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COMPARING PROTEIN CONTENT IN BEE POLLEN FROM DIFFERENT FORESTRY AREAS

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Abstract

Knowledge of protein food used by honey bees is important, as proteins are main component of pollen. The objective of this research was to determine and compare the protein content of bee pollen from different forestry areas in Bulgaria of some popular bee plants. The analysis showed that in pollen it depended on the botanical origin. The protein content in the pollen from Oryahovo ranged from 12.8 % for *Taraxacum officinale* L. to 25.35 % for *Cornus sanguinea* L., and the average was 20.66 %, from Borushtitsa ranged from 12.3 % for *Chondrilla juncea* L. to 27.51 % for *C. sanguinea*, and the average was 21.16 %. The protein content in pollen from *Brassica napus* L.*, Cornus mas* L.*, C. sanguinea, Robinia pseudoacacia* L. and *Salix* sp. showed variability for both forestry areas.

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

Introduction

There are always differences in the protein value in pollen that originates from same taxa according to different ecological factors (Perelson 1962, Stanley and Linskens 1974, Bosi and Ricciardelli D'Albore 1975). Bees need protein to increase their population (Tyurner et al. 1972). Pollen pellets play major role for honey bees' development, reproduction and productivity (Radev et al. 2014). Protein value in pollen more than 20 % meets their nutritional needs (Shaw 1999).

Liolios et al. (2016) found range from 12.8 % of *Smilax* sp. L. to 30.1 % for *Fallopia* sp. Adans., with an average of 20.8 %. Radev (2018) determined protein content in pollen ranged from 11.5 % for *C. juncea* to 27.4 % for *Cucumis melo* L., and the average value was 19.9 %. In another research in a forestry region Radev (2021) found range from 14.83 % for *Helianthus annuus* L. to 26.14 % for *Prunus cerasifera* Ehrh., and the average value was 20.90 %.

The objective of this research was to determine and compare the protein content of pollen of some floral species from different forestry areas in Bulgaria.

Materials and Methods

Pollen traps were used in three bee hives and pollen grains were harvested every 5 days in April till May at a forestry area near Oryahovo (43º73′06" N and 23º92′74" E),

in North Bulgaria, 173 m a.s.l.; and from April to August at Borushtitsa (42°73′38" N and 25°57′29" E), in Central Balkan Range, Bulgaria, 727 m a.s.l.

Thirty-six samples of mixed bee pollen loads from Oryahovo and 114 from Borushtitsa were collected. Samples of each hive were mixed and 10 % of sample was taken (Dimou and Thrasyvoulou 2007). Pollen grains were separated over white sheet according to colour, shape and texture. The labeled pollen samples were stored in separate vials in a freezer at –20 °C. For mellisopalynological analysis we used the methodology proposed by Louveaux et al. (1978). To identify the pollen database of plants from the area was created.

Dry matter measurements were carried out with the method of drying to a constant weight at a temperature of 105 °C (Serra Bonvehi and Casanova 1987). For nitrogen content determination, pollen was analysed using Kjeldahl method. The crude protein content was estimated using factor 5.60 (Rabie et al. 1983). Three replicates from each sample were analyzed, and the results were averaged.

The results were statistically processed by using Excel and Anova with significance level of α=0.05.

Results and Discussion

The indicated plants in Oryahovo were from Cornaceae – *C. mas* and *C. sanguinea*, and 6 families by one representative – Asteraceae, Moraceae, Juglandaceae, Salicaceae, Brassicaceae and Fabaceae. The protein content results are represented in Figure 1. The total protein content

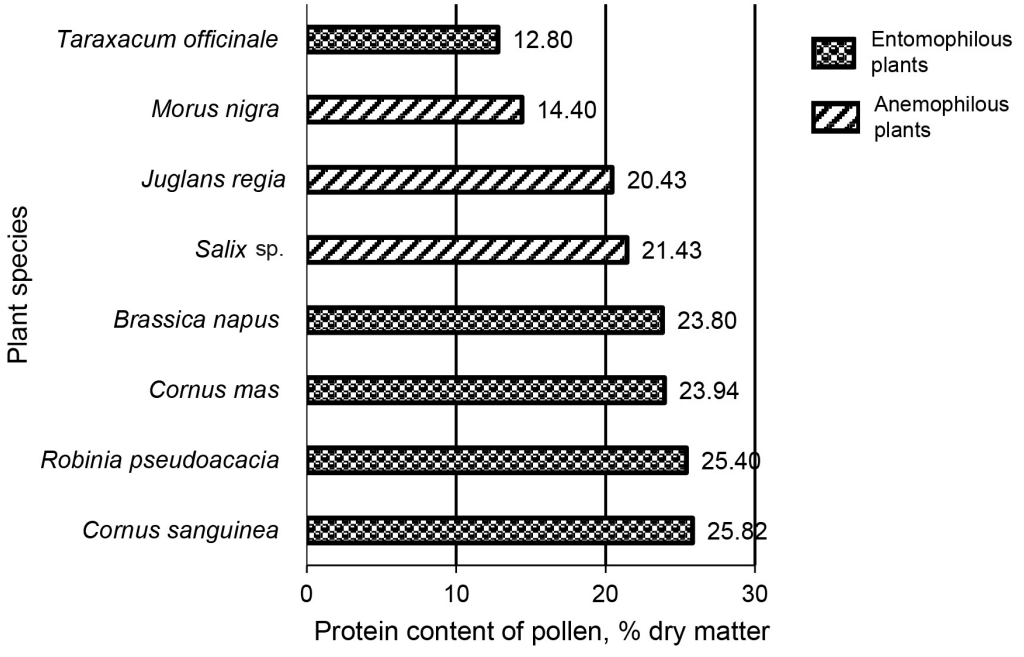

Fig. 1. Protein content of pollen species in Oryahovo.

in the studied bee-pollen grains ranged from 12.8 % for *T. officinale* to 25.82 % for *C. sanguinea*, and the average value was 20.66 %. Pollen from different taxa was found to have different protein content. No significant difference in the protein value between wind pollinated compared to insect pollinated floral species (*p*-value = 0.35) was found.

