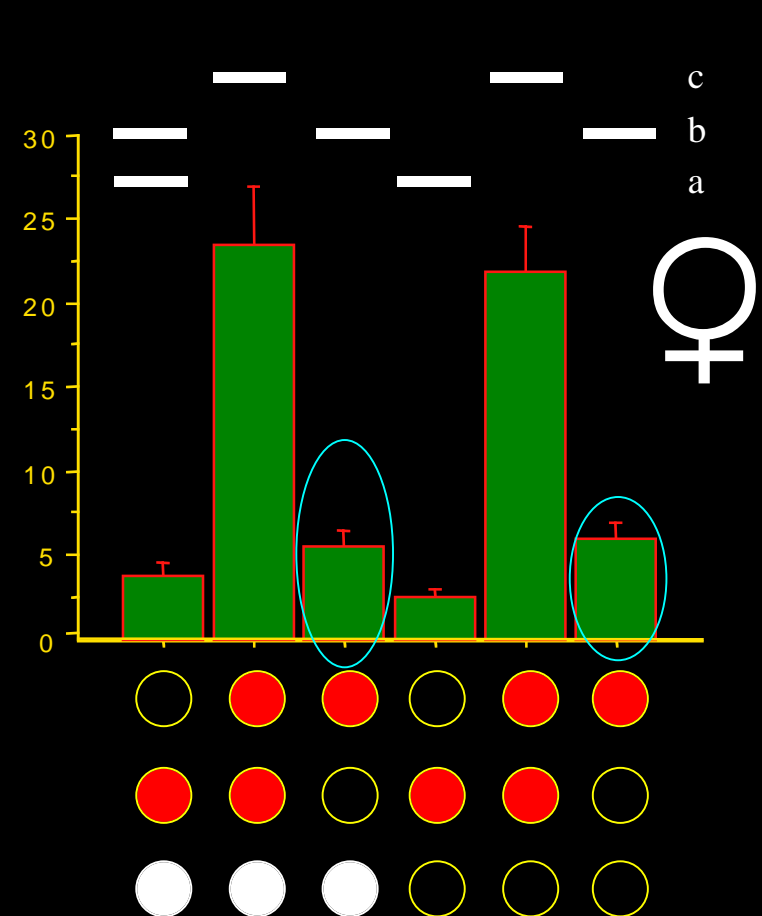


In *A. ustulatus*, a floral lure has been discovered, which attracts females.  
 (White colour as attractive visual cue showed negligible influence)

Debrecen, Hungary, 2008  
 (total caught: 4814 beetles)



