African Bees: Taxonomy, Biology and Economic Use, ed. D.J.C. Fletcher. Pretoria: Apimondia. 207 pp. Proceedings of an Apimondia International Symposium held in Pretoria, South Africa, from 17-19 November, 1976.

THE DENSITY OF BRISTLES COVERING THE WINGS AS DISCRIMINATION VALUE BETWEEN AFRICAN AND OTHER RACES OF HONEY BEE

J. Woyke

Bee Division, Agricultural University, Warsaw, Ursynów, Poland

Introduction

It is difficult to distinguish between the African and European honey bees, especially between Apis mellifera adansonii and Apis mellifera ligustica (or hybrids of this race with other European races). A method of distinguishing between the South African A.m. adansonii imported to Brazil and A.m. ligustica in the USA is urgently needed.

More than 30 morphological characters of African bees from Brazil and Italian bees from the USA were measured or counted in our laboratory. Differences in the means were found but results of many measurements of individuals belonging to both races overlapped. The only character which clearly divided the two races was the density of bristles covering the front wing. Therefore, front wings of different races of worker honey bees originating from different countries were investigated in detail.

Materials and methods

A.m. adansonii was collected in Brazil, South Africa, Tanzania and Guinea. A.m. capensis and A.m. adansonii originate from South Africa. They were supplied by Dr. Fletcher. A.m. ligustica collected in Brazil originated from Dadants in the USA, and those collected in Poland originated from Prof. Laidlaw in California. Original Italian bees were supplied by Mr. Piana from Italy. Additionally A.m. carnica originating from Rumania and A.m. caucasica from Krasna Polana in USSR and A.m. mellifera from Poland were investigated. All three species of Indian honey bees originated from India.

The bristles covering the upper surface of the front wings were investigated. They were counted in the middle of the big discoidal cell on a surface of 0.8 mm x 0.5 mm = 0.4 mm^2 with the aid of a micrometric screen placed in a 10x eyepiece of a microscope giving a total magnification of 150x. Additionally, the cubital index was measured under the same magnification, and the length and width of front wing, using a stereoscopic microscope at a magnification of 16x. Wings of thirty workers from each colony were investigated.

Results

The number of bristles covering the investigated area of wings of workers from several colonies of different races were as shown in table 1. The highest number of bristles was found in A.m. capensis (mean 100). The wings of A.m. adansonii from Brazil and South Africa were covered with almost identical numbers of bristles (means 88 and 93 respectively). African bees from Central Africa (Tanzania and Guinea) had lower number of bristles (72 - 77) covering the wings. The number of bristles on the wings distinguished the two ecotypes, which could not be distinguished by other morphological measurements. (Table 2).

All the Italian bees had wings covered with a very low number of bristles (average 54-66). No overlapping occurred between the numbers of bristles covering the wings of African and Italian bees collected in Brazil, so the two races were easy to separate. Those with more than 80 bristles could be classified as African and below that number, as Italian. When distinguishing Italian bees from Central African bees, only those with less than 60 bristles can be classified as Italians.

Among the black European races, the lowest number of bristles (68) was found on the wings of the carniolans which is similar to that found in the Italians. The highest number was found in A. mellifera. There was no difficulty in distinguishing between the black European and African bees.

Table 1. No. of bristles covering the frong wing in different races of worker bees

Race	Queen No.	No. of bristles Range	Mean	Coeff. of variation	Mean for group
A.m. capensis	1	80-129	100.4	11	100.4
A.m. adansonii S. Africa	1	78-119	90.4	11	
	2	73-121	95.9	12	
	3	63- 96	77.8	11	
	4	76-100	86.8	7	87.7
A.m. adansonii Brazil	141	82-114	94.2	8	
	146	85-108	95.1	6	
	182	82-104	90.6	7	93.3
A.m. adansonii Tanzania	1	66- 89	70.6	7	
	2	68- 87	76.5	8	77.1
A.m. adansonii Guinea	1	62- 96	72.8	11	
	2	62- 90	71.3	12	
	3	61- 85	70.7	11	71.6
A.m. ligustica Brazil/Dadants	103	45- 64	54.9	9	
	154	41- 68	51.9	10	
	155	42- 66	54.9	15	53.9
A.m. ligustica California USA	2406	53- 78	63.3	12	
	2551	57- 81	67.0	8	
	2605	48- 63	56.3	7	62.2
A.m. ligustica Italy/Piana	9	61- 78	68.0	7	
	93	55- 73	64.2	7	
	98	55- 78	65.1	8	65.8

A.m.	35	67- 95	79.1	7	
mellifera	72	78-103	87.4	8	
Poland	77	71- 97	84.7	8	83.7
A.m.	2514	72- 94	80.4	10	
caucasica	2515	65- 84	73.3	7	
USSR	2354	71- 94	80.2	9	78.0
A.m.	2528	64- 78	69.2	5	
carnica	2286	61- 88	72.6	10	
Rumania	2526	51- 79	62.4	13	68.0
A. florea	1	47- 87	66.6	18	66.6
A. cerana	1	43- 54	46.6	7	
	2	37- 56	46.4	10	46.5
A. dorsata	1	150-178	165.2	4	165.2

