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THE INFLUENCE OF THE BOTANIC ORIGIN OF HONEY PLANTS ON THE QUALITY OF HONEY

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SUMMARY

Numerous parameters affect the quality of honey from different beehive types (Albert – Žindaršić AŽ, Langstroth – Roott LR i Dadant – Blatt DB), i.e. the material of beehives are made of, the origin of queen bees (natural and selected), etc. Our research focuses on the influence of the botanic origin of honey plants (*Tilia sp. L.* ***(lime),*** *Amorpha fructirosa L.* ***(desert false indigo),*** *Helianthus annuus L.* ***(sunflower),*** *Brassica napus subsp. olifera DC.* ***(oil beet) and*** *Robina pseudoacacia L.* ***(acacia)) on the quality of honey. The physical and chemical analyses of honey (N=133) (water %, water insoluble compounds %, acidity level, mmol of acid per kg, electrical conductivity, mS/cm, reducing sugar %, sucrose %, HMF, mg/kg, and diastasic number) were conducted by Harmonised methods of the European Honey. The pollen analysis was conducted by Harmonised methods of melissopalynology.***
The pollen analysis indicates that the botanic origin has had a statistically significant influence (P<0.001) on the quality of all investigated characteristics of honey, except on the share of the non–dissolving substances (P=0.088). The research was conducted in the Vukovar-Srijem County, the Republic of Croatia. All bees used in this research belong to the Carniolan honey bee (Apis mellifera carnica), the European bee species.

Key-words: botanic origin, honey, pollen grains

INTRODUCTION

The botanic origin of honey is one of the most important parameters of honey quality (Tucak et al. 1998, 2000, 2004). The quality of honey depends on the melliferous plants that bees use in their nourishment. The honey obtained from different melliferous plants has different characteristics and applications, both in medicine and in food industry.

MATERIALS AND METHODS

We examined the botanic origin of 136 honey samples obtained from different melliferous plants (lime, desert false indigo, sunflower, oil beet and acacia) and collected from beehives (Albert-Žnideršić, AŽ, Dadant-Blatt, DB, Langstroth-Root, LR) made of three different wood types (fir, poplar, lime). The queen bees used in the research were of different origin (natural and selected). The physical and chemical characteristics of honey (water %, water insolubles %, acidity level, mmol of acid per kg, electrical conductivity, mS/cm, reducing sugar %, sucrose %, HMF, mg/kg and diastasic number) were determined using the Harmonised methods of the European Honey (Bogdanov et al., 1997), and the pollen analysis was conducted by Harmonised methods of melissopalynology (Von der Ohe et al., 2004).
The research was carried out in the Vukovar-Srijem County, the Republic of Croatia. All bees used in this research belong to Carniolan honey bee species *(Apis mellifera carnica*), the European bee species. The SAS/STAT package was used for the statistical analysis (SAS Institute Inc., 2000). The research results have been presented in the tables. The following statistical parameters have been shown: mean ($\bar{x}$), standard deviation (s), standard deviation of the mean (s$\bar{x}$). The significance of the differences among the groups was determined by Duncan test.

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RESULTS AND DISCUSSION

Table 1. The parameters of the honey quality of the honey types of all tested samples (n=133)

