

COMPOSITION OF ROYAL JELLY AND DRONE BROOD AND ITS PHYSICO-CHEMICAL INDICATORS

Dmitriy Mitrofanov^{1*}, Natalya Budnikova¹

¹Federal State Budgetary scientific Institution «Federal Beekeeping Research Centre», Rybnoye, Russia

*Corresponding author: dima-mitrofanoff2012@yandex.ru

Abstract

The drone brood and royal jelly have both similarities and differences in the composition, physico-chemical parameters, the spectrum of biological activity. In this work, it is shown that in terms of indicators of antioxidant activity, the drone brood surpasses royal jelly, and the content of acidic components, on the contrary, royal jelly surpasses the drone brood. This is due to the possibility of expanding the spectrum of the biological activity of the composition of royal jelly and drone brood.

Key words: *royal jelly, drone brood, antioxidative potential, acidity*

Introduction

Drone brood is close to royal jelly in terms of mineral composition, protein content and reducing sugars, while in terms of the quantitative content of free decene acids it is significantly inferior to royal jelly, and surpasses it in terms of the content of hormonal components and sulfhydryl groups (Burmistrova, 1999).

The high content of sulfhydryl groups makes a significant contribution to the antioxidant properties of drone brood.

In drone brood, the content of sulfhydryl groups is 2-3 times higher than in royal jelly (Burmistrova, 1999, Lazaryan, 2003).

Comparative studies of preparations of royal jelly, drone brood, and queen larvae confirmed a significant difference in their chemical composition. Carbohydrate, lipid and protein components of royal jelly and drone brood were determined (Margaoan et al., 2017).

The cytoprotective effect of drone brood and royal jelly on alveolar macrophages after two-hour incubation in 1% solution of the test product was revealed. In drone brood solution, cell survival was 41.5% higher, and in royal jelly solution 58.2% higher than in the control. (Adilgozhina et al., 2017).

Royal jelly contributes to the preservation of glycogen in skeletal muscle during intense physical activity, while drone brood practically does not affect this indicator (Burmistrova, 1999). Royal jelly contains a specific 57 kDa protein - royalactin, which promotes ovarian development, increases body size and accelerates the development of individuals, which determines the development of queens from larvae. A similar effect is observed in fruit flies (Kamakura, 2011).

Due to the difference in the spectrum of biologically active substances and the effects of royal jelly, their combined use is possible. This necessitates the development of a product containing a

composition of royal jelly and drone brood, the search for the optimal technology of this product and the determination of its physicochemical parameters. This product will combine the properties of biologically active substances of royal jelly and drone brood.

The quality of native royal jelly is regulated by GOST 28888-2017, adsorbed - GOST 31767-2012, TR homogenate - GOST R 56668-2015, adsorbed - by enterprise standards.

Materials and methods

The material for the study was a homogenate of drone brood, native royal jelly, raw and dry adsorbed drone brood, raw and dry adsorbed product containing drone brood and royal jelly.

An approximate estimate of the total content of substances with antioxidant potential is given by the definition of the oxidizability index of the product. The method is based on the ability of potassium permanganate to be reduced in an acidic environment, while the solution becomes discolored. The oxidizability index for native and adsorbed royal jelly is no more than 10 s, for drone brood homogenate no more than 16 s. Another way to determine unsaturated and other substances with antioxidant potential is to determine the iodine number. The method is based on the ability of iodine to bind with unsaturated compounds, followed by titration of excess iodine with sodium thiosulfate solution. The iodine number is regulated for wax, but not for other beekeeping products. Drone brood contains substances that give it a slightly acidic reaction. These substances are contained both in the fresh brood (free decenic acids, phenolic compounds) and are formed from unsaturated compounds during their reaction with atmospheric oxygen during processing and storage. The hydrogen index of drone brood is quite constant and is no less than 5.8, while in native and adsorbed royal jelly it is in the range of 3.5-4.5. Thus, in terms of the pH value, royal jelly and drone brood differ significantly, the royal jelly has a much more acidic reaction, which is determined both instrumentally and organoleptically. Free acidity is determined by potentiometric titration to pH 8.3. The acid number is determined by titration in an alcohol-ether medium to an alkaline reaction with phenolphthalein. Among beekeeping products, free acidity is normalized for honey, and acid number for wax.

