



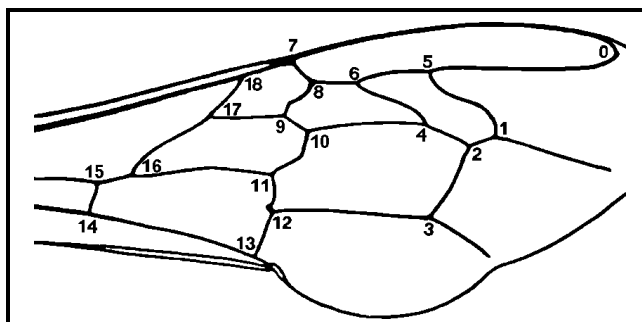
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MORPHOMETRICAL ANALYSIS AND TAXONOMETRICAL CLASSIFICATION OF HONEY BEES BY WING CHARACTERS

I. THE GENERAL DESCRIPTION

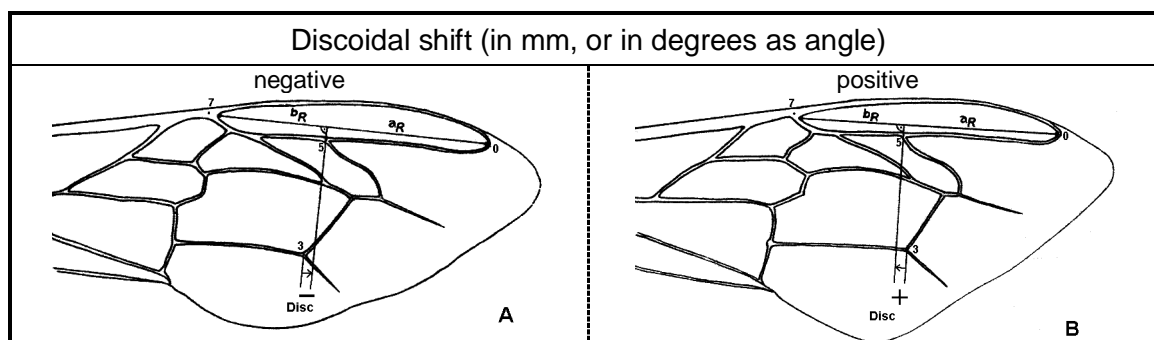
Description of the procedure

1. Wings are scanned.
2. XY co-ordinates of the following 19 points are measured on each wing of the complete wing set:



3. 30 wing characters are calculated on the basis of co-ordinates:

ANGLE	points	ANGLE	points	LENGTH	points	INDEX	points
A1	2;1;4	J10	6;9;10	Radial field	0;7	Cubital	2;4;1;2
A4	4;1;5	J16	8;9;18	A	2;4	Precubital	4;9;8;10
B3	1;4;3	K19	12;11;14	B	1;2	Dumb-bell	1;4;5;6
B4	1;4;5	L13	5;7;6	C	3;4	Radial	see p. 3
D7	4;3;13	M17	7;8;18	D	11;15	AREA OF 6 FIELDS	see p. 3
E9	6;5;10	N23	9;18;17	Inner length	1;14		
G7	3;13;4	O26	15;14;16	Inner width	7;13		
G18	12;13;14	Q21	11;16;17	Discoidal shift	see next picture		
H12	11;10;12					Area6 (mm ²)	see p. 3



4. DAWINO (Discriminant Analysis With Numerical Output) results are computed on the basis of the above defined characters.

