

Morphometric variation in workers of stingless bees *Tetragonula laeviceps* smith in south Gujarat

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ABSTRACT

The studies on the morphometric variations in workers of stingless bees *T. laeviceps* available in South Gujarat was carried out at Bio-control Laboratory, Department of Entomology, N.M. College of Agriculture, N. A. U., Navsari. For the purpose, worker bees were collected from seven district of the south Gujarat and dissected for studying the morphological variations if any by measuring different fifteen body parts. The significant variations were observed in to all body parts except tongue length and number of hamuli in bees collected from different districts of south Gujarat. The mean body length of *T. laeviceps* varied from 3.50 mm (Dang) to 3.88 mm (Narmada) with an average of 3.67 mm; head length varied from 0.72 mm (Valsad) to 1.01 mm (Bharuch) with an average of 0.84 mm, antennal length varied from 1.62 mm (Valsad) to 1.88 mm (Bharuch) with an average of 1.72 mm, tongue length varied from 1.11 mm (Bharuch) to 1.12 mm (Narmada) with an average of 1.11 mm, thorax length varied from 1.35 mm (Bharuch) to 1.78 mm (Narmada) with an average of 1.45 mm and thorax breadth varied from 1.30 mm (Navsari) to 1.41 mm (Narmada) with an average of 1.37 mm, forewing length 2.79 mm (Tapi) to 3.31 mm (Bharuch) with an average of 3.09 mm and forewing breadth varied from 0.96 mm (Tapi) to 1.21 mm (Surat) with an average of 1.10 mm, hindwing length was varied from 2.06 mm (Dang) to 2.37 mm (Navsari) with an average of 2.21 mm and hindwing breadth 0.50 mm (Valsad and Tapi) to 0.71 mm (Narmada) with an average of 0.56 mm, extent of hamuli varied from 0.14 mm (Dang) to 0.17 mm (Narmada) with an average of 0.15 mm, hindleg length varied from 3.32 mm (Dang) to 3.95 mm (Navsari) with an average of 3.52 mm and hindleg breadth varied from 0.29 mm (Narmada) to 0.46 mm (Navsari) with an average of 0.39 mm and abdomen length varied from 1.30 mm (Dang) to 1.70 mm (Bharuch) with an average of 1.44 mm.

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INTRODUCTION

Stingless bees or dammar bees are the non -*Apis* bees. They do not belong to genus *Apis* but they do collect nectar and pollen like honeybees and they are helpful in pollinating small flowers. They are distributed in tropics and subtropics even in temperate region. They built their nests in dark enclosures like cavities in branches or trunk of trees, anthills, termite tunnels in ground, wall crevices or any abandoned receptacles like logs, pots, tins etc. Stingless bees belong to the super family *Apoidea*, family *Apidae* and sub family *Meliponinae*. It consists of two genera *Melipona* and *Trigona* which belongs to the tribe *Meliponini* and *Trigonini*, respectively. *Meliponinae* includes eight genera, having 15 sub-genera and more than 500 species (Wille, 1983).

Recently, a new reference book on stingless bees was published in January 2013 called 'Pot-honey: a legacy of stingless bees.' Professor Michener contributed a chapter to this book in which he outlined a new classification for all the stingless bees, based on current scientific knowledge. In this new classification, the large genus *Trigona* has been split up into nine smaller genera and *Trigona* bees have all been placed in a genus called *Tetragonula* (Patricia *et al.*, 2013). *Tetragonula laeviceps* Smith was first originally described from Ceylon by Smith in 1954. The studies on various aspects morphology of stingless bees were made by Devanesan *et al.* (2003); Araujo *et al.* (2004); Kuberappa *et al.* (2005); Patnaik and Prasad (2007); Danaraddi and Shashidhar (2009); Devanesan *et al.* (2009) and Pallavi (2011). No information is available on morphometrics of stingless bees *Tetragonula laeviceps* in Gujarat as well as in India. Large numbers of colonies of stingless bee are available in south Gujarat so to find out variations if any in morphology of bees available in different districts of south Gujarat.

