

## ОЦЕНКА КАЧЕСТВА ПЕРГИ ПЧЕЛИНОЙ

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**Аннотация.** Определена необходимость оценки качества перги пчелиной. Этот продукт известен и используется многими цивилизациями уже на протяжении многих веков. Но, несмотря на это, в научной литературе недостаточно экспериментальных результатов и знаний об этом продукте пчеловодства. Поэтому в данной работе представляем модель оценки основных показателей качества перги пчелиной.

Важнейшими показателями качества считаем местность сбора перги, период сбора, технологию сбора, способ хранения, растительное происхождение, морфологические характеристики, основной химический состав, содержание тяжелых металлов, остатков пестицидов, присутствие микроорганизмов и другие. Необходимо, чтобы для каждого образца были оценены все показатели. Комплексная оценка позволяет определить экономическую ценность образца и его практическое применение. Многие научные работы ориентированы только в одном направлении, чтобы оценить только один показатель. Во время презентации модели были использованы собственные результаты и выводы из литературных источников.

**Ключевые слова:** перга, модель оценки, качество, показатели качества.

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### **POLLEN AND BEE POLLEN FEATURES OF SWEET CHESTNUT (CASTANEA SATIVA MILL.)**

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**Annotation.** The aim of this work was to study general morphological characteristics of pollen grains and bee pollen of sweet chestnut (*Castanea sativa* Mill.). The studies were carried on pollen extracted from genotypes,

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which are cultivated in M.M. Gryshko National Botanical Garden (Kyiv). Bee pollen was collected by selves. The polar axis and equatorial diameter of pollen grains values were varied from 12.58 to 24.39  $\mu\text{m}$  and 7.10  $\mu\text{m}$  and 13.92  $\mu\text{m}$ , respectively. Value of the form of pollen grains was ranged from 1.09 to 2.64  $\mu\text{m}$ . For the bee pollen the height in the range 2.01–3.91 mm and width in the range 1.42–3.19 mm were determined.

**Key words:** *Castanea sativa*, pollen, bee pollen, morphological traits.

Sweet chestnut (*Castanea sativa* Mill.) belongs to the Fagaceae Dumort. family, to the genus *Castanea* Mill. Sweet chestnut is considered a good honey plant. Chestnut honey is popular in Switzerland, France, Italy, Spain, Germany, Austria, the countries of the former Soviet Union and Yugoslavia [6].

Every year the sweet chestnuts' flowers have visited by bees, which prepare chestnut better, than linden. The honey is not so dense, almost isn't able to crystalized, has specific smell and bitter flavor. For the last reason some apiculturists don't use the sweet chestnuts. But it should pay attention that chestnut has high nectar production every year [3]. Honey from chestnut is quite suitable for winter bees feeding and has a great demand in the confectionery industry. This honey helps in the gastrointestinal and renal diseases, also has a positive effect on the vascular system, and strengthens the immunity [8]. In a lot of European countries it is very popular, for example, in France it is a main and most lovely kind of honey. Mixed chestnut and lime honey for taste is above than the pure linden honey.

Gulácsy (1975) investigated the nectar production of sweet chestnut in Hungary, in sunny weather, before the drying up of dew. She found that daily nectar weight was above 1 mg/flower, higher than previously reported abroad (0.02–0.09 mg/flower) by Kuliev (1952), but average sugar content was similar in the two studies (21.8% and 22.0%, respectively), ranging from 17.8% to 32.0%, and sugar value was between 0.3–0.5 mg [5]. The highest colony weight gain reported by Halmágyi (1966) was 8.3 kg. Counting 100 trees/ha, 54.4 kg nectar is produced, which corresponds to 27.20 kg honey, and 11.98 kg pure sugar [10].

Aim of our research was to determine the sizes of pollen grains and bee pollen.

**Material and methods.** Pollen grains of sweet chestnut, harvested in M.M. Gryshko National Botanical Garden of NAS of Ukraine (NBG), were used for the experiments. The pollen and bee pollen grains were studied at the Institute of Biodiversity and Biological Safety of Slovak Agricultural University in Nitra using an electron microscope Carl Zeiss LS 15. The measurement of morphometric parameters was carried out on 50 pollen and bee pollen grains using the AxioVision Rel. 4.8.2.0 program and was made in micrometer ( $\mu\text{m}$ ). The characterization of pollen grains was calculated by taking the following parameters: the polar axis (P – line connecting the proximal and distal pole), the equatorial axis (E – a line perpendicular to the polar axis and located in the equatorial plane).

