



Middle-Eastern limit of distribution of *Apis mellifera* in Turkmenistan

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Abstract

In the investigation so far under way, it was made clear that Turkmenistan's bees, in comparison with other species, have close affinity with their Iranian counterparts (*Mellifera meda*) and we daresay that in ancient times these bees had had a widespread distribution. But due to the existence of vast natural borders such as high mountain ranges, deserts and quite varied climates within this outstretched geographical distribution of *Meda*, subspecies of bees and the debility of the relationship between the bees' population, the varied regions of their distribution and their adjustment to these varied environmental conditions has brought about distinctions in their morphology so that they will ultimately manage to adapt to the standards and the level of the geographical race or ecological race of *Apis mellifera* Turkmenistan's bees (*Apis m. meda turkmenica*).

Keywords: *Apis mellifera*; *meda*; Turkmenistan; distribution

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Introduction

According to the latest reports, the extensive investigations carried out by Prof. Ruttner et al. (1992 and 1985) in connection with the distribution of the western species of *Mellifera*, there came a speculation that the farthest distribution of this species ended up in the province of Kerman in Iran. But, later on, a contradictory report pinpointed Sistan and Baluchestan on the borders of Pakistan and Afghanistan as the natural boundary of Iran (Pourelmi and Fuchs, 2008). As for the distribution of *Apis mellifera* species in Asia Minor (the northern neighbor of Iran), Turkmenistan, which used to be part of the Iranian territory, the existence of a close affinity between the bees of these two regions (Iran and Turkmenistan), and *Mellifera* species and the other Sub-species within this species, due to certain political issues in the past and breach of their scientific and investigatory ties with the west, we have no reliable data available. Thus, through a scientific research carried out on the bees, native to Turkmenistan, it has been made quite possible to draw up a new plan of *Apis mellifera* distribution and pave the way for an enhancement of the global data in this area.

Materials and Methods

In total, 13 samples from among twelve colonies in Turkmenistan were put to the test from morphological viewpoint in an attempt to unravel and analyze the origin and sample colony of the selected bees from investigatory regions. A total of 64 samples were selected from other regions in Iran (*Meda*) as follows: 13 samples from Anatoly (Turkey), 19 samples from Syrian breed, 7 samples from Iraq, 32 samples from Italian breed, 29 samples from Caucasia, 10 samples from *Mellifera mellifera*, 13 samples from Carnica (200 samples in total). In an attempt to consider the total variance of phenotype, queen Mother and a variety of Fathers peculiar to a bee population for each sample, at least 10 workers are required. For this investigation, 2000 workers (10 workers per sample) were brought into analysis.

For a precise investigation of morphology, a standard international approach was employed (Ruttner et al., 1978). In this research, 51 parameters were brought into consideration. A fraction of these selected parameters have been employed and will continue to be in the selection of the ancestors and recognition of the

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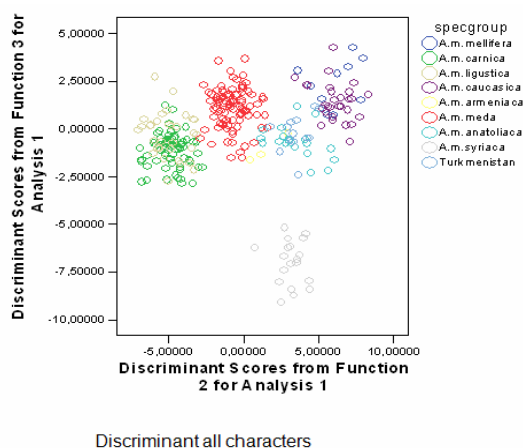
European breed of bees (Ruttner, 1983). From among 51 parameters 42 are size and characteristic features, including hair length, extremities, the size and characteristic feature of the forewing, skin color and nine other parameters also belong in the index of parameters. The purpose of this study was to show the differences between Turkmen honey bees and some other races of *Apis mellifera*.

Statistical analysis

All the studies about morphology were strictly continued in a beekeeping institute affiliated to Frankfurt's University of Goethe (Polytechnische Gesellschaft) located in the Oberursel, Germany. Subsequently, statistical calculations were completed using SPSS program.

Results

All the parameters were interred into the analyses in order to point out that the total number of Turkmenistan's sample bees have been isolated from the sample bees from the other regions and have evolved into a closed colony by contrast. Means and standard deviations of some important traits in honey bee breeds were compared to Turkmen honey bee as shown in Table 1. The distance between Turkmenistan's honeybees in comparison with the European breed is much greater and clearer and by contrast nearer to the Iranian counterpart of Meda. The results of the discrimination of nine honeybee subspecies (*A. Mellifera*, *A. Carnica*, *A. Ligustica*, *A. Caucasica*, *A. Armenica*, *A. meda*, *A. Anatolica* and *A. Syriaca* (Turkmenistan) based on standard morphometry is given in Figure 1.



A comparison between the mean of the total Turkmenistan's sample bees and the other breeds within the *Mellifera* species clearly revealed that the hair length, body size in comparison with the Syrian breed is shorter. The morphometric analysis showed a clear relationship between the samples from

Turkmenistan and the other samples from *A. meda*. In particular, the Turkmenistan bees were characterized by smaller body size, hair length, cubital index and longer legs in relation to *A. meda* from Iran.

