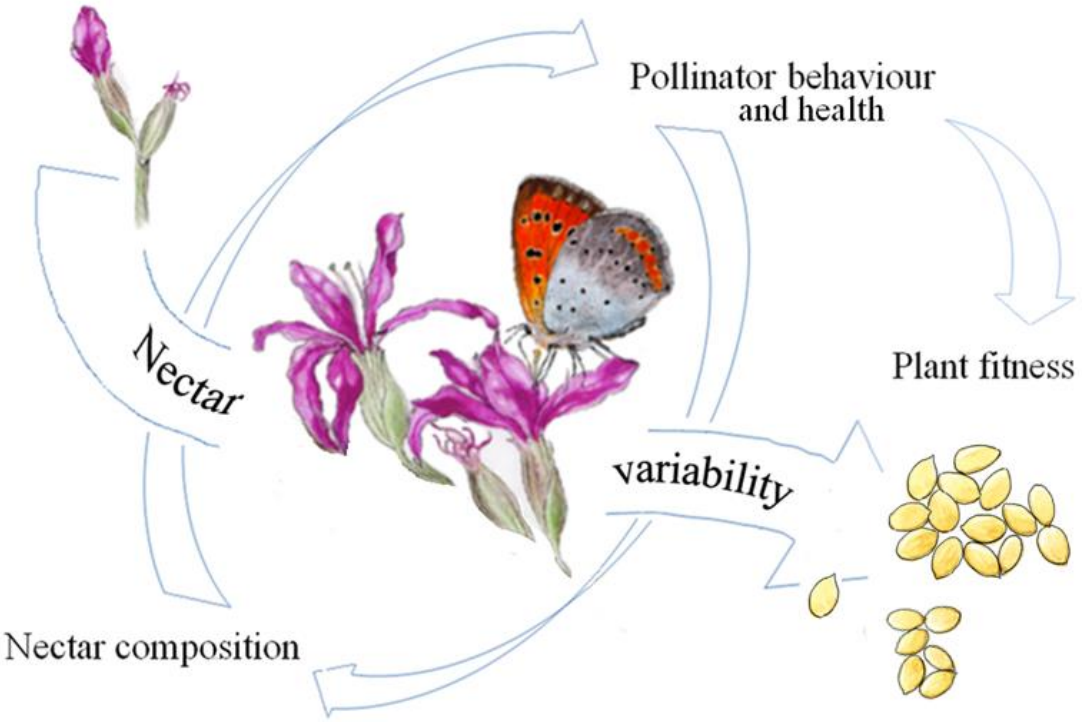
TOPIC 5. **Plant-pollinator interactions**

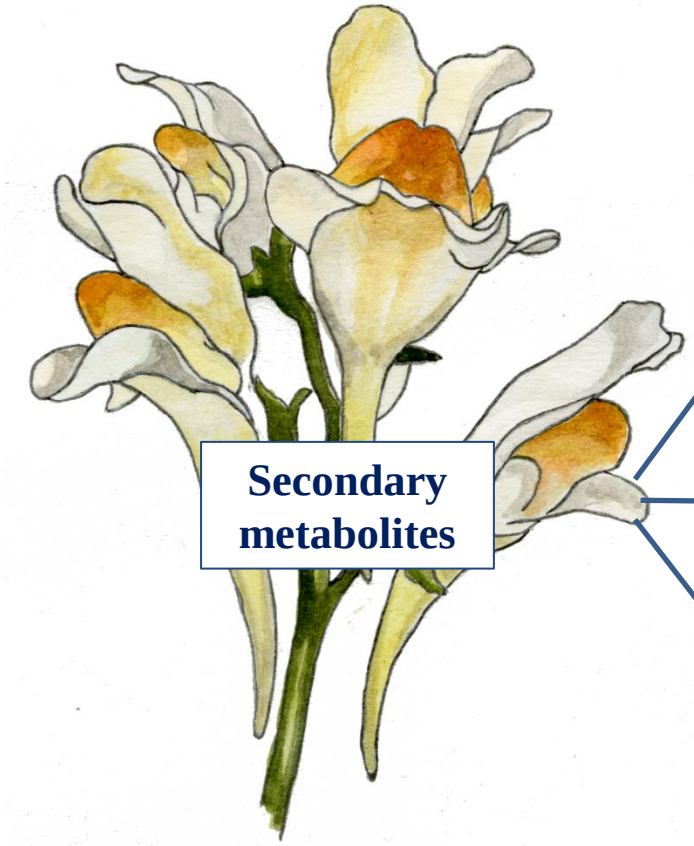
Pollinator behaviour mediated by nectar quality

