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LIPID CONTENT IN BEE POLLEN OF SOME PLANTS IN FORESTRY AREA

Zheko Radev

Tobacco and tobacco products institute, 4108 Markovo, Bulgaria. E-mail: zhekoradev@abv.bg

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Abstract

Lipids are main components of bee pollen grains, and vary among different pollen taxa. The objective of this study was to determine the lipid content in pollen of 20 popular bee plants and the impact of lipids to honey bees. The analysis showed, that the percentage of the total lipid content in the examined bee pollen ranged from 0.87 % for *Zea mays* L. to 13.6 % for that of *Echinops ritro* L., and the average was 3.91 %. The average level of lipids for the entomophilous plants was 4.20 % and 1.31 % for anemophilous, for Asteraceae was 5.42 % and 1.88 % for Fabaceae. The average weight of one hundred worker bees fed on pollen from *Z. mays* was 8208.2 mg, whereas it was 9882.2 mg for the bees fed on pollen from *E. ritro*. The weight of bees that consumed pollen with higher lipid content is higher compared to that consumed pollen with lower lipid content.

Key words: honey bee, honey bee nutrition, monofloral bee pollen.

Introduction

Honey bees prefer pollen with high lipid levels (Singh et al. 1999), but the quantative lipid requirements of bees have not been established yet (Manning 2001). The lipid content in samples of bee pollen from Australia ranged from 0 % for *Eucalyptus macrorhyncha* F. Muell. Ex Benth. to 11.2 % for *Hypochoeris radicata* L. and average was 2.52 % (Somerville 2005). The content of the lipids in bee pollen from Poland ranged from 6.74 % to 10.99 % and 8.7 % on average, while in Korean was 5.5 % and in Chinese was 6.2 % (Szczesna 2006).

In the literature there is not much information about lipid content of identified pollen grains. The published results are limited (Manning and Harvey 2002). Lipid content of pollen has been estimated through ether extraction (Somerville 2005).

The objective of this study was to determine the lipid content in pollen of 20 popular bee plants and the impact of lipids to honey bees. This study is the first which reports results for lipid content of Bulgarian floral species.

Materials and Methods

The experimental part was carried in Belozem forestry area (42º17′05" N and 25º09′33" E), 142 m a.s.l. Pollen collection was performed by using pollen traps.

In the study were used three honey bee colonies.

Two hundred and ten samples of mixed pollen were collected. They were carefully mixed and a sample of 10 % was taken (Dimou and Thrasyvoulou 2007). Then the pollen pellets were separated according to colour, shape and texture. Melissopalynological analysis was carried out using a similar methodology as described by Louveaux et al. (1978). To identify the pollen database of plants from the area was created.

For lipid content determination, identified pollen was analysed applying methodology used in Laboratory of Apiculture-Sericulture at Aristotle University, Thessaloniki. Results are expressed as a percentage to 2 decimal place for the samples tested. Three replicates from each sample were analyzed, and the results were averaged.

Two groups with five cages 10×10×10 cm each were created. One hundred newly emerged worker bees were placed in each and fed on 20 mL 50 % sugar syrup. Two grams of pollen from *E. ritro* were added to the syrup of the first group and two grams of pollen from *Z. mays* were added to syrup of the second group. The syrup was changed daily. The experimental cages were kept in darkness at 27 °C. In fifteen days, the weight of each cage was recorded every day by using electronic scales KERN. The weight of one hundred bees is reported in milligrams (mg).

The results were statistically processed by using Excel and Anova.

Results and Discussion

The most identified plants were from Asteraceae – 9, followed from Fabaceae – 4, and 7 families by one representative. Lipid content of bee pollen is presented in Figure 1. It ranged from 0.87 % for *Z. mays* to 13.6 % for *E. ritro*, and the average was 3.91 %. Pollen from different taxa had different lipid content.

Comparison between insect-pollinated and wind-pollinated taxa was made, and significant difference in the lipid content was not found ($F \leq F_{crit}$). No significant difference in lipid content between Fabaceae compared to Asteraceae plants ($F \leq F_{crit}$) was found either.

Chenopodium sp. L., *Eryngium campestre* L., *Z. mays* and some floral species from Fabaceae showed lowest levels of lipid content. The cultivated crop *Brassica napus* L., produced pollen with higher lipid content – 9.43 %, compared to the others two frequently cultivated plants *Helianthus annuus* L. – 1.91 % and *Z. mays* – 0.87 %.

Results for lipid content compared with results of other authors are given in Table 1.

Table 1. Comparing pollen lipid contents results in %.

Species	Our present results	Results of other authors
Zea mays	0.87	1.8[1]
Trifolium repens L.	1.69	2.5[1]
Helianthus annuus	1.91	1.41[1]
Brassica napus	9.43	5.92[2]
Centaurea solstitialis L.	4.82	2.83[1]
Chondrilla juncea L.	5.83	3.43[1]

Other authors: Somerville (2005)[1], Manning and Harvey (2002)[2].