Table 2. Comparison of the front wing of different bee races

Race of bee	No of Bristles	Size of wing Length	Width	Index
A.m. capensis	100.4	8.50	3.97	2.12
A.m. adansonii S. Africa	87.7	8.46	2.92	2.11
A.m. adansonii Brazil	93.3	8.73	3.01	2.13
A.m. adansonii Tanzania	77.1	8.52	2.96	2.20
A.m. adansonii Guinea	71.6	8.50	2.94	2.37
A.m. ligustica Brazil	53.9	9.22	3.16	2.26
A.m. ligustica USA	69.2	9.24	3.11	2.25
A.m. ligustica Italy	65.8	9.26	3.18	2.56
A.m. mellifera Poland	83.7	9.33	3.13	1.91
A.m. caucasica USSR	78.0	9.25	3.14	2.09
A.m. carnica Rumania	68.0	9.26	3.15	2.22 /2.45/
A. florea	66.6	6.21	2.14	3.20
A. cerana	46.5	8.45	2.98	4.32
A. dorsata	165.2	12.77	4.33	12.64

Table 3. No. of bristles on the front wing of the three castes of honey bee

Race	Drones	Workers	Queens
African	36.1	75.0	137.5
	32.3	77.1	135.3
	35.7	74.2	135.9
Italian	24.2	53.1	117.5
	-	46.4	88.6
	26.8	51.1	-
Backcross	29.6	65.4	129.5
	28.9	63.2	108.8
	28.8	62.5	99.1

Table 4. Length of wings of different races of worker bees

Race	Queen No.	Range	Mean	Coeff. of variation	Mean for group
A.m. capensis	1	8.4-8.7	8.5	1	8.5
A.m. adansonii S. Africa	1	8.3-8.7	8.5	1	
	2	8.2-8.7	8.4	1	
	3	8.3-8.7	8.5	1	
	4	8.3-8.6	8.5	1	8.5
A.m. adansonii Brazil	141	8.4-9.0	8.7	2	
	146	8.2-9.0	8.7	2	
	182	8.7-9.0	8.8	1	8.7
A.m. adansonii Tanzania	1	8.1-8.7	8.5	1	
	2	8.2-8.9	8.5	1	8.5
A.m. adansonii Guinea	1	8.4-8.7	8.5	1	
	2	7.9-8.6	8.4	2	
	3	8.4-8.7	8.6	1	8.5

A.m.	103	8.8-9.6	9.4	1	
ligustica	154	8.9-9.3	9.1	1	
Brazil	155	9.1-9.3	9.2	1	9.2
A.m.	2406	9.1-9.5	9.3	1	
ligustica	2551	8.8-9.4	9.0	2	
California USA	2605	9.3-9.6	9.5	1	9.2
A.m.	9	9.1-9.4	9.2	1	
ligustica	93	9.1-9.5	9.3	1	
Italy/Piana	98	9.1-9.4	9.2	1	9.2
A.m.	35	9.2-9.5	9.3	1	
mellifera	72	9.2-9.5	9.3	1	
Poland	77	9.2-9.6	9.4	1	9.3
A.m.	2514	9.1-9.6	9.3	1	
caucasica	2515	9.0-9.5	9.3	1	
USSR	2354	8.9-9.4	9.1	1	9.2
A.m.	2528	9.0-9.3	9.2	4	
carnica	2286	9.3-9.6	9.5	5	
Rumania	2526	9.0-9.3	9.1	8	9.3
A. florea	1	6.1-6.3	6.2	1	6.2
A. cerana	1	8.3-8.7	8.5	2	
	2	8.3-8.7	8.5	1	8.5
A. dorsata	1	12.6-13.0	12.8	1	12.8

Table 5. Width of wings of different races of worker bees

Race	Queen No.	Range	Mean	Coeff. of variation	Mean for group
A.m. capensis	1	2.8-3.1	3.0	3	3.0
A.m.	1	2.8-3.0	2.9	2	
adansonii	2	2.8-3.0	2.9	1	
S. Africa	3	2.8-3.0	2.9	2	
	4	2.8-3.0	2.9	2	2.9