Floral nectar: attractant or manipulant?[1]



[1]Pyke GH (2016). Floral nectar: pollinator attraction or manipulation? Trends in Ecology and Evolution , 31 339- 341

The role of secondary metabolites[2]



Secondary metabolites

- **Defence against fungi and bacteria**
- **Nectar forager selection theory**
- **Behavioural manipulation**

[2]Nepi M (2014). Beyond nectar sweetness: the hidden ecological role of non protein amino acids in nectar. Journal of Ecology, 102 108-115

Distasteful nectar deters floral robbery

Barlow S.E.[1,7,8] *, Wright G.A.[2,8], Ma C.[2], Barberis M. [3], Farrell I.W.[1], Marr E.C.[4], Brankin A.[1], Pavlik B.M.[5], Stevenson P.C.[1,6,*]

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Nectar robbery

❖ ***B. hortorum*** **is a proper pollinator of both *A. napellus* and *A. lycoctonum*, whilst *B. terrestris* robs nectar by making a hole on the galea.**

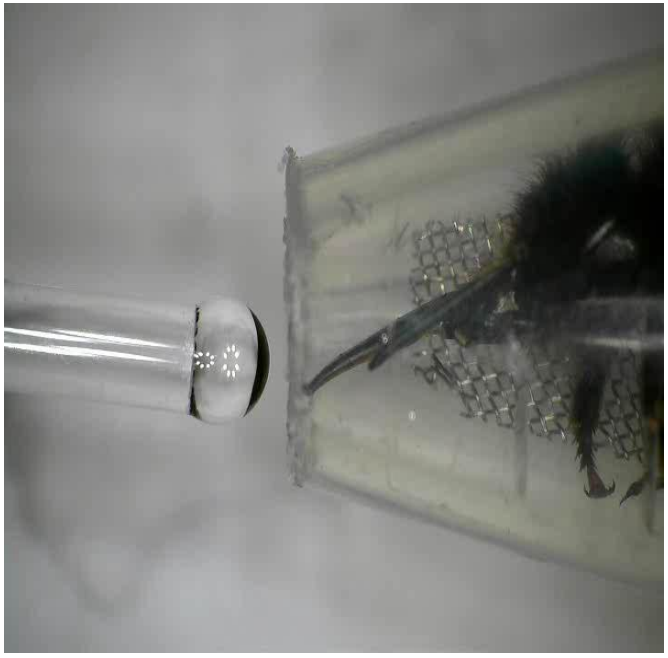
❖ **RANA video recordings reported a more frequent nectar larceny on *A. lycoctonum* than *A. napellus*.**

Aconitum lycoctonum

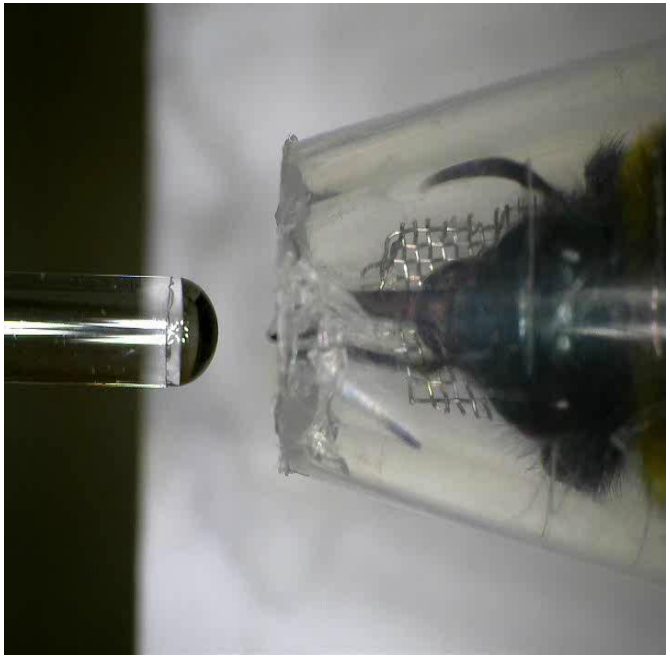
Aconitum napellus

Species	Compound	Corolla	Nectar
A. napellus	aconitine	0.13 mM	0.03 mM
A. lycoctonum	licaconitine	0.17 mM	0.007 mM