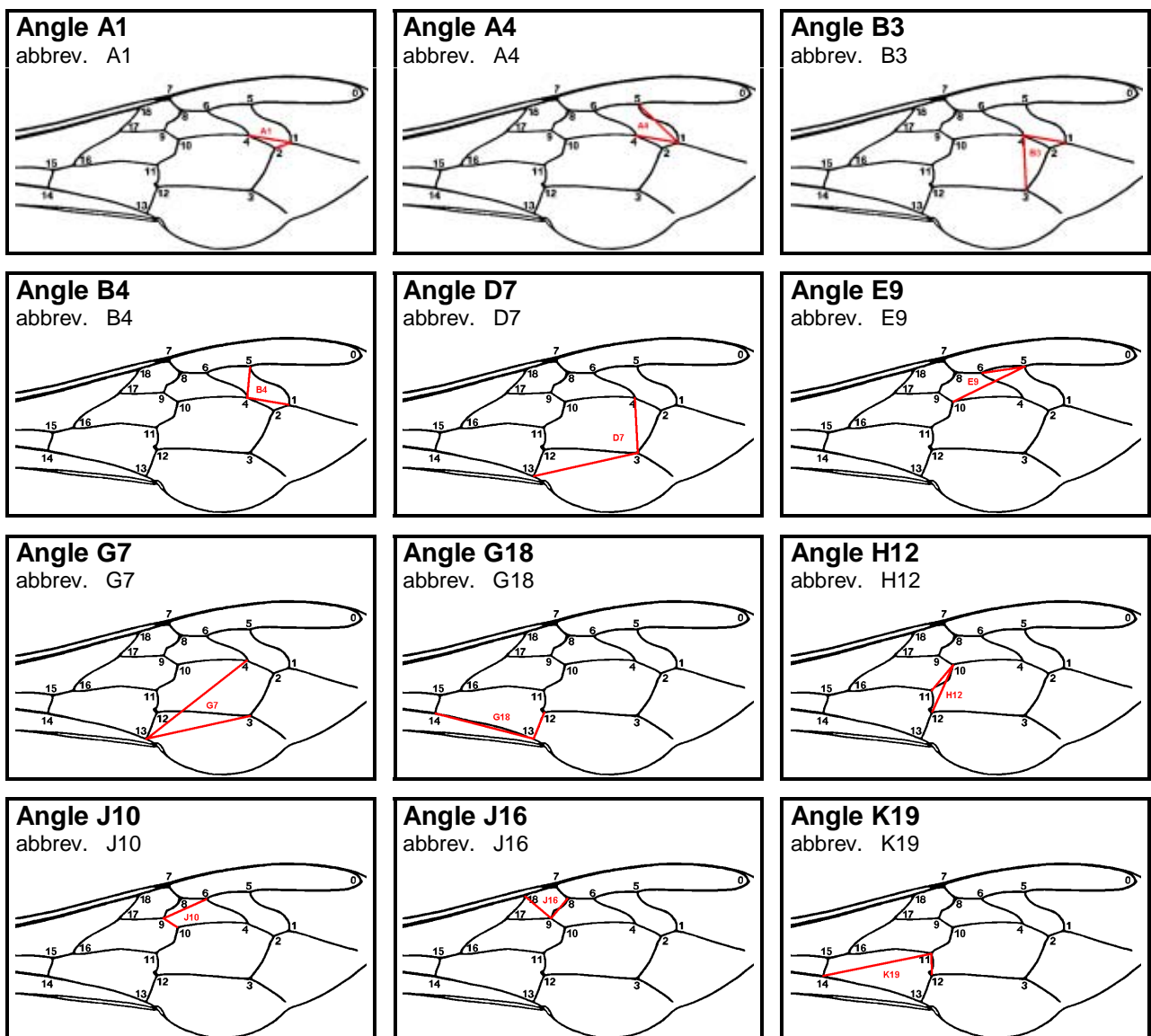
The principle of the sample classification with the DAWINO method is that the computation compares the whole wings design with racial standards by including 30 wing characters.

The computation runs similarly as by discriminant analysis. Centroids of each of races in standard is calculated from all 30 wing characters. Then the so called Mahalanobis distances are computed for tested sample between it and each race centroid. The sample is defined with greatest probability to that race which is most closed to, i.e. has shortest Mahalanobis distance to it and vice versa. Posterior Probabilities are computed on the basis of Mahalanobis Distances in the range 0 to 100 per cent. The sum of Posterior probabilities for all races in standard is 100.