Bees which consumed pollen from *E. ritro* were heavier than those consumed pollen from *Z. mays* ($F > F_{crit}$) (Table 2). The average weight of one hundred bees fed on pollen from *Z. mays* was 8208.2 mg, whereas it was 9882.2 mg for the bees fed on pollen from *E. ritro*. The weight of bees

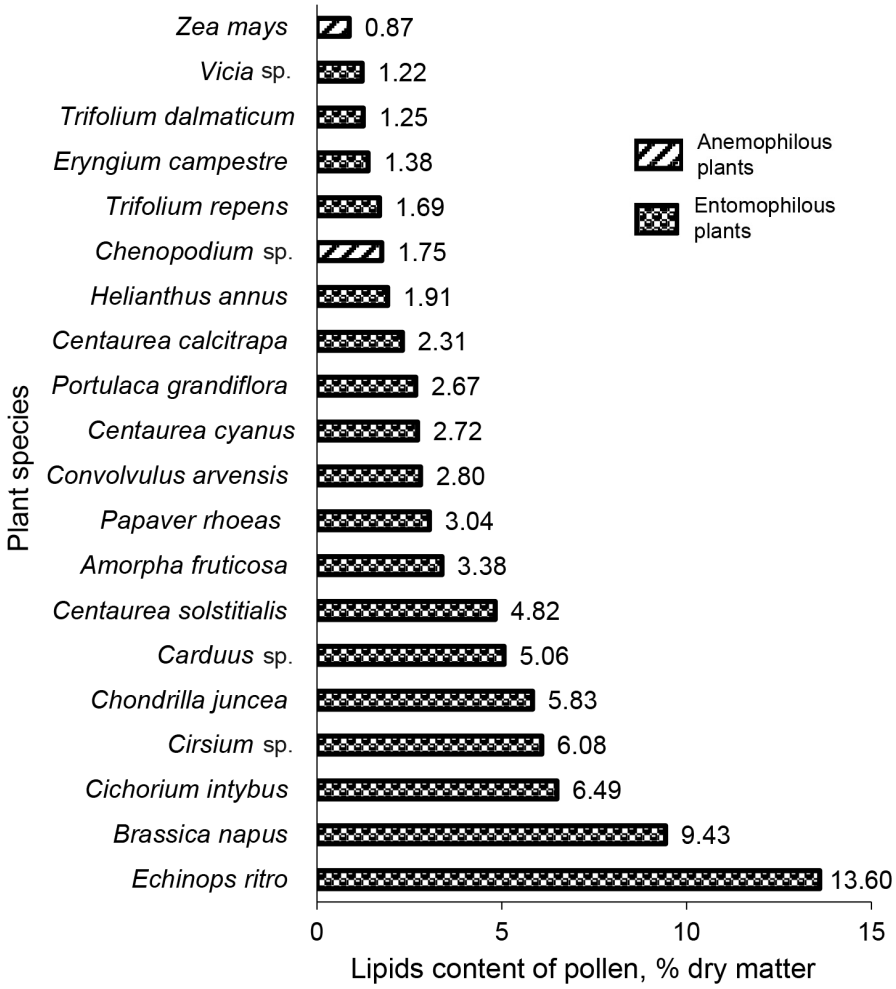

Fig. 1. Lipid content of 20 taxa.

Table 2. Average weight of one hundred worker honey bees in mg.

Groups of honey bees	means±std
Bees fed on sugar syrup and pollen from *E. ritro*	9882.2±151.87
Bees fed on sugar syrup and pollen from *Z. mays*	8208.2±76.01

that consumed pollen with higher lipid content is higher compared to those consumed pollen with lower lipid content. The statistical analysis showed highly significant positive correlation ($r = 1$, $p \leq 0.05$).

Asteraceae species play major role in honey bees' nutrition diet, because a large number of them provide pollen till late autumn such as *Centaurea calcitrapa* L.*, C. solstitialis, Carduus* sp. L., *C. juncea, Cirsium* sp. Mill., *Cichorium intybus* L. and *E. ritro*. These plants, especially *E.*

ritro, need to be preserved and spread in the environment, where it is possible, with purpose to provide more quality nutrition and higher vitality for honey bees.

The differences between lipid content of pollen observed in our study and that cited in the literature could be due to differences in geographical origin, soil components or hybrid variety of cultivated plants.

Conclusions

The percentage of the total lipid content in the bee pollen ranged from 0.87 % for *Z. mays* to 13.6 % for *E. ritro*, and the average was 3.91 %. The average weight of one hundred worker bees fed on pollen from *Z. mays* was 8208.2 mg, whereas it was 9882.2 mg for the bees fed on pollen from *E. ritro*. The weight of bees that consumed pollen with higher lipid content is higher compared to those that consumed pollen with lower lipid content.

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