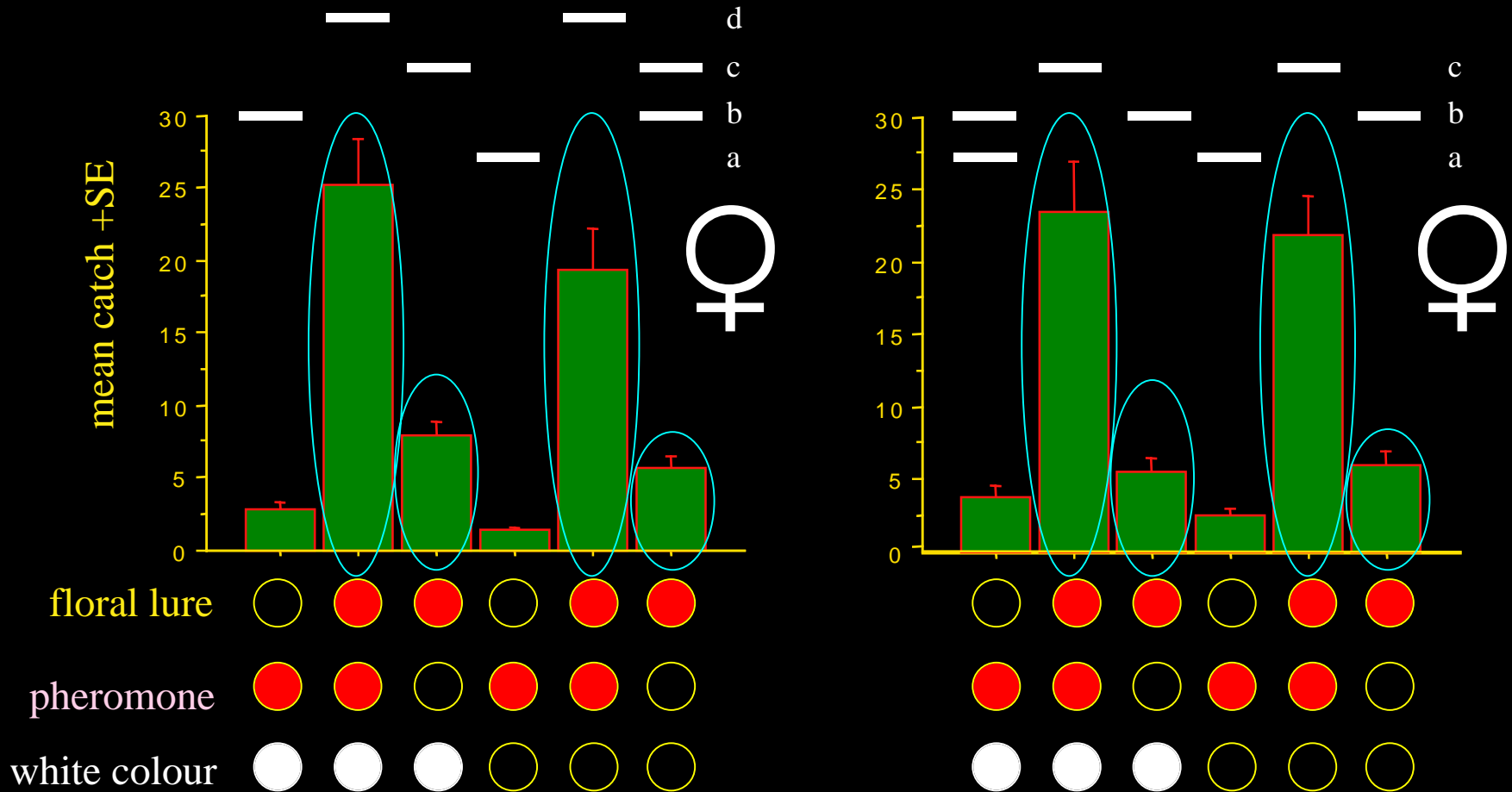
Eraclea, Italy, 2008  
 (total caught: 2532 beetles)



# The addition of the pheromone to the floral lure in the same trap increases catches of females!

Debrecen, Hungary, 2008  
(total caught: 4814 beetles)