A bee's reaction to different nectar compounds



Aconitine 0.1 mM
in sucrose 100 mM



Licaconitine 0.1 mM
in sucrose 100 mM

Irwin et al. (2015). Quantifying direct vs indirect effects of nectar robbers on male and female components of plant fitness. Journal of Ecology 103, 1487–1497

Pollinator directionality as a response to nectar gradient: promoting outcrossing while avoiding geitonogamy

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Pollinators on *Dictamnus albus* and…

…nectar thieves!




Dictamnus albus is self-compatible but shows inbreeding depression.


Progressive upwards flowering along the raceme



10 – 12 days

Dichogamy + Herkogamy: intra-flower pollination avoidance

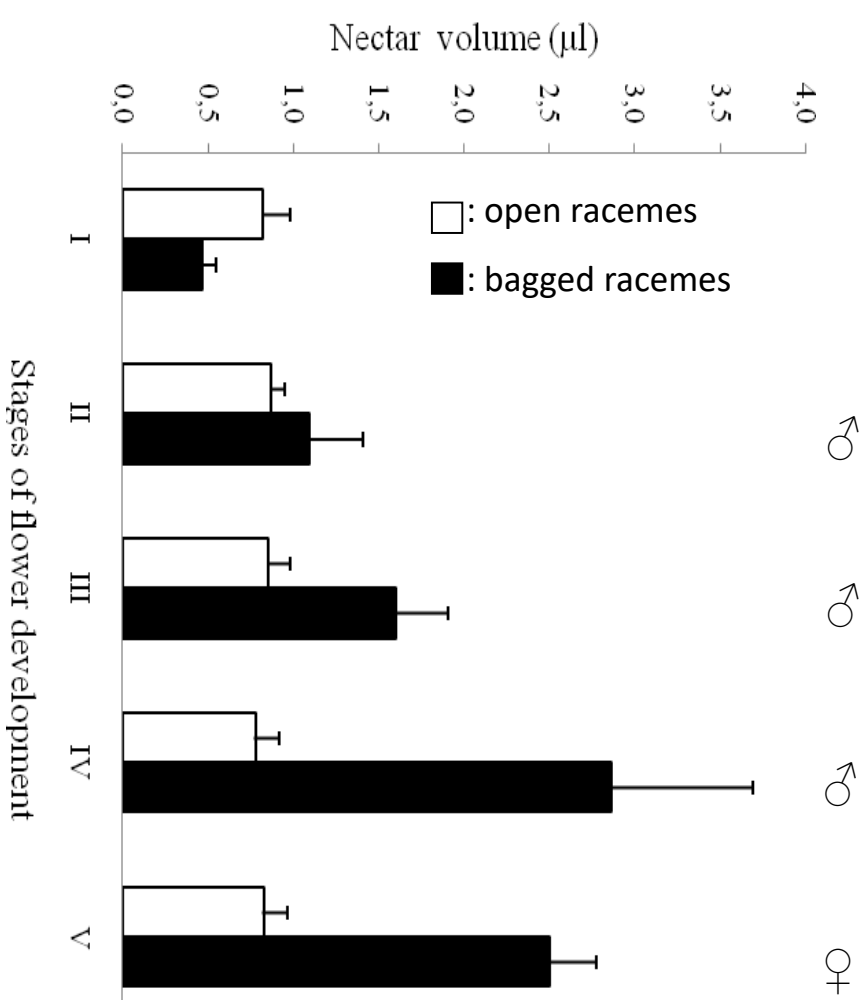
Male phase

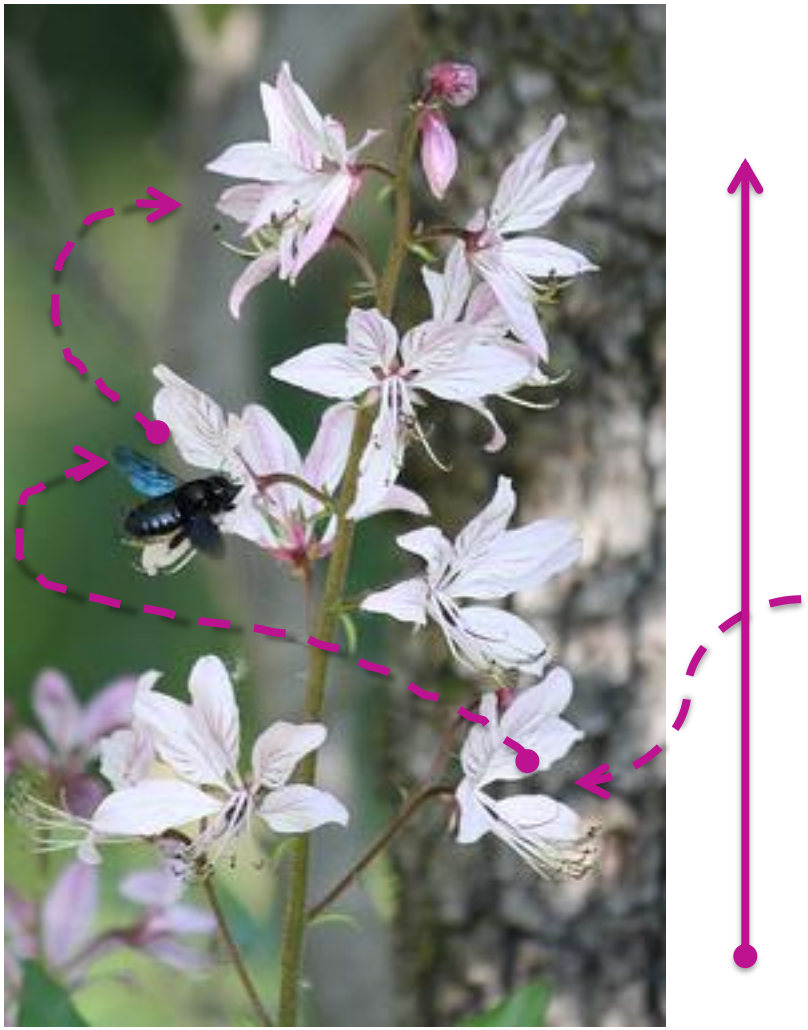
Female phase

Sexual phases assumed during anthesis

Flower appearance along the raceme

Gender-biased nectar production





Gender-biased nectar targets different behavioural traits of floral visitors

Barberis M.[1] *, Bogo G.[1], Bortolotti L.[2], Alessandrini M. [1], Conte L.[1], Nepi M.[3], Galloni M.[1]

