MORPHOMETRICS OF WORKERS OF INDIAN HONEY BEE, *Apis cerana* F. IN GUJARAT

***PATIL P.N. AND PASTAGIA J. J.**

DEPARTMENT OF ENTOMOLOGY
N. M. COLLEGE OF AGRICULTURE
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI - 396 450, GUJARAT, INDIA

****E-MAIL: aayoj2000@yahoo.com***

ABSTRACT

The studies on the morphometrics of worker bees of Indian honey bee, Apis cerana Fabricius were made at Navsari Agricultural University, Navsari, Gujarat. The honeybee foragers were collected from the hive entrance, preserved in alcohol and care fully dissected to study the various morphometric parameters. Total twenty four morphological parameters were studied. The mean body length of A. cerana was 13.18 mm, head length was 3.15 mm, antennal length was 3.82 mm, tongue length was 4.62 mm, postmentum length was 0.33 mm, prementum length was 1.48 mm, thorax length was 4.35 mm and thorax breadth was 3.61 mm, forewing length was 7.70 mm and forewing breadth was 2.64 mm, hindwing length was 5.22 mm and hindwing breadth was 1.74 mm, extent of hamuli was 1.23 mm, number of hamuli was 17.61, hind leg length was 8.49 mm and hind leg breadth was 1.16 mm, abdomen length was 6.11 mm and the length of sterna-I to VI was 1.04, 1.11,1.27, 1.52, 1.58 and 1.82 mm, respectively. Sting length of A. cerana was 1.84 mm.

KEY WORDS: Apis cerana, honey bee, morphological characters

INTRODUCTION

The Indian or the Asiatic or the Eastern honey bee, *Apis cerana* Fabricius are small honeybees of Southern and Southeastern Asia, such as China, India, Japan, Malaysia, Nepal, Bangladesh and Papua New Guinea (Abrol, 2009). The Engel (1999) given the subspecies of *A. cerana* as *A. cerana cerana*, *A. cerana heimefeng, A. cerana indica, A. cerana japonica, A. cerana javana, A. cerana johni, A. cerana muluensis* and *A. cerana skorikovi*. *A. cerana* constructs parallel combs in dark enclosures such as caves, rock cavities and hollow tree trunks. The species is widely domesticated which stores sealed ripe honey and susceptible to wax moths. The various parameters on morphometrics of *A. cerana* have been studied across the country from Himalaya to Kanyakumari to Andaman Island by different workers. Venkatasubbaya (1938) from Mysore; Ratnam (1939) from Madras; Rahman and Singh (1948) from hills of North India; Kapil (1956) from North India; Narayanan *et al.* (1961) from South India; Deodikar (1962) from Mahabaleshwer, Maharastra; Kshirsagar and Ranade (1981) from Kashmir and Himachal region of Himalaya; Kumari (1987) Himachal, Kashmir and Manipur region of

Himalaya; Singh *et al.* (1989) from North - East and North -West Himalaya; Makhoor and Ahmed (1998) from Jammu, North India, Ananda (2000) from different locations in Karnataka and Pal *et al* (2008) from different locations in Orissa. The information on the various morphological parameters of *A. cerana* for Gujarat is not available. Therefore, to generate the data base on morphological parameters of *A. cerana*, this study has been undertaken at Navsari Agricultural University, Navsari, Gujarat.

MATERIALS AND METHODS

The study on the morphometrics of worker bees of Indian honey bee, *Apis cerana* F. was made at Navsari Agricultural University, Navsari, Gujarat. For the purpose, fifty worker bees were collected from their hive entrance. The collected bees were killed in acetone to ensure full extension of external parts of the body and preserved in 70 per cent alcohol. The samples were carefully dissected in the Bio-control Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, NAU, Navsari for studying their morphometrics. Measurements of 24 morphometric characters were made with the help of standardized ocular micrometer placed in one of the eyepiece of a stereoscopic binocular microscope after due calibration with stage micrometer. The size of the bigger parts was measured with the help of graph paper. The measurement of length of body, antennae, tongue, prementum, postmentum, abdominal sterna I to VI and sting; length and breadth of thorax, forewing, hind wing and hind leg as well as extent and number of hamuli were recorded.