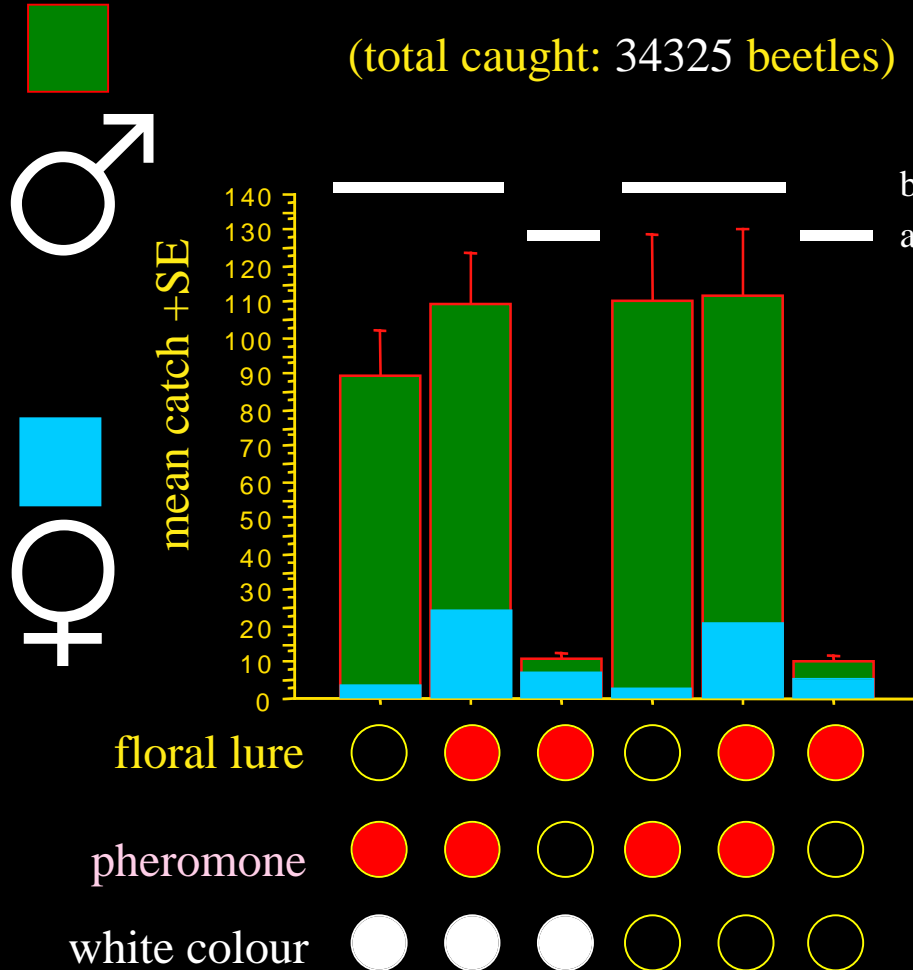
Eraclea, Italy, 2008  
(total caught: 2532 beetles)



# Most female specimens are caught in traps with both floral AND pheromonal baits

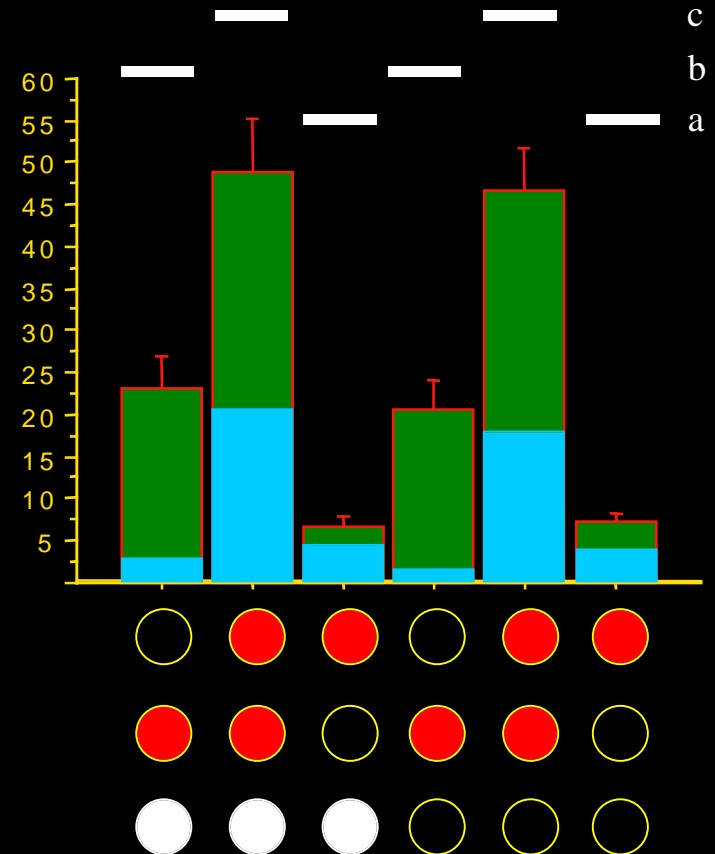
Debrecen, Hungary, 2008

(total caught: 34325 beetles)