Results and discussion

Raw drone brood adsorbed with royal jelly is a homogeneous light-colored mass with organoleptic properties typical of drone brood and royal jelly.

Dry drone brood adsorbed with royal jelly are elongated light-colored granules with organoleptic properties characteristic of drone brood and royal jelly. The highest pH value was observed in the native homogenate of drone brood and amounted to 6.24, slightly lower than the values in the raw and dry adsorbed drone brood (5.67 and 5.56, respectively). The lowest pH value was observed in native royal jelly (4.02), close to it were the values of raw and dry adsorbed product containing royal jelly and drone brood (4.92 and 4.72, respectively). The highest value of free acidity was noted in native royal jelly (592 mEq / kg), slightly less - in homogenate of drone brood (364 mEq / kg). Significantly lower free acidity of raw and dry drone brood (28.2 and 31.8 mEq / kg, respectively) and drone brood with royal jelly (raw - 32.1, dry - 35.3 mEq / kg). The highest value of the acid number is characteristic of native royal jelly (22.3 mg / g), the homogenate of drone

brood is almost twice as low (13.6 mg / g). The acid number of both raw adsorbed drone brood and raw adsorbed drone brood with royal jelly (3.91 mg / g and 4.57 mg / g) exceeds that for dry products (1.23 and 1.52 mg / g, respectively). Moreover, products containing royal jelly have a slightly higher acid number (Fig. 1).

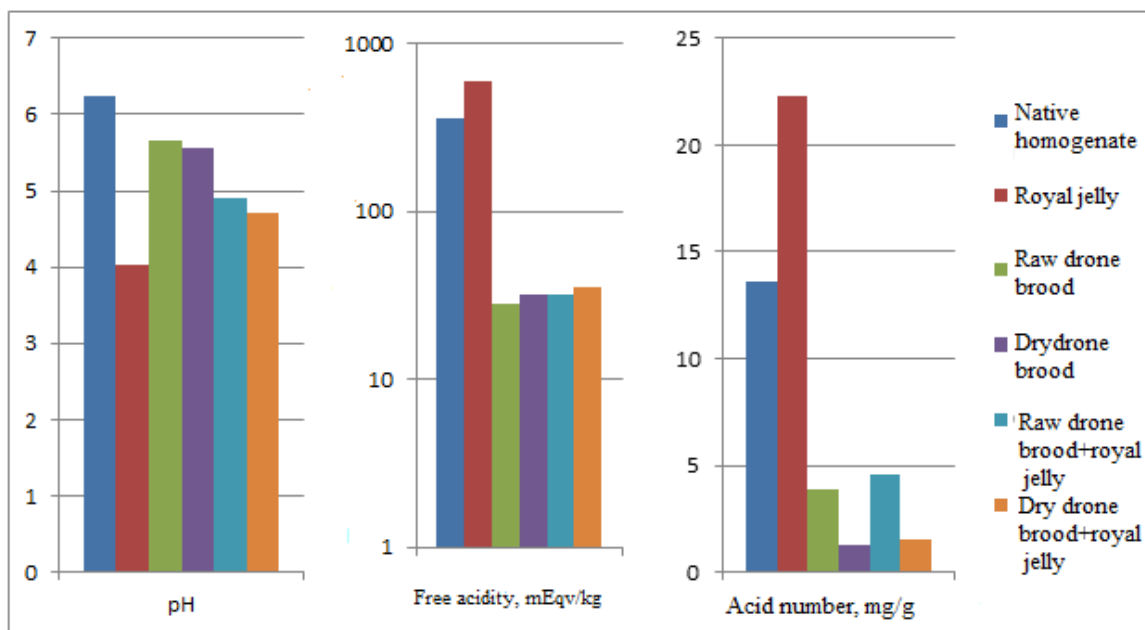


Figure 1. Hydrogen index, free acidity and acid number of drone brood and compositions of drone brood and royal jelly.

