Melliferous potential of some herbaceous plants in agricultural habitats

Nicoleta Ion, Jean Francois Odoux, Bernard Vaissière

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INTRODUCTION

- Klingen 1911 proposed melliferous crops
- Melliferous potential: what does it mean ?
- Need for innovative cropping system for a pollinator sustainability in *Agro-Environmental-Schemes*

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This work entailed :

- Methodological goal: How to use the existing data ?
- Make use of many data sets collected in the same region with same method over many years in natural conditions within cropping habitat
- Selection of historical and homogeneous data to permit the collection of solid information
- Standardization and addition of information concerning phylogeny and ecological traits of plant species

3

Materials & Methods

nectar collection with microcapillary pipets

the common point of all studies

Factors of variation existing

(flower density, sampling hour, anthesis day, season period…)

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Calculation of honey potential

based upon sugar content
and flower density

<u>Formula</u>: honey/ha (kg) of pure stand =

sugar/flower/day (mg) x flower density (flowers/ ha) x anthesis duration (day) x (0.8=honey Dry Matter content)$^{-1}$

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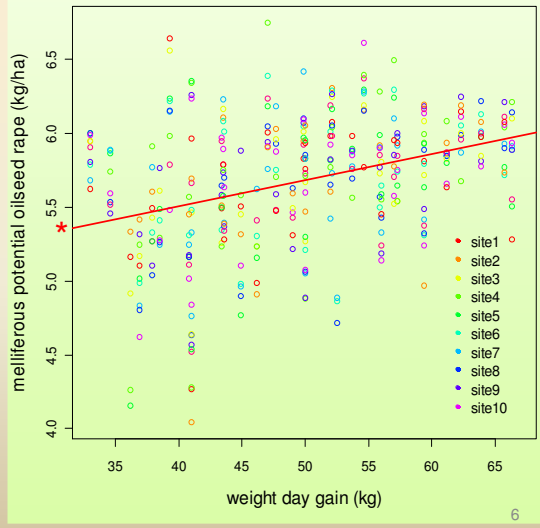
Methods

Relationship between nectar secretion measurements and honey yields in honey bee colonies ?

There is a positive relationship between the average colony weight gain and the melliferous potential ($p<0.05$, $df=344$)

2009/2010 in South Romania:
using 10 different locations during the oilseed rape flowering close to fields, (30-85 colonies / apiary)



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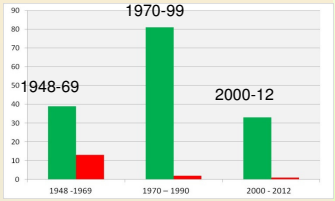
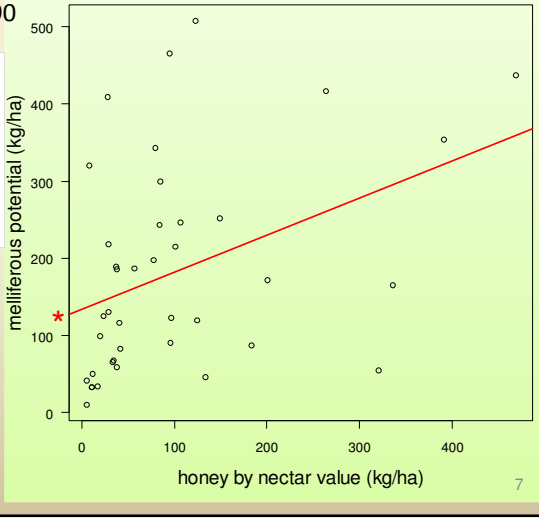
Methods

- Authors & references were standardized among 339 honey yield data & 162 sugar content data (32 papers, 15 authors kept)
  >10 authors in 1948-69, <5 authors in 2000-12
  80 species during 1970-90



- Species with both melliferous potential *and* nectar secretion
  => our data were correlated
  ($p<0.05$, $r^2 = 0.16$, $n = 41$)



