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RESEARCHES ON MORPHOLOGICAL CHARACTERISTICS AND BIOLOGICAL FEATURES OF THE BEE POPULATION IN ROMANIA

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ROMANIA

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Systematic studies have not been made on the morphological characteristics and biological features of our local bee.

Seyfried (1936) studied the length of the proboscis in 6 samples from the Cluj region. Fisteag I (1937) investigated six morphological characteristics in 17 samples from the Banat, Braşov, Ploieşti and Suceava regions, establishing some correlations between the body sizes.

Farcaş (1939) determined the cubital index in six samples and the length of proboscis in 10 samples from the Cluj region.

Among foreign authors, Goetze (1940) in the geogram of the proboscis length, as well as in that of the cubital index shows that the territory of our country falls under the area of distribution of *Apis m. Carnica* Pollm. bee. The same opinions are expressed by Ruttner (1965), Alpatov (1947), referring to the Banat bee.

Grosd specifies that this bee is not sufficiently studied and he thinks that it represents a plain variety of the carnolian bee.

Data concerning the biological features of the local bee were also lacking particularly the economically valuable ones such as: productivity, rate of development, swarming instinct, gentleness, resistance to wintering and diseases, etc.

Our researches in this direction forming the object of this paper, were carried out with the purpose of working out the plan of dividing of the bee population into districts and of establishing the place of our bee within the classification of European races.

WORKING METHOD

The researches regarding the morphological characteristics were carried out during 1949—1962, on 189 bee samples, collected from 41 localities from all the regions of this country. The samples consisted in 50—110 bees. They were prepared and conserved in the usual way, consisting in narcotizing the bees with sulphuric ether keeping them for about 5 minutes in hot water (80—90°C) and then preserving them in 70° alcohol.

The biometrical measurements were made according to Alpatov's and Goetze's (1940) method on a microscope with the objective 1, observing 16 indices (of which 9 are presented in this paper). The statistical method was used to work out the data.

The biological characteristics were observed for 4 years (1953—1956) in the Danubian plain zone, on an experimental lot of 45 colonies comprising 3 groups of 15 bee colonies each, comprising the populations of the Danubian plain, Transylvania and the Western plain.

RESULTS AND DISCUSSION

1. Morphological features

Length of Proboscis. The results are presented in Table No. I, by the mean values expressed in mm, accompanied by the standard derivation of the mean and the variability limits of the means per each sample. The average length of the proboscis is 6.3491 ± 0.0014 , and the variability limits 6.02—6.61 mm.

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gress participants.

The longest proboscides are recorded in the population of Maramureş and the Transylvania plateau, which vary within the limits of 6.20 and 6.61 mm. with an average of 6.4411 ± 0.0022 mm followed in decreasing order by:

The Western plain bee population with an average of 6.3588 ± 0.0027 and variability limits of 6.20—6.51 mm, the Moldavian plateau bee population with an average of 6.3137 ± 0.0036 , and a variability within the limits of 6.02—6.50, and the Danubian plain bee population with an average of 6.2959 ± 0.0019 and a variability within the limits of 6.03—6.5 mm.

Table I

No.	Morphological characteristics	Number of tests	Number of individuals.	$\begin{matrix} - & + & - \\ \times & - & \times \end{matrix}$	Variability limits	
					Minim	Maxim
1	2		4	5	6	7
1	Length of proboscis (mm)	189	14,723	6.3491 ± 0.0014	6.02	6.61
2	Width of third tergite (mm)	116	8,357	2.2378 ± 0.0007	2.12	2.34
3	Width of wax gland (mm)	111	7,726	1.6058 ± 0.0006	1.52	1.69
4	Length of tarsus (mm)	110	7,848	2.0497 ± 0.0006	1.99	2.11
5	Length of tibia (mm)	126	9,253	3.2055 ± 0.0006	3.11	3.30
6	Length of fore-wing (mm)	174	14,025	9.0893 ± 0.0005	8.80	9.40
7	Tarsus index %	130	9,486	56.987 ± 0.022	58.56	54.97
8	Cubital index %	170	15,359	44.354 ± 0.047	50.45	38.42
9	Number of staples on hind-wing	175	13,704	21.766 ± 0.035	19.41	24.08

With some exceptions, it was found that the length of proboscis increases with altitude, the highest values being registered on plateaus and hills. In general lines, with regard to this index, two population groups result: on the one hand, populations with medium proboscides on the Transylvanian plateau, and the Western plain, and on the other hand, those on the Moldavian plateau and the Danubian plain with short proboscides.