Quality label	Statistical Traits	Honey types determined by the pollen analysis					P value
		Lime (n=12)	Desert false indigo (n=15)	Sunflower (n=28)	Oil beet (n=37)	Acacia (n=41)	
Pollen, %	$\bar{x}$	36.47^{c}	50.46^{b}	60.73^{a}	61.58^{a}	31.22^{d}	<0.001
	s	6.17	2.37	10.50	10.70	3.64	
	$s_{\bar{x}}$	1.59	0.66	1.92	1.76	0.57	
Water, %	$\bar{x}$	17.11^{ab}	17.26^{a}	17.22^{a}	16.15^{c}	16.76^{b}	<0.001
	s	1.32	0.82	1.65	0.91	0.84	
	$s_{\bar{x}}$	0.34	0.23	0.30	0.15	0.13	
Water insoluble compounds, %	$\bar{x}$	0.024^{a}	0.015^{a}	0.017^{a}	0.022^{a}	0.015^{a}	0.088
	s	0.025	0.010	0.027	0.019	0.020	
	$s_{\bar{x}}$	0.006	0.002	0.005	0.003	0.003	
Acidity level, mmol of acid per kg	$\bar{x}$	18.49^{c}	21.02^{b}	22.84^{a}	18.50^{c}	11.14^{d}	<0.001
	s	6.18	4.36	3.91	3.64	1.71	
	$s_{\bar{x}}$	1.60	1.21	0.71	0.60	0.27	
Electrical conductivity, mS/cm	$\bar{x}$	0.285^{a}	0.251^{c}	0.269^{b}	0.210^{d}	0.141^{e}	<0.001
	s	0.025	0.051	0.031	0.038	0.024	
	$s_{\bar{x}}$	0.006	0.014	0.005	0.006	0.003	
Reducing sugar, %	$\bar{x}$	75.74^{c}	76.28^{c}	77.92^{a}	79.12^{a}	75.26^{c}	<0.001
	s	1.78	1.10	3.89	2.54	2.46	
	$s_{\bar{x}}$	0.46	0.31	0.71	0.42	0.38	
Sucrose, %	$\bar{x}$	2.16	1.77	1.73	2.29	3.02	<0.001
	s	1.10	0.55	1.12	2.17	1.05	
	$s_{\bar{x}}$	0.28	0.15	0.20	0.36	0.16	
Diastasic number	$\bar{x}$	14.43^{a}	12.45^{a}	12.99^{a}	21.57^{b}	16.67^{a}	<0.001
	s	4.99	2.87	6.29	5.78	7.99	
	$s_{\bar{x}}$	1.44	0.74	1.19	0.95	1.25	
HMF, mg/kg	$\bar{x}$	3.40^{b}	2.69^{cd}	2.30^{cd}	4.25^{a}	3.91^{ab}	<0.001
	s	4.42	1.34	1.43	1.21	1.45	
	$s_{\bar{x}}$	1.14	0.37	0.26	0.20	0.22	

$^{a, b, c, d}$ $P < 0.05$

All tested types of honey (*Tilia sp. L.* (lime)**,** *Amorpha fructirosa L.* (desert false indigo), *Helianthus annuus L.* (sunflower), *Brassica napus subsp. olifera DC***.** (oil beet) and *Robina pseudoacacia L.* (acacia)) met the criteria of the Regulations on the quality of honey and other bee products. The AŽ beehives had the greatest influence on quality parameters of lime and desert false indigo, and the DB type on the same quality parameters of oil beet, acacia and sunflower. The material beehives are made of and the type of queen bees did not have a significant influence on the quality of honey. Research results indicate that different beehive types, origin of queen bees, and the material beehives are made of have an influence of the development of bee diseases and the quality of honey.

The botanic origin of honey has a significant effect of the physical and chemical honey characteristics, which has also been shown in the former research.