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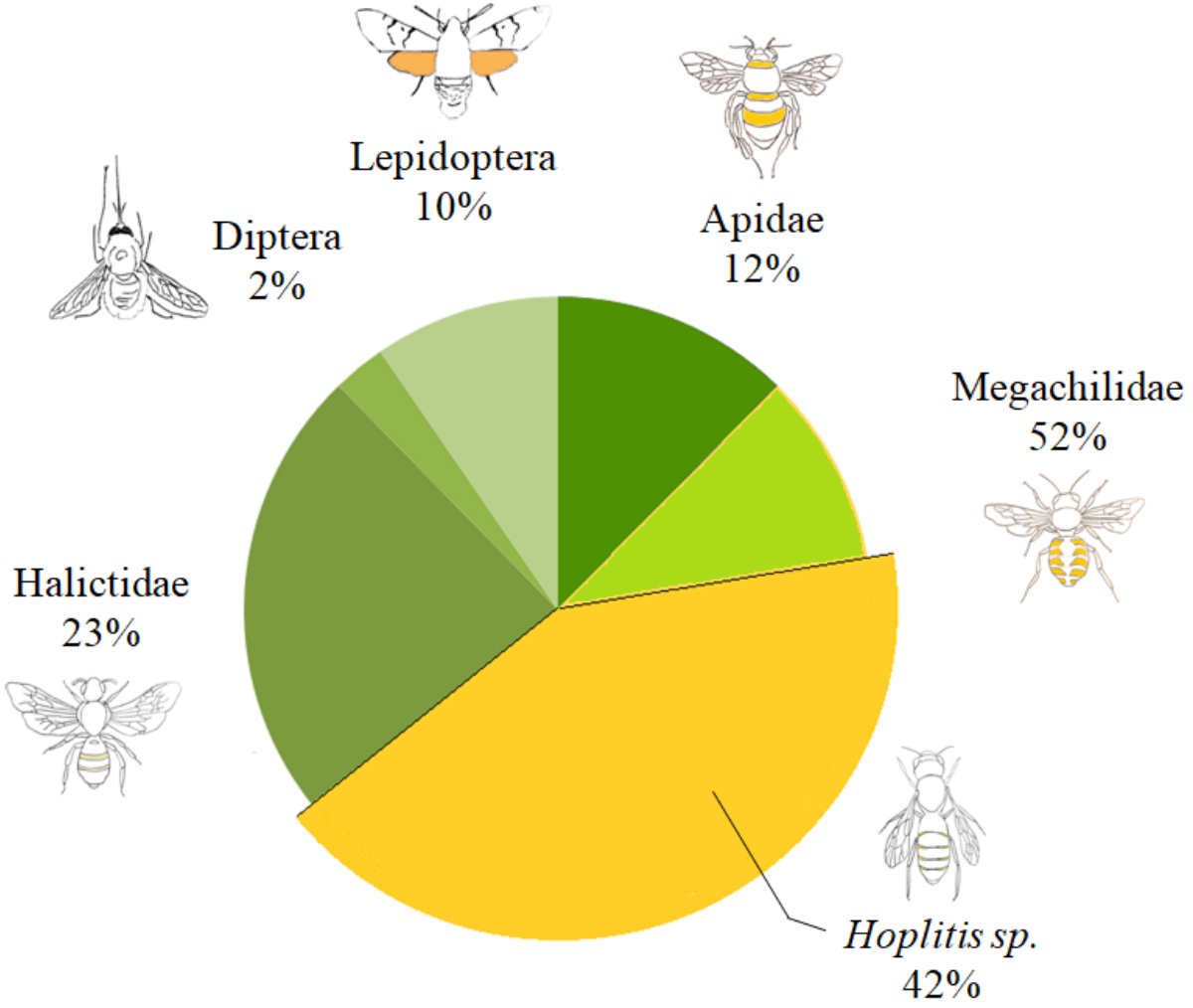
Specialized pollination

Specialized pollination is a phenomenon in which a plant is pollinated by one or few animal species[3] and it can occur, for instance, when floral resources contain toxic metabolites or when floral morphology excludes most visitors.

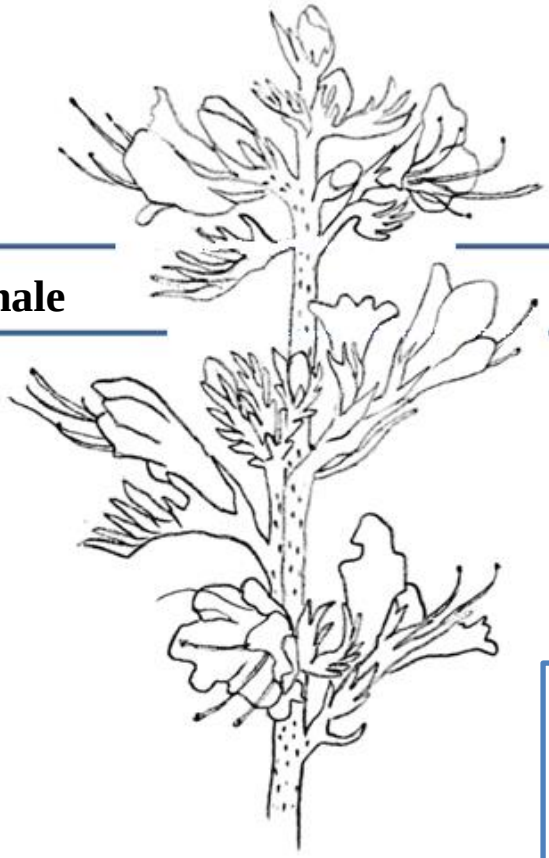
Reciprocal specialization is very rare[4].