Eraclea, Italy, 2008

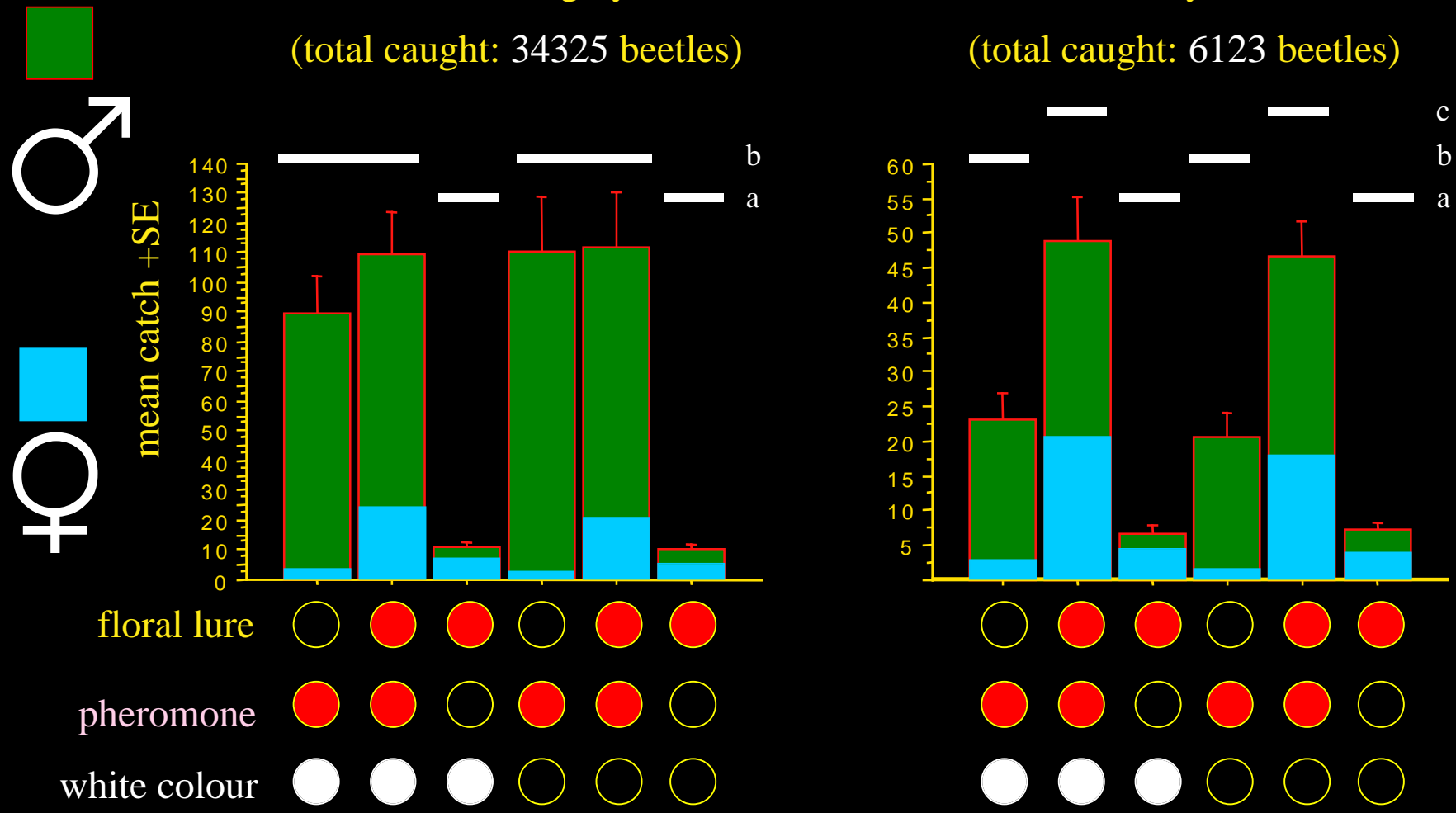
(total caught: 6123 beetles)



A similar phenomenon (that the presence of the pheromone increases the effect of floral bait on females) is unusual with sex pheromones

Debrecen, Hungary, 2008  
(total caught: 34325 beetles)

