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EVALUATION OF UTILITY AND BIOLOGICAL TRAITS OF A CARNIOLAN HONEYBEE LINE

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ABSTRACT

The aim of the study was to analyze the functional and biological characteristics of the Carniolian breed of the Bielka 1 line. The research material consisted of queens subjected to stationary evaluation in ten consecutive feed seasons (2009–2018). The analysis covered such features as: honey yield, winter hardiness, spring development, swarming behavior and the behavior of bees indicating their mildness or malignancy. A statistically significant or highly significant influence of the year of evaluation was found on all the analyzed functional traits of the Bielka 1 line Carniolian bees. The bees of this line were characterized by a very good honey yield. There were positive and significant correlations between this feature and the others. No significant relationships were observed between the behavior of the Bielka 1 bees and their tendency to swarm and spring development. The bees were characterized by good winter hardiness, creating strong colonies and dynamic spring development. The good qualities of the bee colonies of this line are calm and gentleness. Moreover, they are characterized by low swarming behavior and usually received maximum scores for this feature. The Bielka 1 line can be useful in large apiaries focused on intensive production, but also in home, amateur apiaries.

Key words: Carniolan bee, Bielka 1 line, utility traits

INTRODUCTION

One of the stages of the properly conducted breeding work in an apiary, and an extremely important one, is an on-site evaluation of bees, connected with a field reconnaissance. According to Wilde [2008], the apiarist who aims to breed superior honeybees should constantly compare the utility value of families derived from many queens, as this enables proper selection of bees used for reproduction. As the mothers from breeding apiaries go to different places varying in terms of environmental conditions, each beekeeper chooses the breeding material that turns out to be the best in a given area. Good breeding material are bees with a high breeding and utility value, which is measured with the production of honey, pollen, wax, royal jelly, propolis and venom. The products obtained are not the only indicators of the utility value of the bees. Other traits, which impact the profiTablelity and the comfort of working int the bee yard, are equally important. These include a mild vs. malignant character of the bees, swarming ability, winter hardiness and family growth potential. Mild bees make the work easy and allow locating the apiary near human settlements. Aggressive bees, on the other hand, are more productive [Gontarz 2007].

The honey harvest is the prime production feature which determines the utility value of the colony. A strong family in favorable conditions (abundance of forage) demonstrates its full productivity. Assessing the honey yield, the beekeeper must take into account winter stores, the amount of honey harvested from the bees and the amount of honey left for the winter. This can be done after the harvest season or in the spring of the following year [Gontarz 2007]. The production of honey is influenced by the diligence and longevity of workers, the abundance of brood, and environmental factors such as weather and honey flow [Gerula 2004]. Atmospheric conditions are particularly important here: too high temperature adversely affects the honey yield [Afik and Shafir 2007, Blazyte-Cereskiene et al. 2010]. Other features of

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secondary importance for the production are taken into account for reasons of operations, and are assessed on a 3–4 point scale. These are: the gentleness of bees, non-swarming behavior, the rate and intensity of brood production, and winter hardiness.

Apart from environmental factors, the utility value of bees is influenced by their genotype. Due to the specific reproduction, caste structure of a bee colony and the overlapping of generations, learning about the inheritance processes of the traits is extremely difficult [Paleolog 1996]. For some functional traits, heriTablelity coefficients have been estimated. As reported by Prabucki [1998], the indices are low and for honey yield, for example, the heritability is 0.23.

The aim of the study was to analyze the utility and biological characteristics of the Bielka 1 line of the Carniolan bee. Based on the on-site evaluation, the following characteristics were analyzed: honey yield, winter hardiness, spring development, swarming behavior and the behavior of bees indicating their mildness or malignancy.

MATERIAL AND METHODS

The research material consisted of bee queens from the breeding apiary located in the Mazowieckie Voivodeship and subjected to on-site assessment in ten consecutive honey flow seasons (2009–2018). The bees were kept in Wielkopolska hives, with a frame size of 360×260 mm. The queens were artificially inseminated with semen from drones of the same breed and line, coming from the same apiary. The bees belonged to the Carniolan breed, the Bielka 1 line. This line was derived from the Bielka line, which is in turn the result of crossing within the Carniolan breed [KCHZ 2007].