In our research water in lime (*Tilia sp. L.)* was found to be 17.11, compared to Bogdanov (14.6-17.6) (Bogdanov et al., 1999), desert false indigo *(Amorpha fructirosa L.)* was 17.26, sunflower (*Helianthus annuus L.)* was 17.22, compared to Mandić (14.8-19.9) (Mandić et al., 2003), Devillers (18.9) (Devillers et al., 2004), oil beet (*Brassica napus subsp. olifera DC.)* was 16.15, compared to Devillers (18.19), acacia *(Robina pseudoacacia L.)* was 16.76, compared to Mandić (13.8-19.2), Kenjerić (14,0-23.8) (Kenjerić et al., 2004), Bogdanov (14.2-19.0), Devillers (18,48).
In our research acidity level in lime (*Tilia sp. L.)* was 18.49, compared to Popek (2,14) (Popek et al., 2002), Piazza (24.2-30.9) (Piazza et al., 2004), desert false indigo *(Amorpha fructirosa L.)* was 21.02, sunflower (*Helianthus annuus L.)* 22.84, compared to Mandić (13.9-34.4), Devillers (14.23-26.59), Piazza (22.2-29.9); oil beet (*Brassica napus subsp. olifera DC.)* was 18,50, compared to Popek (1.48), Piazza (14.9-23.9), Devillers (6.51-12.30), acacia *(Robina pseudoacacia L.)*was 11.14, compared to Mandić (5.7-18.6), Devellers (6.3-11.36), Popek (1,38), Piazza (8.4-14.3).
In our research, electrical conductivity in lime (*Tilia sp. L.)* was 0.285, compared to Bogdanov (0.,33-1.15), Piazza (0.29-0.81), desert false indigo *(Amorpha fructirosa L.)* was 0.251, sunflower (*Helianthus annuus L.)* was 0.269, compared to Mandić (0.25-0.52), Bogdanov (0.20-0.60), Piazza (1.19-1.50), oil beet (*Brassica napus subsp. olifera DC.)* was 0.210, compared to Bogdanov (0.09-0.27), Piazza (0.14-0.34), acacia *(Robina pseudoacacia L.)* was; 0.141, compared to Mandić (0.09-0.27), Kenjerić (0.092-0.271), Bogdanov (0.09-0.30), Piazza (0.14-0.19).
In our research reducing sugar in lime (*Tilia sp. L.)* was 75.4, compared to Bogdanov (54.7-79.3), Piazza (68.7-73.5), desert false indigo *(Amorpha fructirosa L.)* was 76.28, sunflower (*Helianthus annuus L.)* was 77.92, compared to Bogdanov (68.7-84.8), Piazza (75.8-76.8), Mandić (73.0-80.7), oil beet (*Brassica napus subsp. olifera DC.)* was 79.12, compared to Bogdanov (68.2-83.9), Piazza (70.2-76.1), acacia *(Robina pseudoacacia L.)* was 75.26, compared to Bogdanov (60.6-83.8), Piazza (69.0-79.9), Mandić (67.5-77.5).
In our research sucrose in lime (*Tilia sp. L.)* was 2.16, compared to Popek (0.71), desert false indigo *(Amorpha fructirosa L.)* was 1.77, sunflower (*Helianthus annuus L.)* was 1.73, Devillers (0.227), Mandić (0.6-4.5), oil beet (*Brassica napus subsp. olifera DC.)* was 2.29, compared to Popek (0.99), acacia *(Robina pseudoacacia L.)* was 3.02, compared to Popek (6.13), Devillers (2.049), Mandić (0.5-0.95).
In our research HMF in lime was 3.40, desert false indigo *(Amorpha fructirosa L.)* was 23.69, sunflower (*Helianthus annuus L.)* was 2.30, compared to Devillers (0.2-9.5), Mandić (0.0-6.5), oil beet (*Brassica napus subsp. olifera DC.)* was 4.25, compared to Devillers (0.2-5.9), acacia *(Robina pseudoacacia L.)* was 3.91, compared to Devillers (0.5-5.9), Mandić (0.0-14.2).

CONCLUSION

The botanic origin has statistically very high influence ($P<0.001$) on the quality of honey and all its investigated characteristics (physical and chemical), except on the share of the non-dissolving substances ($P=0.088$).
All tested types of honey (*Tilia sp. L.* (lime)**,** *Amorpha fructirosa L.* (desert false indigo), *Helianthus annuus L.* (sunflower), *Brassica napus subsp. olifera DC***.** (oil beet) and *Robina pseudoacacia L.* (acacia)) met the criteria of the Regulations on the quality of honey and other bee products.
The AŽ beehives had the greatest influence on quality parameters of lime and desert false indigo, and the DB type on the same quality parameters of oil beet, acacia and sunflower.
The material beehives are made of and the type of queen bees did not have a significant influence on the quality of honey.
The research results indicate that different beehive types, origin of queen bees, and the material beehives are made of have an influence on the development of bee diseases and the quality of honey.

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