[3]Patiny S. (2012). Evolution of plant-pollinator relationships. Cambridge University Press
[4]Joppa *et al* (2009) . Reciprocal specialization in ecological networks. Ecology letters, 12 961- 969

Spectrum of visitors on *Echium vulgare*



Floral phenology in *E. vulgare*[5]



Functionally male

1. Anthers dehiscent

2. Stigma rough and sticky. Pollen presentation ends

3. Style longer than stamens

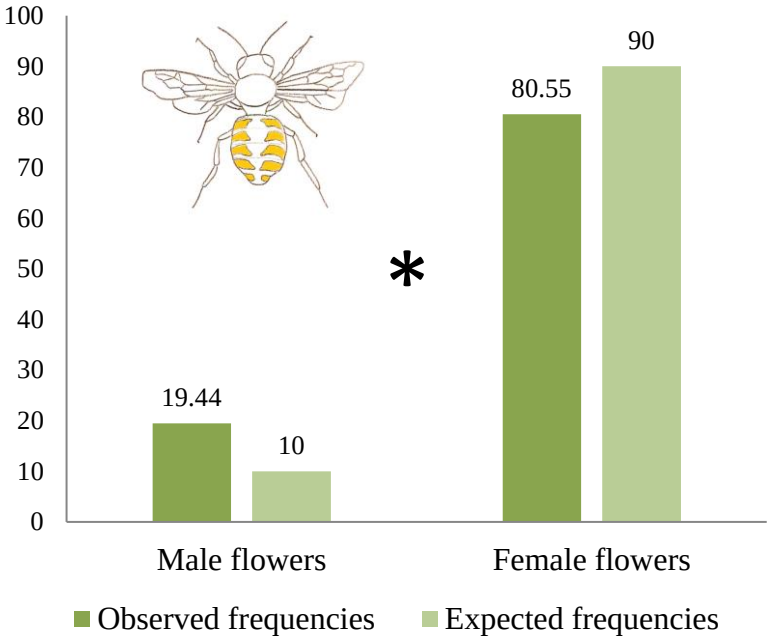
Functionally female

4. Stamens and corolla shrivel

- Male: female ratio in the studied population 1: 9
- For statistical analyses we considered insects visiting the flowers for nectar

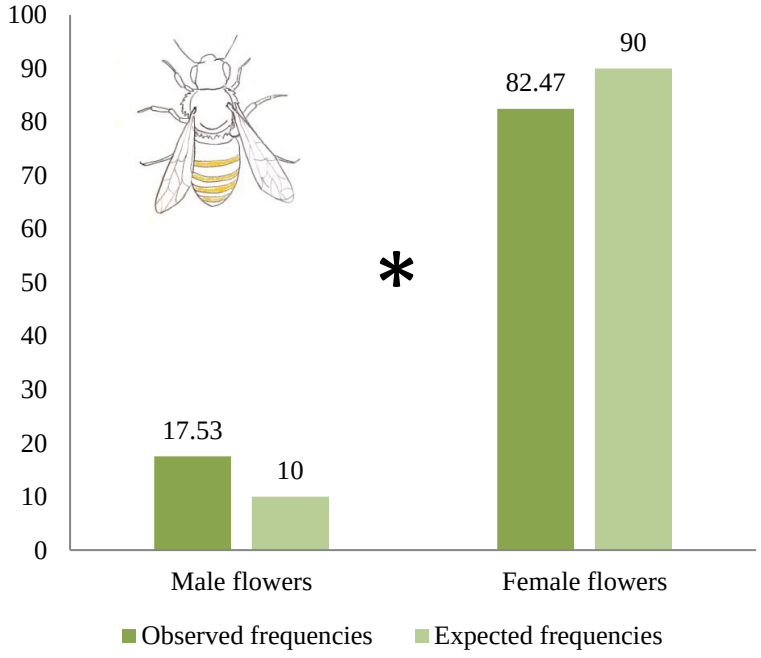
[5]Corbet S. (1974). Bee visits and the nectar of *Echium vulgare* L. and *Sinapis alba* L. Ecological Entomology, 3 25- 37