In total, 663 queen bees were studied. The queens were marked in accordance with currently applicable regulations [Journal of Laws 2017]. The following utility characteristics were analyzed: honeyiness, spring development and winter hardiness.

Honey yield was assessed on the basis of the number of kilograms of centrifuged commercial honey. The honey was centrifuged 2 or 3 times, depending on the year of evaluation.

The spring development of bees was determined by the number of combs inhabited by bees and the number of combs with brood. In both cases, the measurements were made on two dates: the first, during the apple-tree blossom (April/May), and the second, about 3 weeks thereafter.

The number of plasters left for the winter (6 or 7, depending on the year) and after the first spring inspection (the need to reduce the number of plasters after winter or to add them) spoke about the winter hardiness of the family. On this basis, this feature was scored in accordance with the principles of bees performance evaluation (Table 1) [Journal of Laws 2017, KCHZ 2019].

The analysis also covers the tendency of bees to swarm as well as their behavior that indicate a mild or aggressive character. Both these features were assessed according to a 4-point scale (Table 1) based on the observation of swarming mood symptoms, response to anti-swarming measures, or swarm departure – for the swarming trait and diligent observation in various situations (e.g. during honeyflow, during reviews) – for the behavior of bees [Journal of Laws 2017, KCHZ 2019].

Statistical analyzes were performed for each traits. Arithmetic means and standard deviations were calculated and Pearson's linear correlation coefficients were estimated. Based on a fixed mathematical model, an analysis of variance was performed to test the effect significance of the year of assessment:

$$Y_{ij} = \mu + a_i + e_{ij}$$

Table 1. Scoring of selected utility traits of bees

Tabela 1. Punktowa ocena wybranych cech użytkowych pszczół

Points Punkty	Trait – Cecha		
	Winter hardiness Zimotrwałość	Swarming disposition Rojliwość	Behavior Zachowanie
4	good dobra	no swarming mood brak nastroju rojowego	very timid bardzo łagodne
3	medium przeciętna	quick response to anti-swarming treatments szybka reakcja na zabiegi przeciwrojowe	timid łagodne
2	poor zła	slow response to anti-swarming treatments wolna reakcja na zabiegi przeciwrojowe	agressive złośliwe
1	disqualifying dyskwalifikująca	negative response to anti-swarming treatments negatywna reakcja na zabiegi przeciwrojowe	very agressive bardzo złośliwe

Source: KCHZ [2019].
Źródło: KCHZ [2019].

where:

Y_{ij} – trait level,
μ – population mean,
a_i – effect of year,
e_{ij} – random error.

The calculations were made using the statistical software package STATISTICA [Statsoft 2009].

RESULTS AND DISCUSSION

In the studied period, the honey yield of the Carniolan Bielka 1 line was on average 20.15 kg of honey in the range from 1.5 to 49.5 kg of honey per colony (Table 2). The highest honey yield was recorded in 2015, on average 38.71 kg, and the lowest in 2009, on average 9.82 kg per bee colony. Within 6 years, the honey yield of the Carniolan Bielka 1 bees increased almost 4 times. From 2011 to 2015, there was an upward trend in the amount of obtained honey. The years 2016–2017 were marked by a decrease in productivity, followed by a significant increase in the amount of honey obtained from bees. It has been shown that the differences in honey production between the studied years are statistically highly significant (Table 2). Also other authors [Gontarz 2007, Roman et al. 2014, Majewski 2015] found that the year of evaluation has a highly significant influence on the production of honey.

The effect of the calendar year on the volume of honey production should be also understood as the impact of weather conditions, or rather its variability in individual honeyflow seasons (years) and the availability of the forage for honey production (forage base). Majewski [2015] showed in his research that the productivity of bee colonies depended on the geographical location of the apiary. The results he reports indicate that the highest efficiency was recorded in the Lower Silesia Region. Significantly higher honey yields were found in apiaries located in the Masovia and West Pomeranian voivodeships, as compared with the Lubelskie, Podlaskie and Pomorskie voivodeships.

Honey production depends on the strength of the family [Bhusal and Thapa 2006, Gąbka 2014]. Eckert et al. [1994] showed that worker bees from strong families work more efficiently than those from weak, low-potential families. The amount of brood, i.e. the reproductive ability of the queen bee, reflects the resulting strength and might of the colony [Gontarz 2007]. The strength of the family grows with the increase in brood [Gąbka 2014, Gąbka 2018].