MATERIAL AND METHODS

The studies on the mophometrics of workers of stingless bees *T. laeviceps* collected from different districts of south Gujarat was carried out at Bio-control Laboratory, Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari. For the purpose, 50 workers bees were collected separately from seven district *viz.*, Bharuch, Narmada, Surat, Navsari, Valsad, Tapi and the Dangs of the south

Gujarat. The collected bees were killed in acetone to ensure full extensions of external part of the body and preserved in 70 per cent alcohol. The collected samples were carefully dissected for studying their morphometric parameters. Measurements of morphological characters were made with the help of Stereo Trinocular microscope Olympus- SZ (16) fitted with Brand Catcam-130 camera having software Power Scope Photo. The size of bigger parts was measured with the help of advanced microscope. The data collected on morphometric variations of worker bees collected from seven districts were analyzed using RBD making group of ten bees as one replication. The observations on body length, head length, antennal length, tongue length, thorax length, thorax breadth, fore wing length, fore wing breadth, hind wing length, hind wing breadth, extent of hamuli, number of hooks, hind leg length and abdomen length were taken.

RESULTS AND DISCUSSION

The data on measurements of various parts of the worker bees of the *T. laeviceps* are presented in Table 1. The analysis of data recorded on various body parts of *T. laeviceps* in different districts of South Gujarat revealed that there was significant difference existed in each body part in different districts except tongue length and number of hamuli.

The significantly the highest body length was observed in bees of Narmada district (3.88 mm) which was at par with that of Valsad district (3.82 mm). The next in order was Bharuch district (3.71 mm), Surat district (3.69 mm) and Tapi district (3.64 mm). The significantly minimum body length was recorded in the Dang district (3.50 mm). Danaraddi and Shashidhar (2009) reported no significant variation in body length of *Trigona irridipennis* in different places in Karnataka which differs from the present finding. However, the measurement of body length is more or less similar to those reported by Danaraddi and Shashidhar (2009). Devanesan *et al.* (2003) and Kuberappa *et al.* (2005) reported that the bees from hilly zones were bigger while from central dry zone were smaller.

The head length was observed significantly highest in bees of Bharuch and Narmada district (1.01 mm) which was followed by bees of the Dangs (0.84 mm) and Navsari districts (0.78 mm). The significantly minimum body length was recorded in bees of Valsad district (0.72 mm) which was at par with that of Surat

(0.73 mm) and Tapi district (0.76 mm). Danaraddi and Shashidhar (2009) reported that there was no significant difference in head length of *T. iridipennis* from different places in Karnataka and the length of head was varied from 1.52 to 1.61 mm in Karnataka.

The data recorded on antennal length revealed that the significantly highest antennal length was observed in bees of Bharuch district (1.88 mm) which was followed by Surat (1.82 mm), Navsari (1.79 mm) and Narmada districts (1.74 mm). The significantly minimum antennal length was recorded in bees of Tapi district (1.45 mm) which was followed by Valsad district (1.62 mm). The present findings are more or less similar to those reported by Patnaik and Prasad (2007) who recorded the length of antennae of *T. iridipennis* as 1.39 mm in Orissa. Devanesan *et al.* (2009) reported that the mean antennal length of workers of *T. iridipennis* was 2.57 mm.

The data recorded on tongue length revealed that there was no any significant difference in tongue length of bees in different districts. The tongue length was observed in bees of Narmada, Surat, Navsari and Valsad districts as 1.12mm while in Bharuch, Tapi and the Dangs it was 1.11 mm. Devanesan *et al.* (2009) reported tongue length of *T. iridipennis* as 1.38 mm in Kerala. Danaraddi and Shashidhar (2009) reported that the proboscis length of *T. iridipennis* collected from different places in Karnataka showed no significant variation however, it

ranged from 1.30 mm (Bangalore) to 1.41 mm (Raichur).

The data recorded on thorax length revealed that thorax length was significantly highest in bees of Narmada district (1.78 mm). The significantly minimum thorax length was recorded in bees of Tapi and Bharuch districts (1.35 mm) which was at par with that of Surat (1.39 mm), the Dangs (1.40 mm), Valsad (1.41 mm) and Navsari districts (1.43 mm). Danaraddi and Shashidhar (2009) reported that there was no significant difference in thorax length in *T. iridipennis* from different districts however; it varied from 1.38 mm to 1.61 mm at different places of Karnataka. Further, the significantly highest thorax breadth was observed in bees of Narmada, Surat and the Dangs districts (1.41mm) which was at par with bees of Bharuch district (1.36mm). The thorax breadth of bees of Bharuch district was at par with that of Valsad district (1.34 mm), Tapi district (1.32 mm) and Navsari district (1.30 mm). Danaraddi and Shashidhar (2009) reported that thorax breadth varied from 1.40 to 1.61 mm in *T. iridipennis* in different district of Karnataka without any significant variations.