Anthidium florentinum



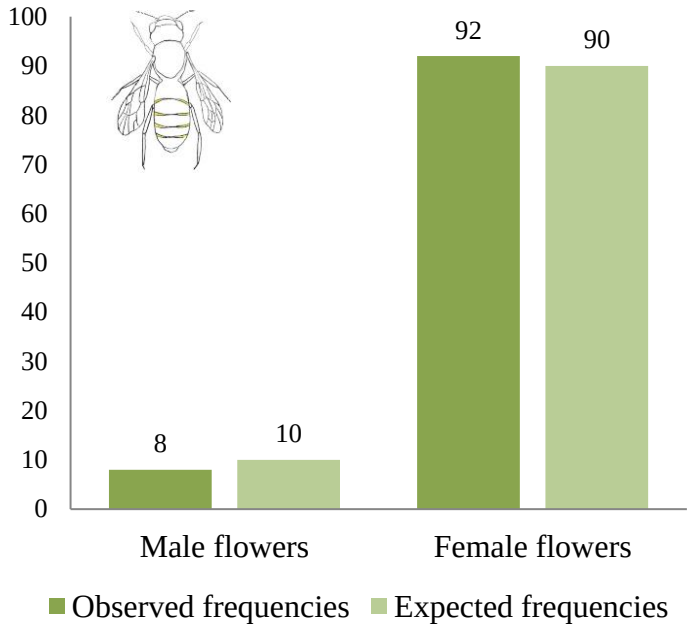
$\chi^2 = 10.704$; ***p*= 0.001**

Apis mellifera



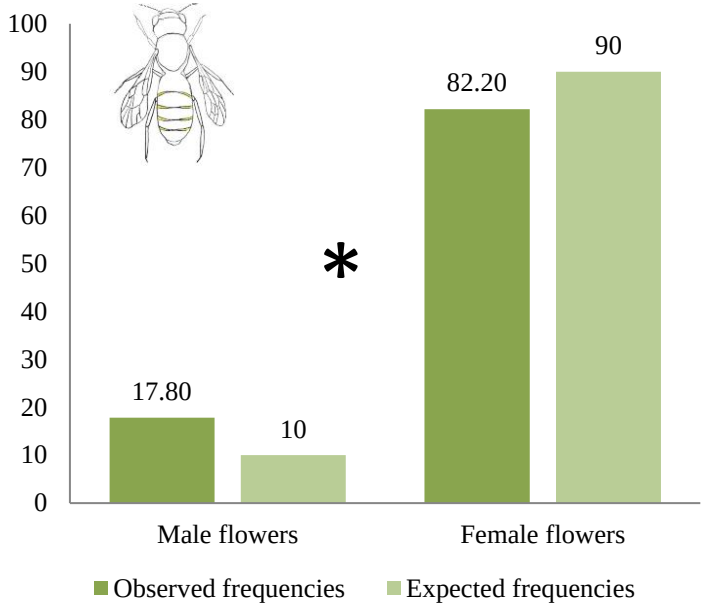
$\chi^2 = 9.709$; ***p*= 0.002**

Females of *Hoplitis* sp.