The greatest numbers of brood in the Carniolan bee of the Bielka 1 line was found in 2014, and the lowest a year earlier. In each year of the assessment, during the second brood measurement, two or three times more brood was counted compared to the first measurement (Table 3). This proves the intensity and speed of spring development of these bees. A fast rate of the family's attaining the appropriate strength is important from the point of view of honey yield, since the effective use of the forage base depends on the strength of the family [Bieńkowska 2004].

As the change in the weather conditions in our country has been observed for a long time, the time and speed of development of a bee colony are of highest importance. The climate now causes a shift in blooming seasons – early-spring plants bloom later and late-spring ones bloom earlier. Therefore, the vast majority of honeyflows bloom at the same time, thus their effective use is a challenge for bees. Only strong families that reach their peak of development early are able to cope with this task [Sparks et al. 2010, Roman et al. 2014]. The Carniolan breed is such a group of bees [Gromisz 1995].

Counts of bees and brood give an overall picture of the development of a colony. The statistical analysis of the numbers (Table 3) shows that there was an increase in their number over the three weeks between the first and the second count in all the years of the analysis. In both counts, the largest numbers of bees, as well as brood, were found in the sixth year of the study, and the lowest in the fifth year (Table 3).

Table 4 presents the statistical description of the spring development evaluation of the Carniolan Bielka 1

Table 2. Honey yield of Carniolan Bielka 1 line bees in 2009–2018

Tabela 2. Wydajność miodowa pszczół rasy kraińskiej linii Bielka 1 w latach 2009–2018

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
Min.	1.5	2.5	1.5	6.2	4.5	2.5	23	6	6	27	80.7
Max.	27	29	29.2	19	37.5	34.7	49.5	32	27.5	37	322.4
$\bar{x}$	9.82^{A}	15.08^{BC}	13.37^{B}	14.83^{B}	17.59^{CD}	19.41^{DE}	38.71^{G}	20.72^{E}	19.54^{DE}	32.41^{F}	20.15
SD	6.29	6.97	6.10	2.60	8.17	8.03	7.70	6.81	4.90	2.79	10.26

^{A}, ^{B}, ^{C}… ^{G} – means marked with different letters differ statistically significantly at $P \leq 0.01$.
^{A}, ^{B}, ^{C}… ^{G} – średnie oznaczone różnymi literami różnią się statystycznie istotnie przy $P \leq 0{,}01$.

Table 3. Statistical description of brood and bees counts of Carniolian Bielka 1 line bees in 2009–2018

Tabela 3. Charakterystyka statystyczna pomiaru czerwia i pszczół rasy kraińskiej linii Bielka 1 w latach 2009–2018

Evaluation year Rok oceny	Number of honeycombes tightly covered with bees Ilość plastrów obsiadanych przez pszczoły na czarno				Number of honeycombes with brood Ilość plastrów z czerwiem			
	1st count – I pomiar		2nd count – II pomiar		1st count – I pomiar		2nd count – II pomiar	
	x̄	SD	x̄	SD	x̄	SD	x̄	SD
2009	4.96	0.93	6.63	1.42	2.09	0.75	4.9	1.45
2010	3.79	1.79	5.38	2.70	2.19	1.49	3.78	2.36
2011	4.02	1.34	5.54	1.93	1.22	0.62	3.87	2.04
2012	5.56	0.83	7.71	1.27	2.51	0.78	5.98	1.39
2013	2.30	1.11	2.74	1.33	0.7	0.39	1.68	1.0
2014	5.68	0.74	8.62	1.04	2.73	0.71	6.78	1.04
2015	5.06	1.15	7.98	1.48	1.87	0.96	6.41	1.59
2016	2.73	1.13	3.51	1.44	1.12	0.67	2.43	1.21
2017	5.38	0.59	6.78	0.97	2.15	0.79	4.92	1.37
2018	5.65	0.60	6.67	0.91	1.57	0.63	5.20	1.15
Total – Ogółem	4.45	1.61	6.07	2.38	1.80	1.03	4.51	2.20