**Results and discussion.** The pollen of *Castanea sativa* is small, prolate, with three ectoapertures (colpus) and three endoapertures (pores)

located at the equator [7]. The ectoapertures were slitted [2]. The exine is thin, and the surface is slightly reticulate [11]. Some authors characterize the pollen grain of chestnut such dimensions, as  $18.3 \times 12 \mu\text{m}$  [7], while others –  $19.6 \times 8.6 \mu\text{m}$  [9].

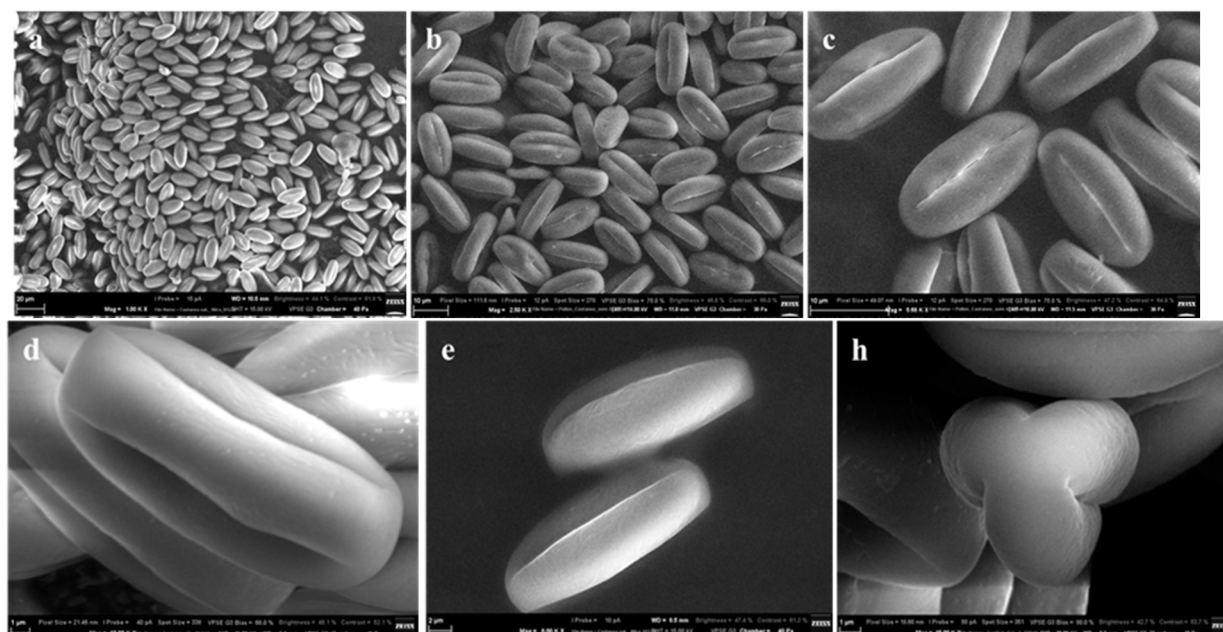
Accordingly to polleninfo.org database [12], pollen grains of *C. sativa* are characterized by following features – shape, in polar view, is circular or slightly triangular, side view is elliptical; their sizes: polar axis – 18.8 (14–16)  $\mu\text{m}$ , equatorial axis – 13.6 (13–14)  $\mu\text{m}$ ; apertures are trizonocolporate with narrow, acute colpi; pollen covering is thin, psilate exine. Intine faintly is thickened underneath the colpi.

Table 1 presented morphological characteristics of pollen grains.

### 1. Measurements of morphological traits of sweet chestnut (*Castanea sativa* Mill.) pollen grains

Shape	min	max	x	S <sub>x</sub>	V%	Literature data			
						Bentham, 1984	Mert & Soylu, 2007	Evrenosoglu & Misirli, 2009	Polleninfo, 2013
Polar axis, $\mu\text{m}$ (P)	12.58	24.39	20.76	2.03	9.79	15.0–20.0	13.33–21.30	16.25(11.3–18.3)	18.8 (14–16)
Equatorial axis, $\mu\text{m}$ (E)	7.10	13.92	10.61	0.99	9.39	10.0–13.0	12.46	8.15(6.5–9.2)	13.6 (13–14)
Shape of the pollen grain (P/E)	1.09	2.64	1.97	0.26	13.48	1.31–1.50	1.16	2.02(1.75–2.27)	1.38 (1.07–1.14)

n – number of measurements; min – the minimum value; max – the maximum value; x – arithmetic mean; v – coefficient of variation in %.