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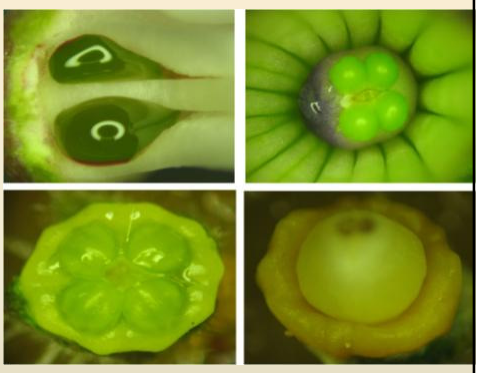
RESULTS

Melliferous potential of the species *versus*:

1. Phylogenetic traits
   - ➢ family and species
2. Floral traits
   - ➢ inflorescence
   - ➢ corolla color
3. Ecological traits
   - ➢ flowering period
   - ➢ life cycle
   - ➢ habitat



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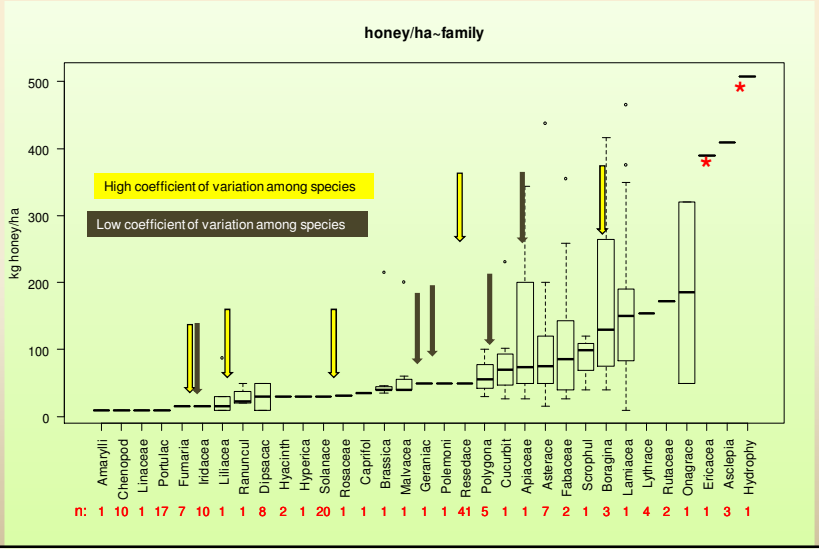
RESULTS: 1. Phylogenetic features

Honey potential by family (mean values):

Hydrophyllaceae and **Ericaceae** are highest ($P < 0.05$)



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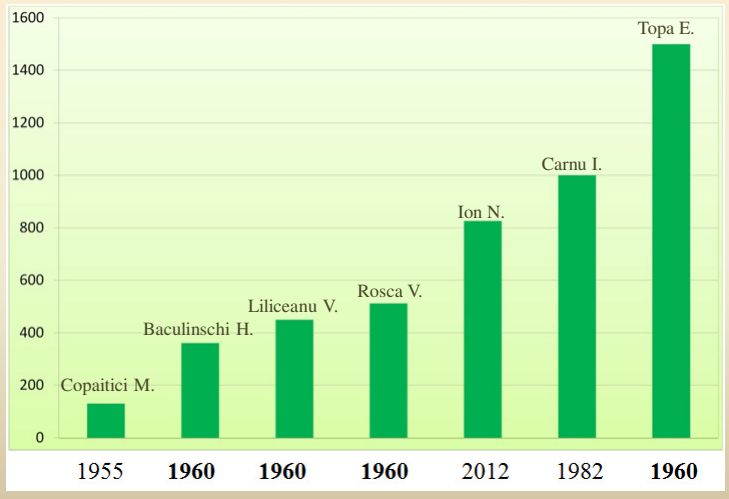
Melliferous potential can vary considerably within the same species: e.g., Lacy phacelia (*Phacelia tanacetifolia)*

Over a period of 57 years, by 7 authors
from 130 kg honey/ha *(Copaitici M., 1955) up to* 1.500 kg honey/ha *(Topa E., 1960)*



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The top species are different for melliferous potential and nectar secretion