RESULTS AND DISCUSSION

The data on the measurements of various parts of the worker bees of the *A. cerana* are presented in Table 1.

The observation on body length of workers of *A. cerana* indicated that it varied from 13.16 mm to 13.22 mm with an average of 13.18 ± 0.017 mm. Ananda (2000) recorded that the body length of *A. cerana* varied from 10.47 mm to 13.43 mm at different locations in Karnataka, which is in confirmation to present findings. The head length varied from 3.02 to 3.48 mm with an average of 3.15 ± 0.215 mm. The antennal length varied from3.80 mm to 3.86 mm with an average of 3.82 ± 0.021 mm. The present findings are very close to those of Pal *et al.* (2008), who reported the mean antennal length as 3.90 mm. Similarly, Ananda (2000) also reported the length of antenna varied from 3.32 mm to 4.08 mm at different locations in Karnataka.

The tongue length varied from 4.60 mm to 4.64 mm with an average of 4.62 ± 0.015 mm. Earlier researchers have reported the tongue length to be of 4.75 mm (Venkatasubbaya, 1938), 4.397 mm (Ratnam, 1939), 4.84 mm (Rahman and Singh, 1948), 4.40 to 4.84 mm (Narayanan *et. al*., 1961) and 3.97 to 5.02 mm (Ananda, 2000), which more or less tally with the report. However, the tongue length is also reported as 5.076 mm (Kapil, 1956), 5.16 mm (Deodikar, 1962), 6.18 mm (Makhoor and Ahmad, 1998) and 2.60 to 3.66 mm (Pal *et. al*., 2008), which differed from present report. The difference in tongue length as reported above might be due to geographical variation at different locations.

The postmentum length varied from 0.32 mm to 0.35 mm with an average of 0.33 ± 0.008 mm. The present findings are more or less similar to those reported by Ananda

(2000), who reported the postmentam length 0.20 mm to 0.37 mm in different locations of Karnataka. The prementum length varied from 1.48 mm to 1.50 mm with an average of 1.48 ± 0.044 mm. Ananda (2000) reported the highest prementum length (1.54 mm) of worker bees from Bhagamandala, whereas the shortest prementum length from Raichur (1.48 mm) in the area of Karnataka which tally with the present findings.

The thorax length varied from 4.34 mm to 4.37 mm with an average of 4.35 ± 0.021 mm. The present findings are similar to those reported by Ananda (2000), who reported the thorax length 4.01 mm to 4.64 mm in different locations of Karnataka. The thorax breadth varied from 3.60 mm to 3.63 mm with an average of 3.61 ± 0.009 mm. According to Ananda (2000), the thorax breadth varied from 3.61 to 4.24 mm at different locations of Karnataka, which is close to present findings. However, Pal *et al*. (2008) reported the thorax width ranges from 2.91 to 3.45 mm with a mean of 3.07 ± 0.15 in different locations of Orissa which differs from the present findings.