Our data correspond to the values obtained by Dr. Fr. Seyfried Fişteag E. and Farcaş A. in the Transylvanian and Western plain populations. In comparison with the average data in other bee races shown by Alpatov, our native bee is situated between the Italian and Caucasian bee. The comparison with the data of West European authors, Goetze G. and others, is rendered difficult due to the methods based on the measurement of the labial palp (applying this method we obtained values by 3.755% higher).

Width of the third tergite. This dimension is indicative of the body size, especially regarding the length. A mean value of 2.2378 ± 0.0007 m. μ , and variability limits of 2.12—2.14 (Table I, 2), were registered.

The smallest values are recorded in the Danubian plain population (2.2070 ± 0.0011) the other populations having about similar values. Comparing them with V. V. Alpatov's data concerning the northern bees (2.345 ± 0.005), Ukrainian bees (2.266 ± 0.006), Caucasian bees (2.257 ± 0.004) and Italian bees (2.172 ± 0.005) it is found that our native bee as regards body length is about similar to the Caucasian bee, and the Danubian plain population about similar to the Italian bee.

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Table 1

	Variability limits	
	Minim	Maxim
	6	7
	6.02	6.61
	2.12	2.34
	1.52	1.69
	1.99	2.11
	3.11	3.30
	8.80	9.40
	58.56	54.97
	50.45	38.42
	19.41	24.08

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Length of tarsus and tibia gives the possibility to estimate the length of the limbs. The average value of the tarsus is 2.0497 ± 0.0006 mm, with variability limits of 1.99—2.11, and that of the tibia 3.2055 ± 0.006 mm with limits of 3.11—3.30 mm. The average value of the tarsus in those 4 populations are comprised between 2.0330 ± 0.0015 and 2.0752 ± 0.0012 , the highest value being recorded in the Transylvanian population. Like in the previous index, the length of the tibia records close average values comprised between 3.1910 ± 0.011 and 3.2212 ± 0.0012 , the highest values being recorded in the Transylvanian population and the lowest in the Danubian plain population.

The average values of these indices in the native bee approach the values recorded by V. Alpatov in the Italian bee (2.081 ± 0.005 respectively 3.255 ± 0.005).

Length of the fore-wing varies within the limits of 8.80—9.40 mm, with an average of 9.0893 ± 0.0005 mm (Table 1.6); the highest average of 9.2262 ± 0.0025 being recorded in the Transylvanian population and the lowest of 9.0022 ± 0.0018 mm in the Danubian plain population; the other two populations having an intermediary position between them. Regarding this dimension our native bee approaches the value of 9.046 ± 0.008 recorded by V. Alpatov in the Italian bee, and the Transylvanian bee population that of the Caucasian bee which has the wing length of 9.190 ± 0.004 .

The above established values permitted us to determine the body conformation of the native bee and to compare it with different conformation types established by V. Alpatov in the European bee races.

Thus the relationship between the hind-limbs length expressed by the length of the tarsus or tibia, on the one hand, and the length of the body expressed by the width of the third tergite, results in the following values: average index tarsus tergite III of the native bee is 91.8% as against 90.69% in the northern brown bee, 92.55% in the Italian bee.

The average tibia tarsus index of the native bee is 143.5% and that of the populations separately: 143.4% in the Transylvanian bee, 144.4% in the Moldavian bee, 144.6% in the Danubian plain population and 142.5% in the western plain bee as against 143.4 in the northern brown bee, 145.4 in the Ukrainian bee, 152.4 in the Caucasian bee and 148.6 in the Italian bee.

It follows that in respect of the conformation the native bee is characterized by relatively short limbs as against the body length, and with regard to the body harmony it approaches the northern brown bee and the Ukrainian bee, although it has smaller body sizes.