Top melliferous species

Melliferous species	Botanical family	Melliferous potential (kg honey/ha) Average data
Phacelia tanacetifolia L.	Hydrophyllaceae	508
Lavandula angustifolia L.	Lamiaceae	465
Echinops sphaerocephalus L.	Compositae	437
Echium vulgare L.	Boraginaceae	417
Asclepias syriaca L.	Asclepediaceae	409

Top nectar species

Melliferous species	Botanical family	Nectar level (mg sugar/flower) Average data
Echinops sphaerocephalus L.	Compositae	2,1
Digitalis lanatus L.	Scrophulariaceae	2,0
Asclepias syriaca L.	Asclepediaceae	1,86
Ruta graveolens L.	Rutaceae	1,82
Borago officinalis L.	Boraginaceae	1,67

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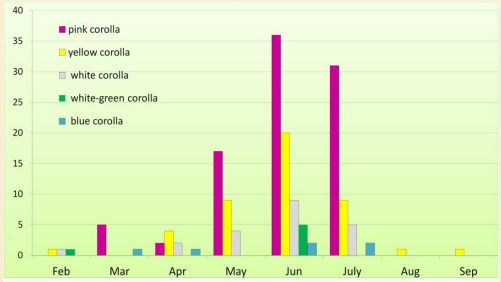
RESULTS

2. Floral features

corolla colour

=> no effect on honey potential

family effect is stronger

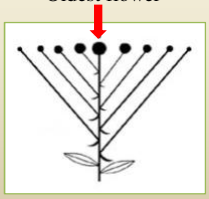


inflorescence

=> cyme effect on sugar production

Sympodial inflorescences

Oldest flower



CYME

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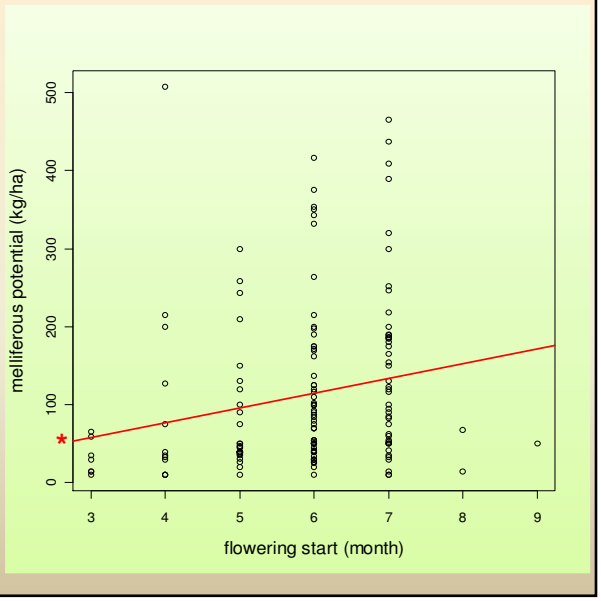
the flowering period

melliferous potential is higher in summer than in spring

(p <0 .05)

period of flowering

⇒ Violet corolla flower later and longer

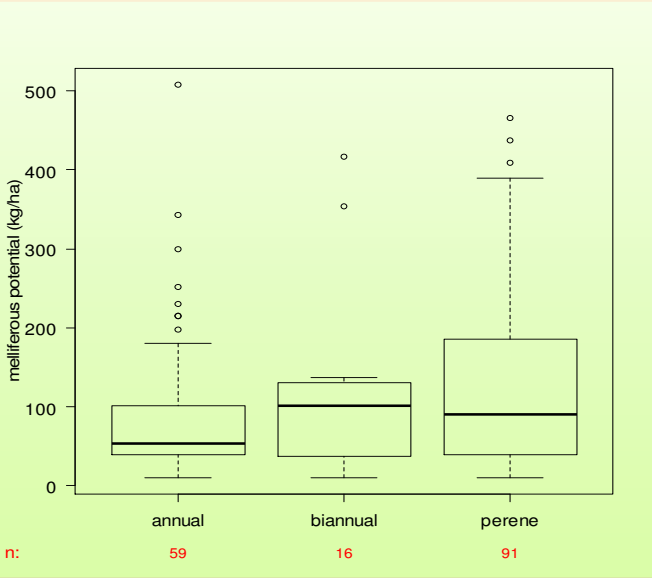


RESULTS

3. Ecological features: major results

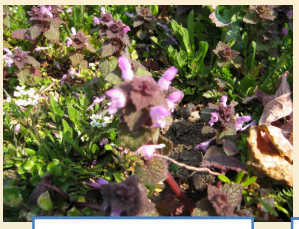
3.2. Life cycle

1. **NO MORE melliferous potential for perenial plants than biannual and annual**
(P < 0.05)

