



Inventory of the race belonging of honey bees in different bio-geographical regions in Bulgaria based on morpho-ethological, population-genetic and productivity characteristics

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The local Bulgarian honeybees have been studied morphologically since the 30s of the last century. Since 1999 it has been worked on the implementation of a new National Programme for Breeding and Improving Work with Bees. Its purpose is the conservation of the gene pool of the local Bulgarian honey bee.

With this regard, a morpho-ethological analysis by specific characteristics has been carried out in the country in order to determine the race standard (Petrov 1990, 1993, 1995, 1997). Biochemical-genetic researches of polymorphism in some protein and isoenzyme systems have been carried out also (Ivanova, 1996; Ivanova et al. 2004; 2006; 2007; 2008). In the last years it has been purposefully worked for reuniting different approaches - morphometrical, ethological, isoenzymical and DNA analysis. The objective is to clarify the race standard of the local honey bee, which is a part of the European genetic resource of *Apis mellifera*. Due to the proved biological and productive advantages and its adaptation to the conditions specific for the country, the local honey bee should be preserved and its selection should be carried out on the basis of a serious scientifically grounded activity together with the common efforts of many scientists by using the possibilities of experience exchange with the European countries. The objective of this study is morpho-ethological and Biochemical-genetic characterization of the local Bulgarian honey bee *Apis mellifera rodopica*. The results would be useful for selection and conservation of local Bulgarian honey bees.



Materials and methods: Different regions from all over the country were studied. Totally over 15 700 samples were collected and 921 590 measurements under microscope were made (according to Alpatov, 1948). Parameters measured in this study were: mass of a non-inseminated and an inseminated queen; length of proboscis; forewing length; forewing width; cubital index; discoidal shifting; tarsal index; diameter of the spermatheca; total sum of the lengths of 3-rd and 4-rd abdominal tergum; coloration of the abdominal tergums; colour of the drone thorax pappi; wax-mirror back border concave; length of the pappi of the 5-th abdominal tergum; hair index of the 4-th abdominal tergum; length of the hind leg; colour of the pappi of the 2-nd abdominal tergum; colour of the pappi of the 3-nd to 6-th abdominal tergums.

More than 3000 individual honey bee samples from different queen reproductive bases in Bulgaria were studied using isoenzymic analysis of six enzymic systems (MDH, ME, EST, PGM, HK and ALP) corresponding to 6 loci. Electrophoresis in 7.5% polyacrylamide gel were done according to Ivanova (1996).

Results and Discussion:

Tabl.I. Morphological and morphometric characteristics for queens of *A. m. rodopica*.

Characteristics	Values
Live weight of an unfertilized queen (mg)	190 – 220
Live weight of a fertilized queen (mg)	230 - 320
Length of proboscis (mm)	4.00 – 4.25
Forewing length (mm)	9.6 – 10.4
Forewing width (mm)	3.25 – 3.45
Cubital index	2.5 – 5.6 typical >3,0
Discoidal shifting (%)	Positive
Tarsal index (%)	> 46.0%

Tabl.II. Morphological and morphometric characteristics for drones of *A. m. rodopica*.

Characteristics	Values
Live weight (mg)	190 - 260
Length of proboscis (mm)	3.9 – 4.3
Forewing length (mm)	11.7 – 12.4
Forewing width (mm)	4.1 – 4.4
Cubital index	1.7 – 2.5
Discoidal shifting (%)	>80 % positive
Tarsal index (%)	
Total sum of the lengths of 3-rd and 4-rd abdominal tergum (mm)	5.5 – 5.6
Coloration of the abdominal tergums	Dark, with small yellow spots
Colour of the thorax pappi	Light brown