The highest value of the oxidizability index was noted in the native royal jelly (5 s), in the native homogenate and dry adsorbed drone brood, the oxidizability index was 4 s, in the raw drone brood, raw and dry drone brood with royal jelly - 2 s. Thus, the compositions of royal jelly and drone brood show intermediate pH values between the values of drone brood and royal jelly. The free acidity of adsorbed products is much lower than that of native products, which can be explained by the presence of an adsorbent. The acid number has maximum values for native products, somewhat lower for raw adsorbed products, and even lower for dry products.

The highest oxidizability index (5 s) was observed in native royal jelly. Slightly less - for homogenate and dry adsorbed drone brood - 4 s. The lowest oxidizability index was observed in the raw adsorbed drone brood and products containing royal jelly and was 2 sec. The highest iodine number was observed in the homogenate of drone brood - 8.12 g / 100g, slightly less - in native royal jelly - 6.6 g / 100g. The raw product with the addition of royal jelly is somewhat inferior to the raw adsorbed drone brood (1.27 g / 100g and 1.57 g / 100g, respectively). Dry adsorbed products have the same iodine value (0.51 g / 100g, respectively) (Fig. 2).

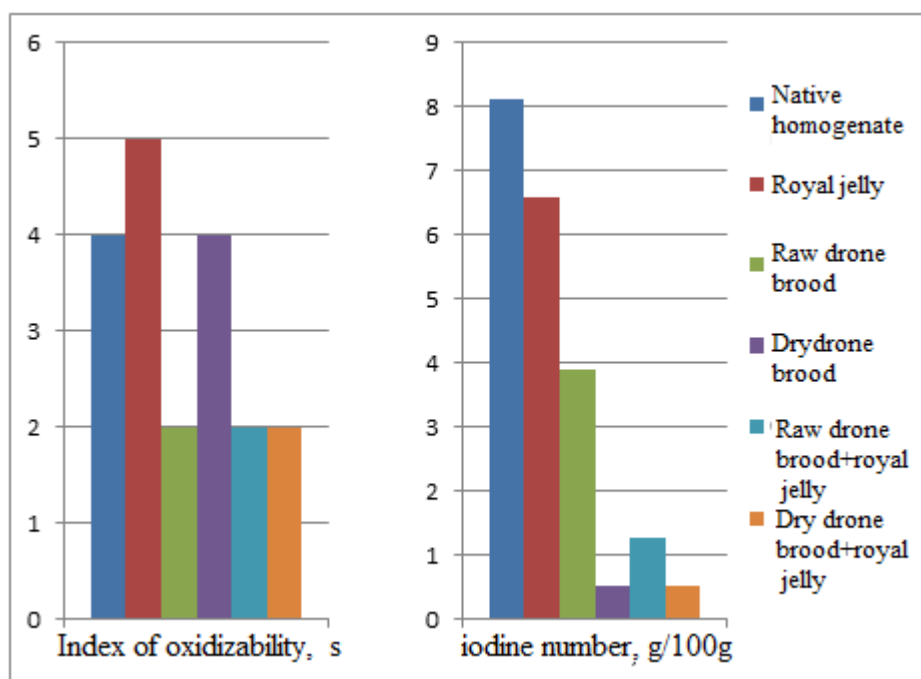


Figure 2. Index of oxidizability and iodine number of drone brood and composition of drone brood and royal jelly.

Conclusions

Thus, in terms of antioxidant activity, drone brood is superior to royal jelly, and in terms of acidity, royal jelly is superior to drone brood. Products containing a composition of drone brood and royal jelly combine the properties of drone brood and royal jelly.

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