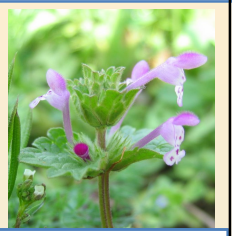


Perenial plants > > Biannual and Annual plants

Lamium album
perenial
210 kg honey/ha



Lamium purpureum
annual
90 kg honey/ha



Lamium amplexicaule
annual
60 kg honey/ha

Stachys palustris
perenial
232 kg honey/ha

Stachys officinalis
perenial
200 kg honey/ha

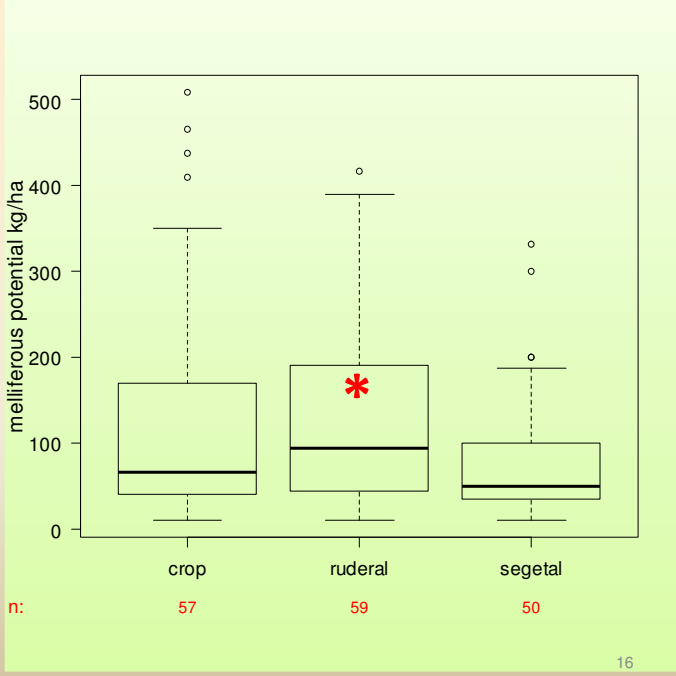
Lamiacea examples

Stachys annua
annual
181 kg honey/ha

3.3. Habitat

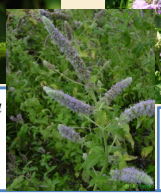
- *ruderal plants*
- *segetal weeds*
- *crop plants*

2. MORE honey/ha for **ruderal** plants than **segetal weeds** *(p<0,05)*



Ruderal weeds >> Crop plants >> Segetal weeds

Mentha aquatica
ruderal
271 kg honey/ha



Mentha longifolia
ruderal
218 kg honey/ha

Mentha pulegium
ruderal
220 kg honey/ha

Mentha piperita
crop
170 kg honey/ha

Mentha arvensis
segetal
83 kg honey/ha

Lamiacea examples

Lamium album
ruderal
210 kg honey/ha

Lamium purpureum
segetal
90 kg honey/ha

Lamium amplexicaule
segetal
60 kg honey/ha

CONCLUSION

Our database based on the literature in Romania provides an overview of important melliferous species.

It allows us to identify some candidates in nectar resources for honey bees. These plants sometimes are ordinary weeds although they could present an agronomic interest.

Melliferous species whose flowers secrete a large amount of sugar are characterized by the following features: **ruderal plants with cyme** inflorescence (as *Echium vulgare* or *Phacelia tanacetifolia*)

Thanks to ….

numerous ancient authors

current technicians at ICDA

- Grigore Fota
- Razvan Coman