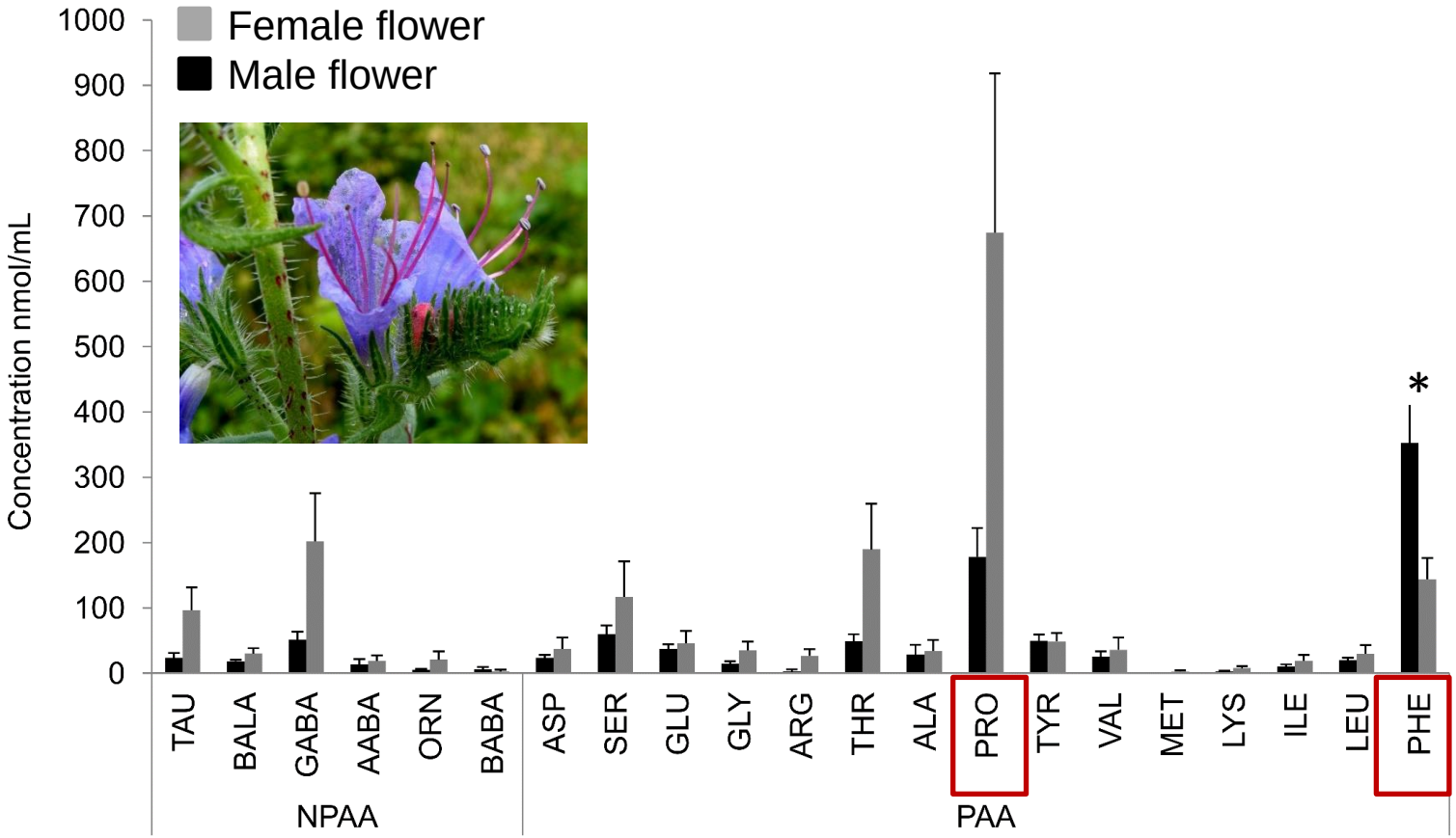
$\chi^2 = 0.333$; ***p*= 0.564**

Males of *Hoplitis* sp.



$\chi^2 = 7.970$; ***p*= 0.004**

Nectar amino acid profile
On the different role of proline[6] and phenilalanine[7]



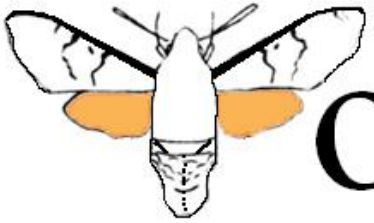
[6]Teulier et al. (2016). Proline as a fuel for insect flight: enhancing carbohydrate oxidation in hymenopterans. Proc. R. Soc. B 283: 20160333

[7]Seo HJ, Song J, Yoon HJ, Lee KY (2019) Effects of nectar contents on the foraging activity of honeybee (*Apis mellifera*) on Asian pear (*Pyrus pyrifolia* Nakai). Sci Hortic 245:185-192

Inbreeding avoidance hypothesis[8]

Quality of nectar offered by two sexual phases may target different insect needs affecting different behavioural traits and ensuring an optimal pattern of visit among functionally different floral stages, unequally present in the population.

[8]Darwin CR (1876) The effects of cross and self fertilization in the vegetable kingdom. Murray, London

Thank  ou!