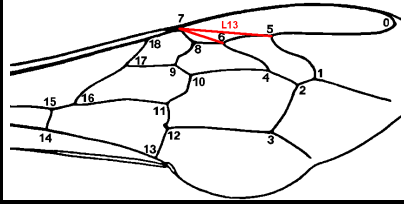
The **result of classification** is numeric data expressing the **similarity** (probability, in %) of the sample **to a race** in standard. High value for a race denotes that the sample belongs to that race, and vice versa. The probabilities of belonging to other races are summed and labeled "Other". (See protocol, first page below.)

Pictures of 30 wing characters

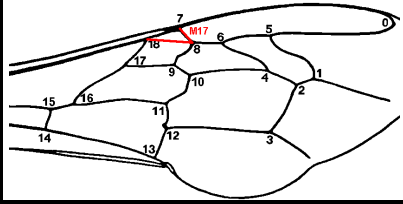
Notice: Abbreviations on the second lines are also used in tables in the protocol.



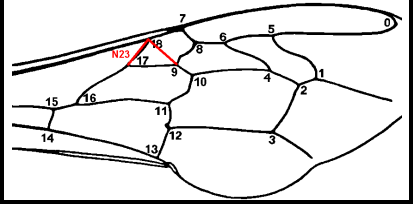
Angle L13
abbrev. L13



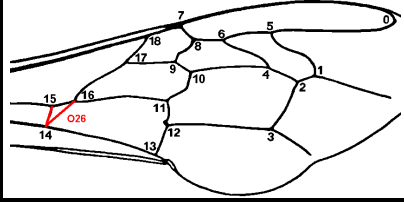
Angle M17
abbrev. M17



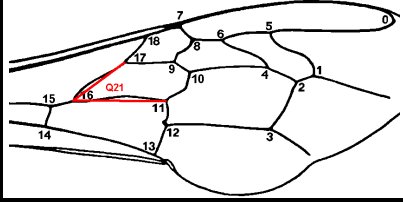
Angle N23
abbrev. N23



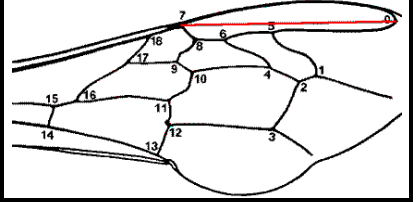
Angle O26
abbrev. O26



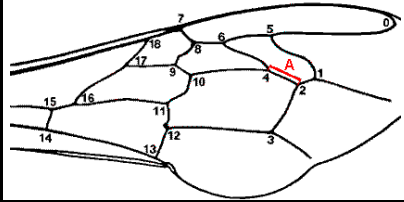
Angle Q21
abbrev. Q21



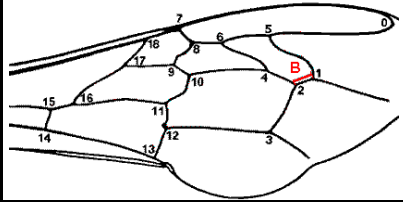
Radial field
abbrev. Radial f.