Table 4. Statistical description of the point evaluation of the spring development of Carniolian Bielka 1 line bees in the years 2009–2018

Tabela 4. Charakterystyka statystyczna punktowej oceny rozwoju wiosennego pszczół rasy kraińskiej linii Bielka 1 w latach 2009–2018

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
x̄	3.01[a]	2.70[b]	2.82[a]	2.98[a]	2.73[b]	2.96[a]	3.02[a]	2.99[a]	2.97[a]	2.89[a]	2.90
SD	0.81	1.19	1.11	0.64	0.94	0.48	0.73	0.91	0.69	0.52	0.85

[a], [b] – means marked with different letters differ statistically significantly at $P \leq 0.05$.
[a], [b] – średnie oznaczone różnymi literami różnią się istotnie przy $P \leq 0{,}05$.

line of bees. The analyzed line attained results similar to other lines of this breed. The average score for the entire research period was 2.90 points, and there were no significant differences between individual seasons. Just in the second and the fifth year of the analysis, the bees of the Bielka 1 line achieved significantly poorer results of the spring development (Table 4); the results for the Carniolan bees of the Pogórska and Austrian lines were at a similar level. As demonstrated in the research by Roman et al. [2014], the Austrian line (Ca) scored 2.98 points, and the Pogórska line (Cb) scored 2.94 points for this trait, and a significant difference in the means in the Cb line was found between the first and the other years of research [Roman et al. 2014].

Changes taking place in the climate and the related shift in the blooming seasons affect the swarming ability of bees [Bieńkowska et al. 2015]. The swarming mood also increases when the colony is strong and numerous and the nest becomes too small, the queens spread more slowly and many bees are "bored" [Roman 2006]. Swarming is undesirable, since it reduces the honey yield of the family [Roman et al. 2014, Bieńkowska et al. 2015]. In addition to environmental factors, the triggering of swarming mood is also influenced by genetic factors and properly conducted breeding work. According to Wilde and Wilde [2002], bees selected for low swarming tendency were less likely to enter the swarming mood compared to unselected lines.

The studied Bielka 1 line bees are characterized by low swarming capability. The families scored on average 3.89 points for the entire period of analysis. It is a very good result, considering that no more than 4 points could be awarded with lacking swarming mood symptoms. Over the 10 years of the research, the bees of this line showed statistically significantly higher swarming mood twice (Table 5). They were the most swarming in 2013, reaching an average of 3.23 points. In the remaining years, the bees did not show swarming mood at all, receiving the maximum (4) number of points (Table 5). In the studies by Gontarz [2007] and Kareta [2000], the Carniolan bees also showed poorer swarming behavior compared to other breeds.

The Carniolan bees have an opinion of being very gentle and timid [Kareta 2000, Roman and Bursy 2000,

Wilde and Wilde 2002]. Our results of the evaluation of the behavior of the Bielka 1 line bees only support this opinion. The bees achieved excellent grades (Table 6). During a half of the analyzed period (5 years), Bielka 1 bees showed great gentleness and attained the maximum number of points, i.e. 4. In the remaining years, they were only slightly less calm. The average for the entire research period that the bees received for their behavior was 3.95, and the differences (albeit slight) between the means in individual seasons turned out to be statistically highly significant (Table 6).

Assessment of bee winter hardiness consists in comparing the condition of bee colonies before and after the winter. Good preparation for wintering determines the condition of the family in the spring to follow [Roman 2006]. Poor wintering causes has an effect in strong weakening in spring, which in turn has a degrading impact on the economic outcomes of the following honeflow season [Kasperek 2012]. The average winter hardiness of the Carniolan bee colonies of the Bielka 1 line for the period 2009–2018 was 3.23 points. (Table 7). When analyzing the winter hardiness of families in individual years of the study, significant differences in the obtained results can be noticed. The obtained means for this feature ranged from 2.72–3.97 points, and the differences between them were statistically highly significant (Table 7). On the basis of the obtained results, it should be concluded that the Bielek 1 line is characterized by average winter hardiness, although compared to other lines of this breed, these results can be considered good. According to Roman et al. [2014], the average winter hardiness of the Podgórska line was 2.89 points, and that of the Austrian line 2.75 points. It is worth noting that the average (3.23 points) of the evaluation of the winter hardiness for the Bielka 1 line for the entire research period (10 years) was influenced by significant differences between the seasons, which – as it can be assumed – were caused not by genotype, but by environmental factors. Research by other authors [Hońko and Jasiński 2002, Olszewski 2007, Kasperek 2012] on various breeds of honeybees and their hybrids may also indicate that the following are important: the period of prepar-