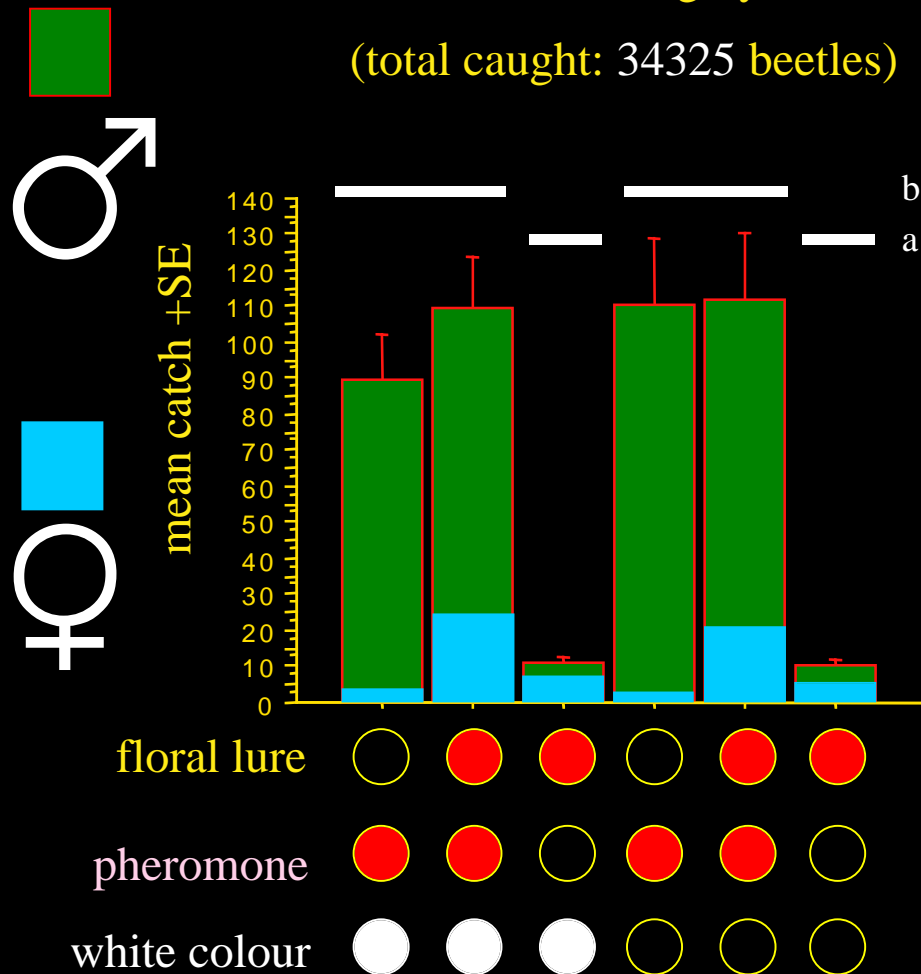
Eraclea, Italy, 2008  
(total caught: 6123 beetles)