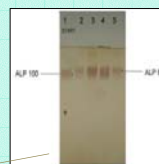
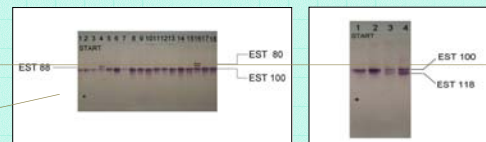
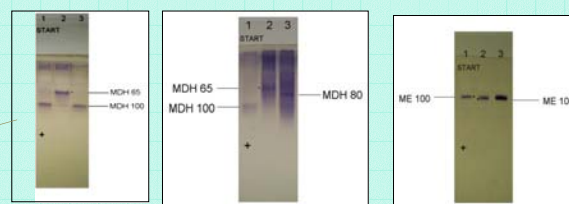
Summarized data about allozyme characteristics of local Bulgarian bees (*A. m. rodopica*) are presented in Table IV.

Polymorphic locus	Alleles found	The most frequent allele for <i>A. m. rodopica</i>
Mdh 1	Mdh 65 Mdh 100	Mdh 100 > 0.590
Me	Me 100 Me 106	Me 100 > 0.730
Est 3	Est 80 Est 88 Est 100 Est 105 Est 118	Est 100 > 0.900
Pgm	Pgm 75 Pgm 100	Pgm 75 > 0.900
Hk	Hk 87 Hk 100 Hk 110	Hk 100 > 0.900
Alp	Alp 80 Alp 100	Alp 80 > 0.500

Some differences between Bulgarian local bees and other subspecies of *Apis mellifera* were reported previously by Petrov (1996) and Petrov and Petkova (1996, 1997). Comparing data about length of the hind leg, tarsal index, forewing length, forewing width and total sum of the lengths of 3-rd and 4th abdominal tergum of Bulgarian worker bees the authors conclude that local honeybees *A. m. rodopica* are reliably different ($P \leq 0.05$; 0.01; 0.001) from *A. m. carnica*, *A. m. carpatica*, *A. m. ligustica*, *A. m. mellifera*, *A. m. caucasica* and *A. m. anatoliaca*.

Tabl.III. Morphological and morphometric characteristics for worker bees of *A. m. rodopica*.

Characteristics	Values
Live weight (mg)	80 - 90
Length of proboscis (mm)	6.4 – 6.6
Forewing length (mm)	8.8 – 9.6 (9.1)
Forewing width (mm)	3.1 – 3.3 (3.2)
Cubital index	2.6 – 3.0
Discoidal shifting (%)	90–100% positive
Tarsal index (%)	53.8 – 59.1 (56.1)
Total sum of the lengths of 3-rd and 4-rd abdominal tergum (mm)	4.3 – 4.7 (4.6)
Wax-mirror back border (%)	90 – 100% concave
Length of the pappi of the 5-th abdominal tergum (mm)	<0.3
Hair index of the 4-th abdominal tergum	>1.5
Length of the hind leg (mm)	7.8 – 8.3 (8.1)
Coloration of the abdominal tergums	Dark, with small yellow spots
Colour of the pappi of the 2-nd abdominal tergum	Yellow-brown
Colour of the pappi of the 3-nd to 6-th abdominal tergums	Light brown



Dedej et al., (1996) reported no polymorphism in the EST-3 and ME loci for *A. m. Macedonica*. According to Bouga et al. (2005) - in Macedonian region of Greece there are three alleles (MDH¹⁰⁰, MDH⁸⁰ and MDH⁶⁵) in Mdh-1 locus and the most frequent of them is MDH⁸⁰. At the same time, the frequency of ALP⁸⁰ for Macedonian bees is calculated as 0.846 which is higher than frequencies found for Bulgarian honey bees. Kandemir et al. (2005) found that the frequency of the MDH⁶⁵ allele is quite high - 0.879 in the Austrian colonies which were known to be *A. m. carnica*.

Comparing the enzyme polymorphism studied and information given by Dedej et al. (1996), Bouga et al. (2005); Kandemir et al. (2005) we could notice that there are differences between Bulgarian honey bees (*A. m. rodopica*), *A. m. macedonica* and *A. m. carnica*.

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