A.m.	141	2.8-3.1	3.0	2	
adansonii	146	2.9-3.1	3.0	1	
Brazil	182	3.0-3.1	3.0	1	3.0
A.m.	1	2.8-3.1	2.9	2	
adansonii	2	2.8-3.1	3.0	2	3.0
Tanzania					
A.m.	1	2.9-3.1	3.0	2	
adansonii	2	2.8-3.1	2.9	2	
Guinea	3	2.8-3.1	2.9	2	2.9
A.m.	103	3.1-3.3	3.1	2	
ligustica	154	3.1-3.4	3.2	2	
Brazil	155	3.1	3.1	0	3.1
A.m.	2406	3.0-3.2	3.1	2	
ligustica	2551	2.9-3.1	3.0	2	
California	2605	3.1-3.3	3.2	2	3.1
A.m.	9	3.1-3.4	3.2	2	
ligustica	93	3.1-3.3	3.2	2	
Italy/Piana	98	3.1-3.3	3.2	2	3.2
A.m.	35	3.0-3.2	3.1	2	
mellifera	72	3.0-3.2	3.1	2	
Poland	77	3.0-3.3	3.1	2	3.1
A.m.	2514	3.0-3.3	3.1	2	
caucasica	2515	3.1-3.3	3.2	2	
USSR	2354	3.0-3.2	3.1	2	3.1
A.m.	2528	3.1-3.2	3.1	2	
carnica	2286	3.1-3.2	3.2	1	
Rumania	2526	3.0-3.3	3.1	2	3.1
A. florea	1	2.0-2.2	2.1	3	2.1
A. cerana	1	2.9-3.1	3.0	2	
	2	2.9-3.1	3.0	2	3.0
A. dorsata	1	4.2-4.5	4.3	2	4.3

Table 6. Index of wings of different races of worker bees

Race	Queen No.	Range	Mean	Coeff. of variation	Mean for group
A.m. capensis	1	1.6-2.6	2.1	11	2.1
A.m.	1	1.7-2.6	2.1	13	
adansonii	2	1.6-2.6	2.0	11	
S. Africa	3	1.4-2.8	2.2	15	
	4	1.5-2.4	2.1	14	2.1
A.m.	141	1.8-2.7	2.1	8	
adansonii	146	1.9-2.7	2.2	10	
Brazil	182	1.4-2.2	1.8	11	2.0
A.m.	1	1.5-2.7	2.1	13	
adansonii	2	1.8-2.7	2.3	10	2.2
Tanzania					
A.m.	1	2.0-3.4	2.5	12	
adansonii	2	1.6-2.6	2.3	11	
Guinea	3	1.5-3.5	2.4	16	2.4
A.m.	103	1.8-2.6	2.1	12	
ligustica	154	2.1-2.9	2.4	17	
Brazil	155	2.1-2.5	2.3	8	2.3
A.m.	2406	1.7-3.2	2.4	15	
ligustica	2551	2.0-2.7	2.3	6	
California USA	2605	1.5-2.6	2.1	13	2.3
A.m.	9	2.1-3.0	2.5	9	
ligustica	93	2.2-2.9	2.6	9	
Italy/Piana	98	2.3-3.1	2.6	8	2.6
A.m.	35	1.5-2.2	1.8	8	
mellifera	72	1.5-2.3	1.9	9	
Poland	77	1.6-2.7	2.0	12	1.9
A.m.	2514	1.7-2.5	1.9	13	
caucasica	2515	1.9-2.7	2.4	9	
USSR	2354	1.4-2.3	2.0	12	2.1

A.m. carnica	2528	2.2-3.0	2.5	13	
	2286	1.4-2.3	1.8	11	
Rumania	2526	2.1-3.0	2.4	8	2.2
A. florea	1	2.4-3.8	3.2	3	3.2
A. cerana	1	3.3-5.8	5.0	14	
	2	3.2-4.4	3.7	11	4.3
A. dorsata	1	9.0-20.0	12.6	30	12.6

Of the Indian bees, the number of bristles on the wings of A. cerana was the lowest (average 47). The number on A. florea wings (67) was similar to the number found in Italian bees. The wings of A. dorsata were covered with an extremely high number of bristles (165).

All the ranges as well as the means were changed only very little when, instead 30 bees, only the 10 first were taken into consideration.

When the wings of drones, workers and queens originating from the same queen were compared, the number of bristles on the wings of the queens was almost twice as high as in the workers, but the drones had only half the number found in the workers (Table 3). Thus, a valuable character for identifying different races and lines was found. More investigation is necessary to find the range of variation in different lines and races.

All the African bees, including A.m. capensis, had smaller wings than the European bees. The mean length of the front wing of the African bees was below 8.75 mm, while those of the European bees was above 9.10 mm (table 4). The mean width of the front wings of all the African bees was 3.00 mm. or less, while that of the European bees was 3.10 mm, or more. (Table 5).

The cubital index, which is widely used for characterization of different races and breeding lines of honey bees, was useless, since most of the values found, overlapped among the various bee races investigated. (Table 6) Only the Indian bees had very high indexes with extreme

values in A. dorsata. The mean was here 13 but in some workers it even reached 20.

Thus the best character for distinguishing between the African and the other bee races is the density of bristles covering the front wings of a bee.