The observations on the length of forewing of *A. cerana* indicated that it varied from 6.69 mm to 7.72 mm with an average of 7.70 ± 0.433 mm. The present findings are more or less similar to those reported by Deodikar (1962) and Ananda (2000), while the present findings differ from those reported by Kapil (1956), Makhoor and Ahmad (1998) and Pal *et al.* (2008), who reported longer length of forewing. The difference as reported by above researchers might be due to geographical variations in different locations. The breadth of forewing varied from 2.62 mm to 2.66 mm with an average of 2.64 ± 0.010 mm. The present findings are more or less similar to those reported by Ananda (2000) who reported that the fore wing breadth varied from 2.47 mm to 3.77 mm at different locations in Karnataka, while Pal *et al*. (2008) reported that it is varied from 2.89 to 3.00 mm at different locations in Orissa. The hindwing length varied from 5.20 to 5.24 mm with an average 5.22 ± 0.013. The present findings are more or less similar to those reported by Ananda (2000) who reported it to be varied from 4.19 mm to 5.62 mm at different locations of Karnataka, while Makhoor and Ahmad (1998) reported it as 6.49 mm from Jammu which differs from the present findings. The hindwing breadth varied from 1.73 mm to 1.76 mm with an average of 1.74 ± 0.010 mm. The present findings are more or less in confirmation to those reported by Ananda (2000), who recorded the hindwing breadth varied from 1.37 mm to 2.07 at different locations in Karnataka. Pal *et al*. (2008) reported hindwing breadth ranging from 1.61 to 2.00 mm with a mean of 1.86 ± 0.12 in Orissa. The observations on the extent of hamuli indicated that it varied from 1.22 mm to 1.24 mm with an average of 1.23 ± 0.007 mm. The extent of hamuli was reported to be varied from 1.03 to 1.40 mm at different locations of Karnataka by Ananda (2000) and 1.06 to 1.22 mm with a mean of 1.17 mm from different locations of Orissa by Pal et al. (2008), which confirm the present findings on extent of hamuli of *A. cerana*. The number of hamuli of *A. cerana* varied from 17.00 to 18.00 with an average of 17.61 ± 0.49. The present findings are more or less similar to those reported by Kapil (1956), who reported the mean number of hamuli of workers as 18.05 mm and 18.00 mm, respectively for Hill and Plains variety. Deodikar (1962) recorded it to be varied from 16.00 to 21.00 with a mean of 17.20 at

Mahabaleshwar plateau, Maharashtra. Narayanan *et al*. (1961) recorded the average number of hamuli as 16.91 in the southern hill, 18.25 in the hill plains and 17.56 in the plains of Uttar Pradesh.

The hindleg length varied from 8.18 to 9.02 mm with an average of 8.49 ± 0.51 mm. The present findings are similar to those reported by Pal *et al.* (2008), who reported that the mean hindleg length was 8.44 ± 0.31 mm in Orissa. The hindleg breadth varied from 1.13 to 1.22 mm with an average of 1.16 ± 0.007 mm.

The abdomen length varied from 6.04 to 6.46 with an average of 6.11 ± 0.202. The observation on the length of abdominal sterna indicated that the sterna I varied from 1.03 mm to1.05 mm with an average of 1.04 ± 0.008 mm; sterna II varied from 1.10 mm to1.12 mm with an average of 1.11 ± 0.008 mm; sterna III varied from 1.26 mm to 1.28 mm with an average of 1.27 ± 0.008 mm; sterna IV varied from 1.51 mm to 1.53 mm with an average of 1.52 ± 0.007 mm; sterna V varied from 1.58 mm to 1.60 mm with an average 1.58 ± 0.007 mm and sterna VI varied from 1.80 mm to 1.83 mm with an average of 1.82 ± 0.010 mm. The sting length varied from 1.84 mm to 1.85 mm with an average of 1.84 ± 0.05 mm. Ananda (2000) reported that the sting length varied from 1.56 to 1.96 mm at different locations in Karnataka which is in confirmation to present findings.

CONCLUSION

From the results, it can be concluded that some variation was observed in the morohometric observations of *A. cerena* in Gujarat, which might be due to geographical variation.

REFERENCES

Abrol, D. P. (2009). Distinguishing Characters of the Cavity Nesting Honeybees. In Bees and Beekeeping in India. Kalyani Publishers, Ludhiana. pp 80-81.

Ananda, M. R. (2000). Studies on morphometric characters and behavioural traits of Indian honeybee, *Apis cerana indica* Fabricius from different locations of Karnataka. M.Sc. thesis (Unpublished) submitted to University of Agricultural Sciences Banglore.

Deodikar, G. B. (1962). Research at apicultural laboratory. *Indian Bee J.*, **24**: 83-91.

Engle, M. S. (1999). The taxonomy of recent and fossil honeybees (Hymenoptera: Apidae: Apis). *J. Hymenopt. Res*., **8**: 165-176.