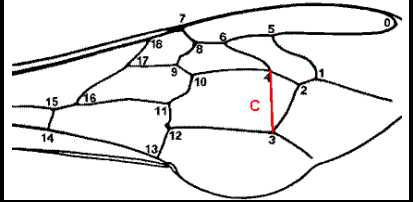
Length A
abbrev. Len. A



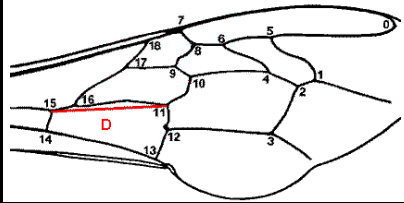
Length B
abbrev. Len. B



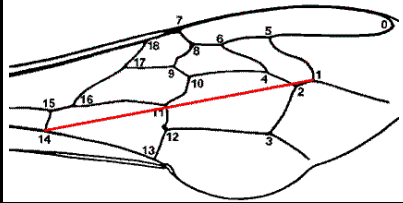
Length C
abbrev. Len. C



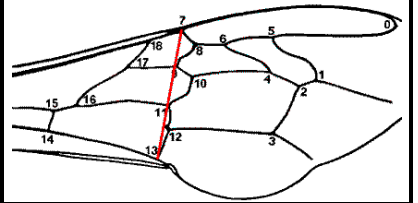
Length D
abbrev. Len. D



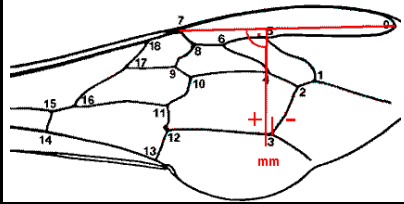
Inner wing length
abbrev. Inn. len.



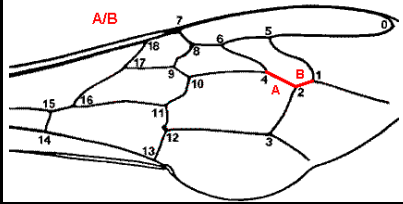
Inner wing width
abbrev. Inn. wid.



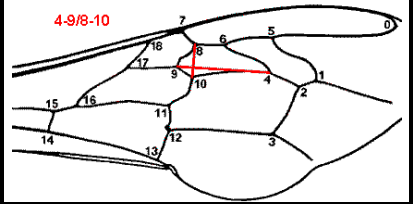
Discoidal shift
abbrev. Disc. sh.



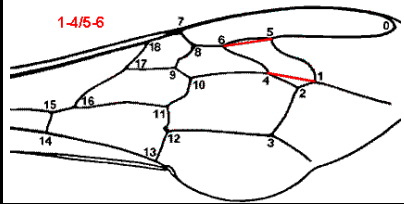
Cubital index
abbrev. Ci



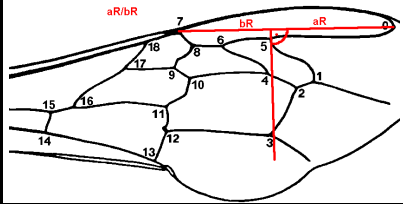
Precubital index
abbrev. Pci



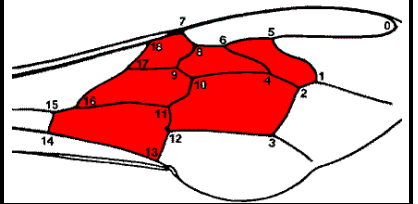
Dumb-bell index
abbrev. Dbi



Radial index
abbrev. Ri



Area of 6 fields
abbrev. Area6



II. PREPARATION OF WING SAMPLES

Collecting bees:

1. In case of collecting samples in the season (preferably):

Catch 30 young bees from a hive which are sure to originate from the colony (they have not flown yet), but not just after hatching from brood cells (their wings are still soft) and put them into a cage. Kill bees in a refrigerator. Then dry them.

2. In case of collecting samples in winter:

Collect 30 dry, clear (!) and not injured dead bees from the hive bottom board or catch live bees in the winter cluster. Put dead bees into a cage or small box or kill live bees as in case Nr. 1.

Preparing samples:

Tear out right-sided forewing from each dead bee from the body by holding it between two fingers as they may not broken. Insert wings from one hive together into a small bag for they could not rumple, close the bag and label with a unique number, beekeepers' name and/or address.

Sending samples:

Pack a few samples into envelope between two durable papers for the wings could not be deformed (important!) and send to:

***Bee Breeding Stn.,
P.O.Box 10,
CZ 756 54 ZUBRI 909,
Czech Republic***

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