



IIZE BARENE, IRENA DABERTE, VIJA ENINA, SANITA SIKSNA, VILHELMINE IRISTE
Riga Stradins University, Latvia

INTRODUCTION

Bee bread (carobread) is fermented and naturally preserved pollen. It contains about 50 different compounds: proteins, amino acids, carbohydrates, vitamins (C, B₁, B₂, pantoic acid, folic acid, biotin, B₆, P, PP, carotenoids, flavonoids, phenolic acids, enzymes, phyto-hormones, growth-stimulators, macro- and micro-elements, etc. (see Tab. 1). Bee bread normalizes metabolism, has a positive influence on liver, nervous and endocrine systems functions and enhances regeneration of tissues, physical and mental persistence of a human body [1].

GOAL

The goal of the work was to investigate microscopic, physical and chemical properties of bee bread collected in three regions of Latvia in order to compare the quality of bee bread samples.

MATERIALS AND METHODS

Three samples of bee bread were used which had been collected by bee masters in Ruzemne, Lalgale and Vitbene. Microscopic analysis was made for each sample prepared in a drop of glycerol solution in water with optical microscopic magnification 10x-60. In order to identify from what plants pollen were collected there was used plant herbaria, special literature and internet sources [2].

This layer chromatography (TLC) was used for the identification of carotenoids and flavonoids [3]. For gel were used as stationary phase: M446 phase, solvent systems for the identification of carotenoids were A, betanone-ethyl acetate 77:23 and ethyl acetate: ethanol (90:10) for the identification of flavonoids: toluene-ethyl acetate: 90:8:formic acid:6:1:0.5.

The absorption, pH of 2% water solution, loss on drying [3] and content of carotenes were estimated. The content of carotenes was assessed by visible absorption spectrophotometry at the wavelengths: 450 nm [4], 48.

Long term and accelerated stability studies were carried out at 25°C, 30°C, 35°C, 40°C and 45°C for 45 months. The samples were packed into brown glass containers with polymer caps.

RESULTS

Microscopic analysis showed that all samples of bee bread contain native and destructed pollen grains with damaged covers. The most part was identified as willow pollen. There were also pollen of dandelion, horse-chestnut, fireweed and birch in them (Fig. 1).

1-carotene was identified and 2-carotenoids were found by TLC in two systems of solvents in day light (see Tab. 2). Two zones of flavonoids were found on chromatograms at day light + zones at UV light. After treatment with ammonia 2-zones were found at day light and 3-zones at UV light (see Tab. 3).

The quality of bee bread samples collected in three regions of Latvia has been shown in Tab. 4, Fig. 2. After storage at 30°C and after storage at 40°C especially all samples of bee bread became darker and softer, the content of carotene increased, but the content of carotenes did not change significantly (see Tab. 5, 6).

Fig. 1. Pollen in bee bread complex optical microscopy (10x-60).

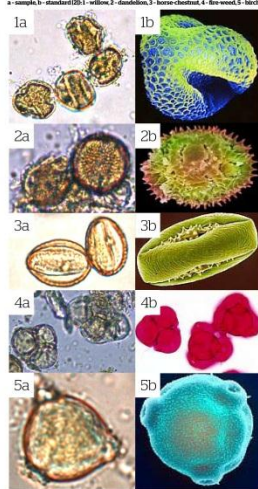


Fig. 2. Appearance of bee bread sample



Table 1. Comparison of the chemical composition of pollen and bee bread by J. Svoboda [5]

Component	Pollen	Bee bread
Proteins	24.06%	20.00-21.70%
Fats	3.33%	0.67-1.58%
Carbohydrates	38.50%	23.40-34.60%
Lactic acid	0.56%	3.06-3.20%
pH	6.3	4.3

Table 2. Identification of carotenoids in bee bread by TLC method

Solvent system	Ratio (V/V)	Colour of the zone (in day light)	R _F of 1st zone	R _F of 2nd zone	R _F of 3rd zone	R _F of 4th zone
Betanon-ethyl acetate	77:23	orange-yellow	0.16x0.18	0.34x0.40	-	-
Ethylacetate-ethanol	90:10	orange-yellow	0.16x0.18	0.34x0.40	-	-

Table 3. Identification of flavonoids in bee bread by TLC method

Solvent system	Ratio (V/V)	Colour of the zone (in day light)	Colour of the zone (under UV light)	R _F of 1st zone	R _F of 2nd zone	R _F of 3rd zone
Betanon-ethyl acetate	77:23	light violet	fluorescence	0.16x0.18	0.34x0.40	0.48x0.52
Ethylacetate-ethanol	90:10	light violet	fluorescence	0.16x0.18	0.34x0.40	0.48x0.52

Table 4. Quality indices of bee bread samples for comparing

Parameter	Bee bread from Lalgale	Bee bread from Ruzemne	Bee bread from Vitbene
Appearance colour index table	Soft grain of brown color with weak specific odour	Hard grain of light brown color with weak specific odour	Hard grain of light brown color with weak specific odour
Loss on drying (% (mean ± SD), n=3)	3.58±0.03	4.25±0.03	4.08±0.03
Content of carotenes by production (% (mean ± SD), n=3)	0.107±0.006	0.08±0.003	0.07±0.002
Content of carotenes by production (% (mean ± SD), n=3)	0.77±0.04	0.72±0.14	0.58±0.16

Table 5. Quality indices of bee bread samples after storage at 30°C temperature

Parameter	Bee bread from Lalgale	Bee bread from Ruzemne	Bee bread from Vitbene
Appearance colour index table	Soft grain of dark brown color with weak specific odour	Hard grain of dark brown color with weak specific odour	Hard grain of brown color with weak specific odour
Loss on drying (% (mean ± SD), n=3)	0.55±0.03	0.59±0.03	0.54±0.05
Content of carotenes by production (% (mean ± SD), n=3)	0.67±0.029	0.60±0.035	0.58±0.027

Table 6. Quality indices of bee bread samples after storage at 40°C temperature

Parameter	Bee bread from Lalgale	Bee bread from Ruzemne	Bee bread from Vitbene
Appearance colour index table	Very soft grain of dark brown color with weak specific odour	Soft grain of dark brown color with weak specific odour	Soft grain of brown color with weak specific odour
Loss on drying (% (mean ± SD), n=3)	0.45±0.05	0.38±0.05	0.58±0.03
Content of carotenes by production (% (mean ± SD), n=3)	0.65±0.016	0.63±0.019	0.56±0.012

CONCLUSION

1. Bee bread contains mostly native pollen. The pollen of willow can be considered as an indicator of the origin of bee bread in Latvia.
2. Bee bread contains carotenoids and flavonoids identified by TLC.
3. Bee bread samples of the three regions of Latvia have insignificant differences in physical and chemical parameters.
4. Stability study shows greater changes after storage at 40°C temperature.

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