Kapil, R. P. (1956). Variations in the biometrical characters of the Indian honey bee, *Apis cerana* F. *Indian J. Ent*., **18**: 440-457.

Kshirsagar, K. K. and Ranade, D. R. (1981). Morphometric characters of Indian hive bee. *Apis cerana* indica F. (Apidae: Hymenoptera) worker. *J. Univ. Pune. Sci. Tech. Section*, 54: 101-120.

Kumari (1987). Morphometry of Indian hive bee, *Apis cerana* indica F. of Andaman Islands. M. Phil. Thesis (Unpublished) submitted to Himachal Pradesh University, Shimla, India.

Makhoor, H. D. and Ahmad, H. (1998). Biometric studies on four species of honey bee in Jammu region, India. *Indian Bee J*., **60**(3): 141-142.

Narayanan, E.S., Sharma, P. L. and Phadke, K.G. (1961). Studies on biometry of the Indian bees 3.Tongue length and number of hooks on the hind wings of

Apis cerana F. collected from Madras state. *Indian Bee J*., **23**: 3-9.

Pal, S., Pataink, H.P. and Satapathy C.R. (2008). Morphometric diversity in *Apis cerana* indica F. worker bees of Orissa. *J. Plant Prot. Environ*., 5(2): 42-51.

Rahman, K. A. and Singh, S. (1948). Preliminary studies in the bionomics of *Apis cerana* indica. *Indian J. Ent*. **10**(1):63-73.

Ratnam, R. (1939). Preliminary study in the biometric variations in the Indian honey bees. *Madras Agric. J.*, **27**(12): 432-439.

Singh, M. P., Verma, L. R. and Daly, H. V. (1989). Morphometric analysis of the Indian honey bee in the North-East Himalayan region. *J. Apic. Res*. **8**: 20-24.

Venkatasubbaya, N. (1938). Variations in the tongue length of the honey bees. *J. Mys. Agric. Expt. Union.*, **17**(2): 65-72.

Table 1: Morphometrics of the worker bees of Indian honey bee *A. cerana* in Gujarat

(n = 50)

Sr. No.	Character	Min (mm)	Max (mm)	Mean ± S.D. (mm)
1	Body length	13.16	13.22	13.18 ± 0.017
2	Head length	3.02	3.48	3.15 ± 0.215
3	Antennal length	3.80	3.86	3.82 ± 0.021
4	Tongue length	4.60	4.64	4.62 ± 0.015
5	Postmentum length	0.32	0.35	0.33 ± 0.008
6	Prementum length	1.48	1.50	1.48 ± 0.044
7	Thorax length	4.34	4.37	4.35 ± 0.021
8	Thorax breadth	3.60	3.63	3.61 ± 0.009
9	Forewing length	6.69	7.72	7.70 ± 0.433
10	Forewing breadth	2.62	2.66	2.64 ± 0.010
11	Hindwing length	5.20	5.24	5.22 ± 0.013
12	Hindwing breadth	1.73	1.76	1.74 ± 0.010
13	Extent of hamuli	1.22	1.24	1.23 ± 0.007
14	Number of hamuli	17.00	18.00	17.61 ± 0.49
15	Hind leg length	8.18	9.02	8.49 ± 0.51
16	Hind leg breadth	1.13	1.22	1.16 ± 0.007
17	Abdomen length	6.04	6.46	6.11 ± 0.202
18	Abdomen sterna length-I	1.03	1.05	1.04 ± 0.008
19	Abdomen sterna length-II	1.10	1.12	1.11 ± 0.008
20	Abdomen sterna length-III	1.26	1.28	1.27 ± 0.008
21	Abdomen sterna length-IV	1.51	1.53	1.52 ± 0.007
22	Abdomen sterna length-V	1.58	1.60	1.58 ± 0.007
23	Abdomen sterna length-VI	1.80	1.83	1.82 ± 0.01
24	Sting length	1.84	1.85	1.84 ± 0.05

[MS received: April 2, 2014] ***[MS accepted: May 19, 2014]***