The trunk's length and the leg's size are both shorter than that of the Italian counterpart's and the cubital-index is shorter than the other breeds with the exception of *M. mellifera* and *Caucasica* breeds. The physical build in proportion to the leg's length is smaller than the other breeds by comparison (the Syrian breed is an exception). The wing's length in proportion to the forewing width is bigger than that of the other breeds (*Meda*, *Ligustica* and *Carnica* are exceptions). The body colour resembles to that of the Iranian breed (*Meda*).

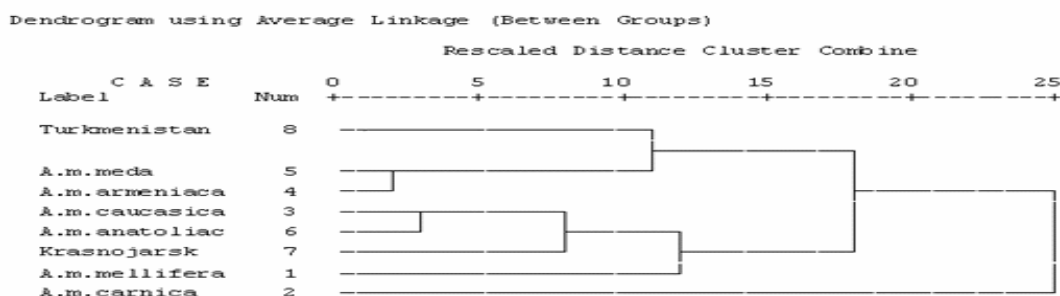
Discussion

In a comparative analysis of Turkmenistan's honeybees and the other breeds within *A. mellifera*, it is vividly observed that Turkmenistan's honeybees have been isolated from the other breeds within this species and has evolved into a completely closed pile compared to the other breeds. The distance of this Turkmenistan pile, in this analysis, is closer to the Iranian pile of honeybees (*Meda*) and its distance from the European pile is much greater and by far more noticeable. The distinction between Turkmenistan honeybees and the other breeds can be put down to the climatic impact peculiar to their area of distribution on the honeybees (Tahmasbi, 2009). The skin's color is brighter than that of *Caucasica*, *Carnica* and *M. mellifera* breeds and stands side by side with the Iranian breed of "Meda". In a cluster analysis of morphometric, an affinity between Turkmenistan's sample bees with the other breeds has been established and an approximation within the Iranian honeybee of *Meda* is vividly observed (Fig. 2). Over 150 years ago, Turkmenistan has been part of Iran territory. In addition, there had been vast commercial and agricultural relationship between Iran and Turkmenistan. But after its separation from Iran, Turkmenistan gets part of Soviet territory and, therefore, the relationship was halted with Iran. Due to extreme environmental differences between Iran and Turkmenistan, some differences were observed in appearance of Turkmenistan honey bee compared to Iranian races. However, compare to other honey bee, Turkmen honey bee have more similarity to *A. meda*, which indicated that these two bees had one origin in the past.

Therefore, the hypothesis that *Mellifera* distribution coincides with eastern north of Turkmenistan, is thus strongly confirmed, which over the years and centuries, the varied environmental impact of these regions on the honeybees has brought about an evolution of ecological or geographical races

Table 1: Means and standard deviations (Mean± SD) of some important traits in honey bee breeds compared to Turkmen honey bee

Race	Hair length	Body size	Complete leg	Cubital index	Pig. T3
<i>A. ligustica</i>	27.66±1.89	439.12±9.87	796.82±10.84	2.54±0.19	8.00±0.60
<i>A. caucasica</i>	33.54±3.26	454.31±7.52	826.93±14.97	2.09±0.15	3.60±0.86
<i>A. armenica</i>	32.28±2.00	455.59±5.43	812.33±5.50	2.69±0.13	8.8±0.26
<i>A. meda</i>	27.95±2.79	435.34±10.82	781.89±15.31	2.50±0.23	8.46±0.57
<i>A. anatolica</i>	29.15±2.48	477.93±5.94	813.98±10.09	2.16±0.18	4.77±0.88
<i>Iraqis</i>	27.93±1.84	429.40±11.31	776.09±12.69	2.51±0.23	8.92±0.24
<i>A. turkmenistan</i>	24.97±1.91	421.73±8.22	787.94±9.74	2.16±0.21	8.45±0.35
<i>A. mellifera</i>	37.86±6.61	457.89±9.87	822.16±14.88	1.80±0.20	1.84±0.70
<i>A. carnica</i>	29.76±2.41	451.78±5.82	805.64±12.99	2.69±0.19	1.71±1.01
<i>A. syriaca</i>	22.27±3.77	419.70±13.20	787.84±14.44	2.24±0.29	8.56±0.43



Klusteranalyse der Quadrierten Distanzen zwischen den Zentroiden der Diskriminanzanalyse

Fig. 2: Cluster analyses distances between the centroids of the quad (discriminate analysis)

within the extensive distribution of *Mellifera* in accordance with the geographic laws (Rensch, 1936; Bergmann, 1848). The consequence of which is the morphologic changes in connection with their habitat (Goetze, 1940; Farshine Adl et.al. 2007; Tofilski, 2008; Meixner et al., 2011). Consequently, *Apis mellifera* (Turkmenica) is an outstanding example of that and the Turkmen bees could be considered as a separated ecotype from Iranian subspecies (*A. mellifera*).

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