Table 5. Statistical description of average swarming disposition of Carniolian Bielka 1 line bees

Tabela 5. Charakterystyka statystyczna przeciętnej skłonności do rójki u pszczół rasy kraińskiej linii Bielka 1

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
$\bar{x}$	4.0^{A}	4.0^{A}	4.0^{A}	4.0^{A}	3.23^{B}	4.0^{A}	3.62^{C}	4.0^{A}	4.0^{A}	4.0^{A}	2.90
SD	0.0	0.0	0.0	0.0	1.32	0.0	1.1	0.0	0.0	0.0	0.85

$^{A, B, C}$ – means marked with different letters differ statistically significantly at $P \leq 0.01$.
$^{A, B, C}$ – średnie oznaczone różnymi literami różnią się statystycznie istotnie przy $P \leq 0{,}01$.

Table 6. Statistical description of behavior of Carniolian Bielka 1 line bees

Tabela 6. Charakterystyka statystyczna zachowania się pszczół rasy kraińskiej linii Bielka 1

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
$\bar{x}$	3.89^{A}	3.96^{B}	3.88^{A}	4.0^{C}	3.91^{B}	4.0^{C}	4.0^{C}	3.94^{B}	4.0^{C}	4.0^{C}	3.95
SD	0.44	0.2	0.32	0.0	0.29	0.0	0.0	0.29	0.0	0.0	0.24

$^{A, B, C}$ – means marked with different letters differ statistically significantly at $P \leq 0.01$.
$^{A, B, C}$ – średnie oznaczone różnymi literami różnią się statystycznie istotnie przy $P \leq 0{,}01$.

Table 7. Statistical description of average winter hardiness of Carniolian Bielka 1 line bees

Tabela 7. Charakterystyka statystyczna średniej zimotrwałości rodzin pszczelich rasy kraińskiej linii Bielka 1

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
$\bar{x}$	3.33^{A}	2.74^{B}	3.05^{C}	3.17^{A}	2.72^{B}	3.77^{D}	3.49^{A}	2.93^{C}	3.78^{D}	3.97^{D}	3.23
SD	0.68	0.28	0.87	0.71	0.62	0.46	0.77	0.94	0.49	0.18	0.87

$^{A, B, C, D}$ – means marked with different letters differ statistically significantly at $P \leq 0.01$.
$^{A, B, C, D}$ – średnie oznaczone różnymi literami różnią się statystycznie istotnie przy $P \leq 0{,}01$.

Table 8. Statistical description of overall family evaluation of Carniolian Bielka 1 line bees

Tabela 8. Charakterystyka statystyczna oceny ogólnej rodzin pszczelich rasy kraińskiej linii Bielka 1

Evaluation year Rok oceny	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009–2018
n	70	73	78	52	66	73	55	72	63	61	663
$\bar{x}$	16.97^{A}	16.34^{B}	16.64^{B}	17.10^{A}	14.88^{C}	17.67^{D}	17.05^{A}	16.97^{A}	17.76^{D}	17.85^{D}	16.91
SD	2.00	2.74	2.71	1.45	2.92	1.47	1.85	2.46	1.42	0.63	2.27

^{A},^{B},^{C},^{D} – means marked with different letters differ statistically significantly at $P \leq 0.01$.
^{A},^{B},^{C},^{D} – średnie oznaczone różnymi literami różnią się statystycznie istotnie przy $P \leq 0{,}01$.