**Fig. 1. The shape of sweet chestnut (*Castanea sativa* Mill.) pollen grain (Photo: Ostrovsky, 2013): a, b, c – groups of pollen grains with different magnification; d, h – in polar projection; c, e – in equatorial projection (SEM)**

The results show that the average length of the polar axis was determined in the range 12.58–24.39  $\mu\text{m}$  and the variability of the length of the equatorial axis is 7.10–13.92  $\mu\text{m}$ . The shape index (ratio of polar length to equatorial length) has been determined within 1.09–2.64. The shape of pollen grains of sweet chestnut is presented in Figures 1.

Table 2 has presented morphological parameters of pollen grains.

## 2. Measurements of morphological traits of sweet chestnut (*Castanea sativa* Mill.) bee pollen (mm)

Morphological parameters	min	max	$\bar{x}$	$S_{\bar{x}}$	V, %
Height	2.01	3.91	2.76	0.42	15.38
Width	1.42	3.19	2.17	0.38	17.49

According to the table 2 and figure 2 were determined height (H) and width (W) of bee pollen, which are in the frame from H: 2.01 to 3.91 mm and W: 1.42–3.19 mm. Nowadays in references are absent the data about measurement of *C. sativa* bee pollen. So, these results can be useful in apicultural research and in creation of different data-bases, as a branch for complete characteristics of *C. sativa* pollen and bee pollen.



**Fig. 2. Variability of size and shape of bee pollen corbiculas of sweet chestnut (*Castanea sativa* Mill.) (lens Zeiss Discovery V12) (Photo: Oravec, 2015)**

### Conclusions

Notwithstanding the increased large-scale studies on pollination and bee floral preferences, detailed floral visits are the main evidence we can count on. Distinguishing between pollen and nectar visits may seem obvious, till this information is lacking in many studies and for many botanical species [1; 4]. In addition, this is not enough information about the sizes of *C. sativa* pollen grains and bee pollen. So, in our paper we tried to report the measurement of pollen grains and bee pollen. According to our measurements we got such results from *C. sativa* pollen grains – P  $20.76 \pm 2.03 \mu\text{m}$ , E  $10.61 \pm 0.99 \mu\text{m}$ , P/E  $1.97 \pm 0.26$  and from bee pollen – L  $2.76 \pm 0.42 \text{ mm}$ , W  $2.17 \pm 0.38 \text{ mm}$ .

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## ОСОБЛИВОСТІ ПИЛКУ І ПИЛКОВОГО ОБНІЖЖЯ З КАШТАНУ ЇСТІВНОГО (*CASTANEA SATIVA* MILL.)

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**Анотація.** Вивчено загальні морфологічні характеристики пилку і бджолиного обніжжя каштана їстівного (*Castanea sativa* Mill.). Досліджено пилки і обніжжя з різних генотипів, які вирощують в Національному ботанічному саду імені М. М. Гришка (м. Київ). Бджолине обніжжя збирали самостійно. Значення полярної осі та екваторіального діаметра пилкових зерен варіювали від 12,58 до 24,39 мкм і від 7,10 до 13,92 мкм, відповідно. Значення форми пилкового зерна становить від 1,09 до 2,64 мкм. Значення пилкової обніжжя перебувають в діапазонах: висота – 2,01–3,91 мм і ширина – 1,42–3,19 мм.

**Ключові слова:** *Castanea sativa*, пилки, пилкове обніжжя, морфологічні ознаки.

## ОСОБЕННОСТИ ПЫЛЬЦЫ И ПЫЛЬЦЕВОЙ ОБНОЖКИ КАШТАНА СЪЕДОБНОГО (*CASTANEA SATIVA* MILL.)

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**Аннотация.** Изучены общие морфологические характеристики пыльцы и пчелиной обножки каштана съедобного (*Castanea sativa* Mill.). Исследована пыльца и обножка с разных генотипов, которые выращивают в Национальном ботаническом саду имени Н. Н. Гришко (г. Киев). Пчелиную обножку собирали самостоятельно. Значения полярной оси и экваториального диаметра пыльцевых зерен варьировали от 12,58 до 24,39 мкм и от 7,10 до 13,92 мкм, соответственно. Значение формы пыльцевого зерна составляет от 1,09 до 2,64 мкм. Значения пыльцевой обножки пребывают в диапазонах: высота – 2,01–3,91 мм и ширина – 1,42–3,19 мм.

**Ключевые слова:** *Castanea sativa*, пыльца, пыльцевая обножка, морфологические признаки.