Tarsus index expresses in percentages the relationship between length and width of the tarsus. V. V. Alpatov, on the basis of a thorough study of the main bee races of the distribution area of the honeybee, considers that this index constitutes a sure criterion for delimiting the bee races and even the bee populations.

The above quoted author presents the following values for the main races: 55.0 in the northern bee, 55.88 ± 0.14 in the Italian race, 57.73 ± 0.13 in the Caucasian race and 58.25 ± 0.11 in the Carnolian race.

The average value recorded in the native bee is $56.987 \pm 0.022\%$ with the variability limits of 58—56—54.97%.

The highest index recorded in the Transylvanian plateau bee is of 56.639 ± 0.030 and the lowest of $57.219 \pm 0.041\%$ in the Danube plain population. Compared to the data of the European races it follows that the native bee constitutes an separate systematic unit having the tarsus index value between the tarsus index value in the Italian race (55.88%) and the Carnolian one (58.25%).

The cubital index constitutes another criterion for the classification of bee races and populations, representing the percentage value of the small portion of the nervure as against the large nervure of the third cubital cell in the forewing.

The average value registered in the native bee is of $44.354 \pm 0.047\%$. The values are comprised between 44.144 ± 0.081 in the Transylvanian population and 45.272 ± 0.112 in the Moldavian population.

The above data show that the bee populations have close indices, except for the population on the Moldavian plateau which has a lower cubital index value, and is explained by its contact with the Ukrainian bee.

Expressing the cubital index by relationship values, the average value of this index is of 2.254, as against 2.55 for the Carnolian race in the German De-

mocratic Republic (Droge 1960), 2.7% average value for the Carnolian race in the Socialist Federative Republic of Yugoslavia (Vlatkovic), 1.97 for the Caucasian race, and 1.7 for the European brown race.

From the data presented it results that in respect of this index too, the native bee constitutes a separate systematic entity characteristic of the Carpathian valleys, that was formed in specific conditions of climate, relief and melliferous flora in this part of South-Eastern Europe. Whether — *Apis m. Carnica* was formed in Alpine wet climatic conditions under Mediterranean influence, our native bee is the result of the temperate continental climate characterized in greatest part of the country by reduced precipitations, important temperature variations and strong currents.

Number of staples on the hind-wing (table I, 9) varies within the limits of 19.41—24.08, with an average value of 21.766 ± 0.035 . As regards this index, the native bee is situated within the values recorded by Alpatov in the Italian bee, 21.61 ± 0.08 .

2. Biological features

Bee behaviour on combs during handling and their reaction to smoke.

In most colonies bees remain quiet on combs carrying on their activity during the inspection of the nest. Bee colonies with moderately quiet behaviour on combs were identified on the average as: 17.6% in the Banat populations, 13.2% in the Transylvanian populations and 11.5% in the steppe populations.

In respect of irascibility, generally the studied bee populations are distinguished by a particular gentleness, specific to the native bee, characteristics which allow the inspection of the nest without protection mask and abuse of smoke. The native bees are incomparably gentler and they react much faster to smoke than the imported Caucasian bees. The same remarks concerning the exceptional gentleness of our bee were made in the past by numerous beekeepers who reared Italian bees.

The predisposition to silfering was not seen in any population during the experimental years.

Predisposition to swarming. The swarming instinct was shown only in one year (1953), particularly favourable to natural swarming, in 33.3% of Banat colonies, 14.2% of Transylvanian colonies, 53.3% of steppe colonies; no measures being taken to prevent swarming in the experimental lot. In the following 3 years no cases of natural swarming were noticed. The largest number of queen cells was noticed in the steppe population (76—195), a smaller number in the Western plain bee (43—110) and the smallest in the Transylvanian bee (17—103). In this respect our native bee is different from the Carnolian and the northern bees.

The character of honey storage in the nest and of honey sealing in cells. A relatively wide variability regarding honey storage in the nest is noticed.

The blocking of brood-rearing is also noticed in the Transylvanian population.

