WATER CONTENT OF MIXED HONEY BEES-COLLECTED POLLEN

Zheko Radev

Abstract: The knowledge of the water content of pollen is important to determine the amount of protein content, lipids, sugars, minerals and other components in the dry matter. The water content of mixed honey bee-collected pollen was determined by a method of drying. A table of the water content in the mixed pollen from different harvesting periods was made. The percentage of water content in the mixed bee-collected pollen samples ranged between 12.3% and 26.6% and the average was 18.8%. Pollen from different harvesting periods has different water content. There are also differences among the same months during three years. The average value of water content for each year is also different. According to the results, can't be said during which season (spring, summer, autumn) the pollen has higher or lower water content. Ecological factors, especially rainfalls, can also affect water content.

Key words: water content, pollen, honey bee, method of drying

INTRODUCTION

Water plays an important role in the diet of honey bees, but is not essentially contained in the pollen. The percentage value of moisture in the pollen species collected by bees, was found to be 11% and in the range of 7-18% [1]. The water content of honey bee-collected pollen from 50 plants from Bulgaria range between 9.69% for *Centaurea calcitrapa* and 23.12% for that of *Crepis* sp. and the average is 17.35%. Pollen from various botanical species has different water content. There are also differences among different species of plants of the same family. The anemophilous species- *Juglans regia* and especially *Chenopodium* sp. and *Atriplex patula* had one of the lowest water content, while *Plantago* sp. and specifically *Amaranthus retroflexus* had one of the highest water content. The introduced plant *Zea mays*, *Salix* sp. and *Morus nigra* occupied a middle position in the results. No differences were found in the water content of pollen between the anemophilous and the entomophilous species [2]. It was found that the average value of moisture content in ten samples of dried pollen originating from isolated plant species was 7.4% [3]. An average of 16.48% moisture in pollen was estimated [4]. The average moisture of freshly collected and dried pollen calculated by [5] was 18.3% and 6.2%, respectively. The amount of moisture in pollen plays an important role for the preservation and storage of products [6-8], while was proposed to add the amount of moisture in pollen to the quality criterion [9]. Ecological factors, especially rainfalls, can also affect water content [2].

It is necessary to know the water content of pollen in order to determine the amount of protein content, lipids, sugars, minerals and other components in the dry matter. In the available literature, there is no information on the water content of mixed honey bee-collected pollen in Bulgaria.

MATERIALS AND METHODS

Pollen traps were placed in five bee hives and the pollen pellets were harvested every 2 days from April to September in the area of Belozem (42.201860, 25.049330), Bulgaria. Around 75 samples of the bee-collected pollen were collected. Every month has two reporting periods: I period from 1st to 15th day of the month and II period from 16th to 30/31st day of the month. The pollen loads of each hive were carefully mixed and a sample of 10% [10] was taken by the quarter method of sampling. First, the pollen was spread on paper and divided into four equal parts. Then two opposite diagonal quarters were removed. The remaining material was mixed and quartered until the sample was reduced to the desired size. The pollen samples were labelled and stored in separate vials in a freezer at -20°C.

The method of drying at 103°C was used for the determination of moisture content in the pollen samples. A quantity of 1g of pollen was accurately weighed in a porcelain-evaporating dish and was placed at 103°C in a oven, for 2.5 hours.

The water content was estimated as the difference in weight of the dried samples before and after introduction into the drying oven.

$$\text{Water \%} = \frac{M - M_1}{M - M_2} \times 100$$

M- dish and sample weight (g)

M₁- mass weight with sample after drying (g)

M₂- weight before adding the sample analysed (g)

RESULTS AND DISCUSSION

According to the analysis, a table with the water content of mixed honey bee-collected pollen has been compiled (Table 1). The study results showed that the water content of the mixed pollen varied for the two reporting periods of each month and for each single month (Table 1). The percentage of water content in the mixed bee-collected pollen samples

ranged between 12.3% and 26.6% and the average was 18.8%. Pollen from different harvesting periods has different water content. There are also differences among the same months during three years. For 2012 the range was from 12.3% to 20.8%, the average value was 16.7%, for 2013 it varied from 16.8% to 26.6%, the average value was 20% and for 2014 it was from 14.7% to 24.6%, the average value was 19.4%. The average value of water content for each year is also different. The statistical analysis (at $p \leq 0.05$, $p = 0.02$) of the results of the experimental work during the three years of research showed

significant difference to increase the water content of the pollen in 2013 and 2014 comparison to 2012. The increasing tendency probably came from the dynamic change of the ecological factors especially the rainfall. During 2013/2014 there were more rainy periods comparison to 2012 (Fig. 1, 2 and 3). Ecological factors, especially rainfalls, can also affect water content.

According to the results, can't be said during which season (spring, summer, autumn) the pollen has higher or lower water content.

Table 1. Water content (%) of mixed pollen in different harvesting periods for three years

Harvesting periods of pollen	2012	2013	2014
April 1-15		20.6	19.9
April 16-30	13.6	18.2	24.6
April (average value)	13.6	19.4	22.2
May 1-15	20.2	18	22.5
May 16-31	20.8	16.8	18.4
May (average value)	20.4	17.4	20.4
June 1-15	20.3	19.5	20.2
June 16-30	15.2	20.7	18.1
June (average value)	17.7	20.1	19.2
July 1-15	15.9	26.6	14.7
July 16-31	18.1	22	18.8
July (average value)	17	24.3	16.8
August 1-15	13.9	18.8	17.1
August 16-31	12.3	18.8	16.3
August (average value)	13.1	18.8	16.7
September 1-15	14.2	19.5	19
September 16-30	19.9	20.9	23.3
September (average value)	17.1	20.2	21.2
X for year	16.7	20	19.4

Pollen is the source of protein necessary for vital processes of the honey bees [11]. The determination of the water content in the pollen is used to reveal the remaining dry matter content and

to express the protein content, lipids, sugars, minerals and other components in the dry matter. The knowledge of the quality of the local pollen flora is very important for beekeeping.

Fig. 1. Climatic characteristics of Belozem area for 2012

Fig. 2. Climatic characteristics of Belozem area for 2013

Fig. 3. Climatic characteristics of Belozem area for 2014

CONCLUSIONS

The knowledge of the water content of pollen is important to determine the amount of protein content, lipids, sugars, minerals and other components in the dry matter. The percentage of water content in the mixed bee-collected pollen

samples ranged between 12.3% and 26.6% and the average was 18.8%. Pollen from different harvesting periods has different water content. There are also differences among the same months during three years. The average value of water content for each year is also different. According to the results, can't

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