Table 9. Correlation coefficents between the analysed traits of Carniolian Bielka 1 line bees

Tabela 9. Wartości współczynników korelacji między analizowanymi cechami pszczół rasy kraińskiej linii Bielka 1

Variable Zmienna	Honey yield Wydajność miodowa	Spring development Rozwój wiosenny	Winter hardiness Zimotrwałość	Swarming disposition Rojliwość	Behavior Sposób zachowania
Honey yield Wydajność miodowa	–	0.44*	0.34*	0.15*	0.08*
Spring development Rozwój wiosenny	0.44*	–	0.61*	0.05	0.08
Winter hardiness Zimotrwałość	0.34*	0.61*	–	0.13*	0.13*
Swarming disposition Rojliwość	0.15*	0.05	0.13*	–	–0.003
Behavior Sposób zachowania	0.08*	0.08	0.13*	–0.003	–

*correlations statistically significant at $P \leq 0.05$.
*korelacje statystycznie istotne przy $P \leq 0{,}05$.

ation for overwintering, air temperature (e.g. too warm winter), humidity or the hygienic condition of the family. The analyzed breeds did not differ significantly in terms of winter hardiness.

The grades obtained by the bees for individual traits are summed up to represent the final grade, for which a maximum of 20 points can be achieved. The analyzed bees of the Carniolan Bielka 1 line obtained the average final score of 16.91 for the period of 10 years (Table 8).

The coefficents of correlation reveal a significant dependency between the honey yield and the other analysed traits (Table 9). There was a strong and positive phenotypic correlation between spring development and winter hardiness, which is understandable as poor wintering affects the timing and dynamics of the spring development. Winter hardiness is also significantly correlated with the swarming tendency of bees and their behavior. The correlation between behavior and development was positive, though non-significant. There was a negative relationship between the swarming tendency and behavior (Table 9).

CONCLUSIONS

To sum up, the results of the study emphasize that establishing the Bielka 1 line of the Carniolan bee was fully rational. Due to very high values of production and biological characteristics, bees of this line can be kept in both large-scale and small, amateur apiaries. The following conclusions can be drawn from this study:

1. The year of evaluation had a significant or highly significant effect on all the analyzed traits. This is evidenced by sinusoidal fluctuations in some traits over the 10 years of analysis.
2. There were positive and significant correlations between the honey yield and the other examined traits. The correlations between the behavior of the Bielka 1 line bees and their tendency to swarm and spring development proved non-significant.
3. The Bielka 1 line of the Carniolan bees exhibit high honey yields and good winter hardiness in the analyzed period (10 years). The bee colonies of this line were strong and were characterized by high dynamics of spring development.
4. In terms of behavior and swarming tendency, the tested bees obtained very good results. They were calm, gentle and rarely had a swarming mood.
5. The levels of some traits show to have increased over the analyzed 10-year period. These traits were: honey yield, winter hardiness, behavior (towards gentleness) and the general score of bee colonies.

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OCENA CECH UŻYTKOWYCH I BIOLOGICZNYCH WYBRANEJ LINII PSZCZÓŁ RASY KRAIŃSKIEJ

STRESZCZENIE

Celem pracy była analiza cech użytkowych i biologicznych pszczół rasy kraińska linii Bielka 1. Materiał do badań stanowiły matki pszczele poddane ocenie stacjonarnej w dziesięciu kolejnych sezonach pożytkowych (2009–2018). Analizą objęto takie cechy, jak: wydajność miodowa, zimotrwałość, rozwój wiosenny, rojliwość oraz sposób zachowania się pszczół wskazujący na ich łagodność lub złośliwość. Stwierdzono statystycznie istotny lub wysoko istotny wpływ roku oceny na wszystkie analizowane cechy użytkowe pszczół rasy kraińska linii Bielka 1. Pszczoły tej linii charakteryzowały się bardzo dobrą wydajnością miodową. Między tą cecha a pozostałymi wystąpiły dodatnie i istotne korelacje. Nie zaobserwowano znaczących zależności między zachowaniem się pszczół linii Bielka 1 a ich skłonnością do rójki i rozwojem wiosennym. Pszczoły odznaczały się dobrą zimotrwałością, tworzeniem silnych rodzin i dynamicznym rozwojem wiosennym. Dobrymi cechami rodzin pszczelich tej linii są spokój i łagodność. Ponadto odznaczają się one niską rojliwością; zazwyczaj otrzymywały maksymalne noty w ocenie punktowej tej cechy. Linia Bielka 1 może być przydatna w dużych pasiekach nastawionych na intensywną produkcję, ale także w pasiekach przydomowych – amatorskich.

Słowa kluczowe: pszczoła kraińska, linia Bielka 1, cechy użytkowe

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