In Borushtitsa the identified taxa came from Fabaceae – 4, followed by Cornaceae – 2, Asteraceae – 2, Brassicaceae – 2, and 5 families by one representative – Salicaceae, Tiliaceae, Rosaceae, Loranthaceae and Onagraceae. Protein content data of identified taxa are showed in Figure 2. The protein content in the studied pollen collected by bees ranged from 12.30 % for *C. juncea* to 27.72 % for *C. sanguinea*, and the average was 21.22 %. Significant difference in the protein content among the families was found only between Brassicaceae compared to Asteraceae (*p*-value = 0.00).

The results are in the range according to the data from other authors. Protein value in pollen collected by honey bees from different species ranged from 7 % to 30 % (Todd and Bretherick 1942) and from 8 % to 40 % (Herbert 1992).

A comparison was performed between the protein content of the same plant species from both areas – *B. napus*, *C. sanguinea, C. mas, R. pseudoacacia* and

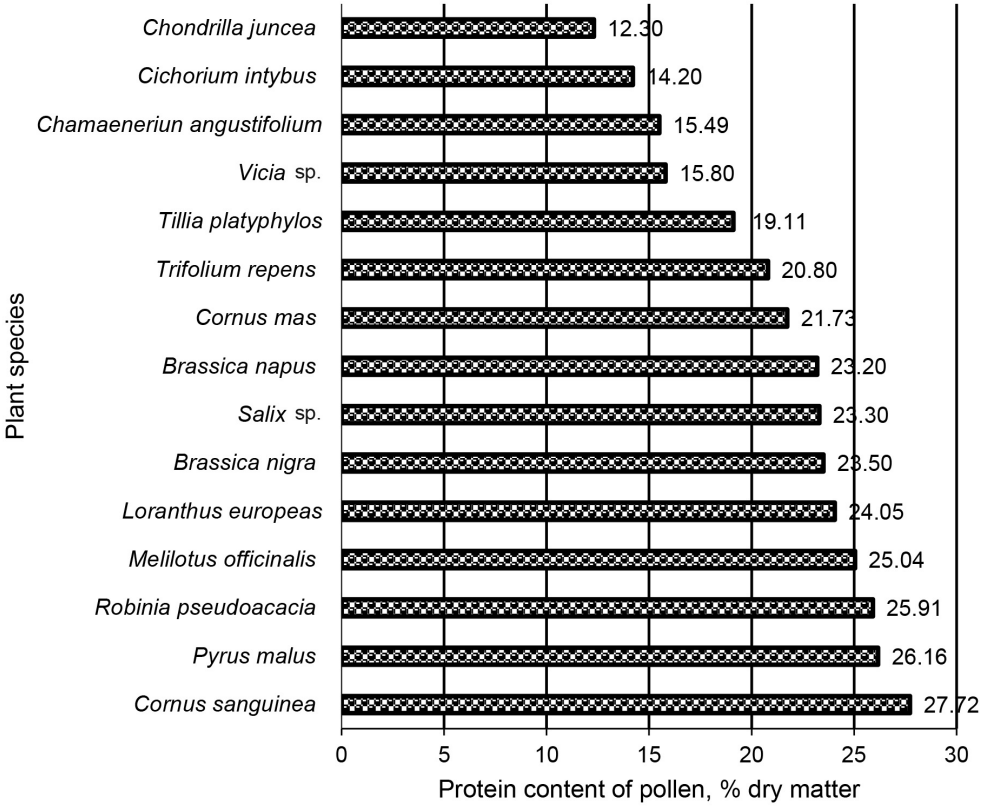

Fig. 2. Protein content of pollen species in Borushtitsa.

Salix sp. and significant differences in the crude protein content of their contents were found (*p*-value = 0.00). That indicated that the protein content in pollen had variability.

It was noted that the protein content of Asteracea species had the lowest protein content, while *C. sanguinea* had the highest protein content for both areas. The main reason for the different results for the same plants in the two areas can be attributed to the soil composition, geographical area, climate or else factors.

Conclusions

The protein content in bee pollen from Oryahovo ranged from 12.8 % for *T. officinale* to 25.35 % for *C. sanguinea*, and the average was 20.66 %. The protein content in bee pollen from Borushtitsa ranged from 12.3 % for *C. juncea* to 27.51 % for *C. sanguinea*, and the average was 21.16 %. The protein content in pollen in *B. napus*, *C. sanguinea, C. mas, R. pseudoacacia* and *Salix* sp. showed variability for both forestry areas. Protein content in pollen from *C. sanguinea, R. pseudoacacia* and *Salix* sp. in Borushtitsa is higher.

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