Regarding the manner of honey sealing in cells "moist", "dry" and "intermediary" sealing forms were noticed in all the populations.

Development rate of colonies, namely the moment when the colonies reach a maximum development; a 10 days' earlier development was noticed in the Transylvanian colonies, a medium one in the Danubian plain colonies and a little belatedly in the western plain population.

Productivity was estimated on the basis of the gross production specified in Table II.

Table II

Year	Western plain		Transylvania		Danubian plain	
	kg	%	kg	%	kg	%
1953	35.49	—	34.47		36.77	
1954	18.89		31.57		25.61	
1955	42.45		45.91		44.48	
1956	56.40		61.50		60.30	
the average	38.3	91.6	43.4	103.8	41.8	100

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Table 11

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From the submitted data it results that under the conditions of the years 1953-1956, production differences among the populations are relatively small; the largest production was obtained by the Transylvanian and Danubian plain populations.

The total 1956 peak productions per bee colony were 102.74 and 70 kg for the western plain population, 98.94 and 84 kgr. for the Transylvanian population and 81.73 kg. for the Danubian plain population.

Resistance to diseases. Differences concerning resistance to the brood diseases were ascertained between populations.

The populations behave differently towards nosema apis parasite, so that an infection of 28.5% in the Transylvanian population, of 13.33% in the western plain populations, and 7.14% in the Danubian plain population were recorded.

Workers cell sizes (E. Mirza and A. Mălai). This study was carried out with the purpose of sizing adequately the artificial combs cells.

The measurements were made on samples of naturally built combs.

The values of the cell diameter (horizontal) vary within the limits of 5.11-5.88 mm, the average value is 5.41 mm.

The highest values were recorded in the Transylvanian plateau of 5.50 mm, with a variability within the limits of 5.35-5.88 mm, and the smallest in the Danubian plain with the average value of 5.33 mm and a variability within the limits of 5.11-5.36 mm. A positive correlation between the third tergite size and the diameter of cells was established.

CONCLUSIONS

We can draw the following conclusions from the above presented data:

1. The native bee is characterized by the following morphological indices:
 - the length of proboscis varies within the limits of 6.02-6.61 with an average value of 6.4391 ± 0.0014 mm;
 - the width of the third tergite varies within the limits of 2.12-2.34 with an average value of 2.2378 ± 0.0007 mm.
 - the width of wax gland varies within the limits of 1.52-1.69 with an average value of 1.6058 ± 0.0006 ;
 - the length of tarsus varies within the limits of 1.99-2.11 with the average value of 2.0497 ± 0.0006 mm;
 - the length of tibia varies within the limits of 3.11-3.30, with an average value of 3.2055 ± 0.0006 mm;
 - the length of the fore-wing varies within the limits of 8.80-9.40, with an average value of 9.0893 ± 0.0005 mm;
 - the tarsus index varies within the limits of 58.56-54.97, with an average value of $56.987 \pm 0.022\%$;
 - the cubital index varies within the limits of 50-45-38.42, with an average value of 44.354 ± 0.035 ;
 - the number of staples on the hind-wing varies within the limits of 19.41-24.08, with an average value of 21.766 ± 0.035 .

In respect of bodily conformation the native bee is characterized by relatively short limbs as against the length of the body and an average length of the proboscis.

2. Among bee populations the Transylvanian bee type is distinguished as characterized by a larger body size specific to the plateau and mountain zones, and the plain type which populates the Danubian plain, and partially the plain of western part of the country with smaller body sizes.

3. No differences were found between populations as regards the behaviour of bees on combs, their reaction to smoke and irascibility; the bees are particularly gentle and have an instantaneous reaction to smoke and a quiet behaviour on combs.

4. Under Danubian plain conditions the bee populations of Transylvania, Western plain and Danubian plain behaved generally speaking alike as regards honey productivity, with a slight superiority of the Transylvanian and Danubian plain populations.

5. Transylvanian colonies under Danubian plain zone conditions reach a maximum development a few days earlier than the bees in the Danubian and western plains.

6. Both by its body sizes, value of indices and by its biological features the native bee is an independent Carpathian systematic unit, — *Apis mellifica carpatica*.

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