However, it is frequently reported with aggregation pheromones

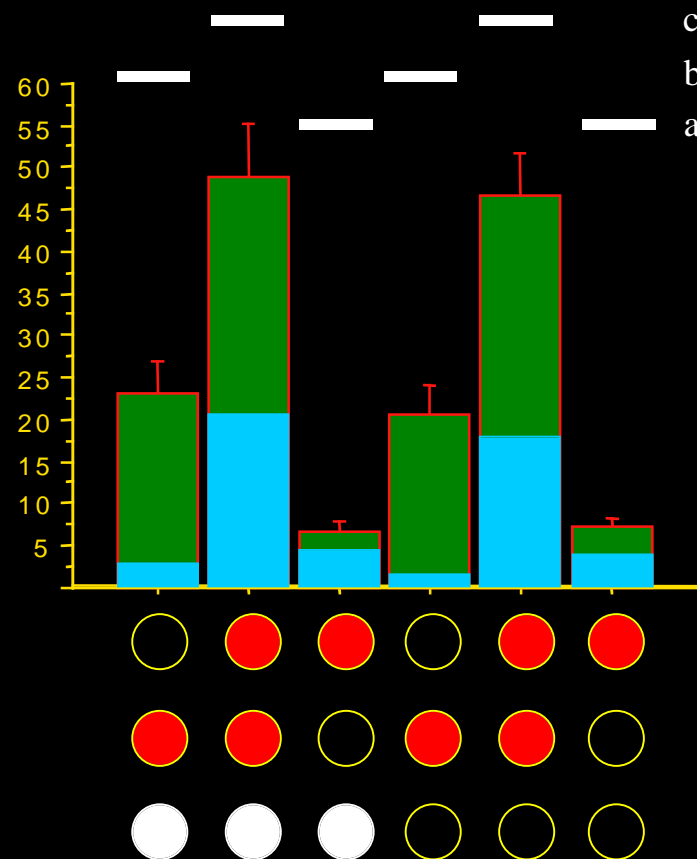
Debrecen, Hungary, 2008

(total caught: 34325 beetles)



Eraclea, Italy, 2008

(total caught: 6123 beetles)

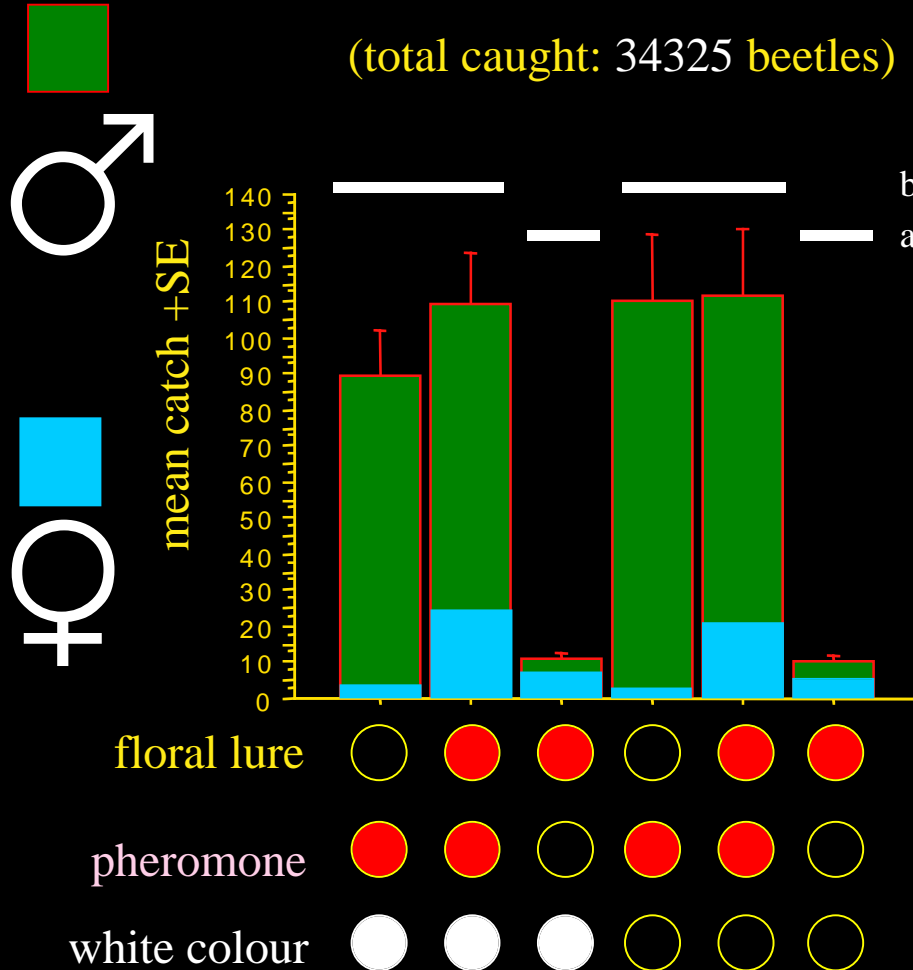




This again suggests that the pheromone of *Agriotes* click beetles is not a “classical” sex pheromone

Debrecen, Hungary, 2008

(total caught: 34325 beetles)



Eraclea, Italy, 2008

(total caught: 6123 beetles)