The significantly highest forewing length was observed in stingless bees of Bharuch district (3.31mm) which was at par with Navsari district (3.21mm) followed by the Dangs (3.15 mm) and Surat districts (3.12 mm). The significantly minimum forewing length was recorded in stingless bees of Tapi district (2.79 mm). The present findings tally with those reported by Patnaik

Table 1 : Morphometrics of stingless bees, *Tetragonula laeviceps* Smith workers in different districts of south Gujarat

Characters	Measurement of characters of workers (mm) collected from different districts							Mean	S.E.±	C.D. (P=0.05)	CV%
	Bharuch	Narmada	Surat	Navsari	Tapi	Valsad	Dang				
Body length	3.71	3.88	3.69	3.44	3.64	3.82	3.50	3.67	0.03	0.08	1.58
Head length	1.01	1.01	0.73	0.78	0.76	0.72	0.84	0.84	0.01	0.04	3.27
Antennal length	1.88	1.74	1.82	1.79	1.45	1.62	1.71	1.72	0.02	0.05	2.25
Tongue length	1.11	1.12	1.12	1.12	1.11	1.12	1.11	1.11	--	NS	0.48
Thorax length	1.35	1.78	1.39	1.43	1.35	1.41	1.40	1.45	0.04	0.13	6.91
Thorax breadth	1.36	1.41	1.41	1.30	1.32	1.34	1.41	1.37	0.02	0.06	3.16
Forewing length	3.31	2.97	3.12	3.21	2.79	3.11	3.15	3.09	0.04	0.11	2.84
Forewing breadth	1.10	1.09	1.21	1.08	0.96	1.13	1.10	1.10	0.02	0.07	4.67
Hindwing length	2.30	2.14	2.25	2.37	2.21	2.12	2.06	2.21	0.01	0.03	1.08
Hindwing breadth	0.55	0.71	0.59	0.56	0.50	0.50	0.51	0.56	0.03	0.10	13.00
Extent of Hamuli	0.16	0.17	0.15	0.15	0.15	0.15	0.14	0.15	0.00	0.01	5.04
Number of Hamuli	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	--	--	--
Hindleg length	3.33	3.60	3.34	3.95	3.45	3.65	3.32	3.52	0.04	0.12	2.55
Hindleg breadth	0.38	0.29	0.40	0.46	0.45	0.44	0.33	0.39	0.01	0.02	4.21
Abdomen length	1.70	1.46	1.48	1.10	1.51	1.54	1.30	1.44	0.07	0.19	10.25

Non = Non-significant

and Prasad (2007) and Devanesan *et al.* (2009). Danaraddi and Shashidhar (2009) reported the fore wing length of *Trigona iridipennis* in the range of 3.54 mm (Bangalore) to 3.78 mm (Dharwad) without any significant difference among different districts.

As regards to forewing breadth, significantly highest forewing breadth was observed in bees of Surat district (1.21 mm). The next in order was bees of Valsad district (1.13 mm) which was at par with the Dang district (1.10 mm), Narmada district (1.09 mm) and Navsari district (1.08 mm). The significantly minimum forewing breadth was recorded in bees of Tapi district (0.96 mm). All most similar breadth of fore wing of *Trigona* was reported by Patnaik and Prasad (2007). However, Devanesan *et al.* (2009) reported it as 1.36 mm which differed from the present findings. Danaraddi and Shashidhar (2009) reported no significant variations in the fore wing breadth of *Trigona iridipennis* collected from different districts of Karnataka.

The significantly highest hind wing length was observed in bees of Navsari district (2.37 mm) which was followed by Bharuch district (2.30 mm), Surat district (2.25 mm) and Tapi district (2.21 mm). The hind wing length in bees of Narmada district (2.14 mm) and Valsad district (2.12 mm) was comparable to each other. The significantly minimum hind wing length was recorded in stingless bees of the Dang district (2.06 mm). The present findings are in confirmation to those reported by Patnaik and Prasad (2007) who recorded the length of hind wing of *T. irridipennis* as 1.21 mm in Orissa. However, Devanesan *et al.* (2009) reported it as 2.46 mm which differs from the present findings. As regards to hindwing breadth, it was significantly highest in bees of Narmada district (0.71mm) which was followed by bees of all districts. The significantly minimum hind wing breadth was recorded in stingless bees of Tapi and Valsad districts (0.50 mm) which was at par with the Dangs (0.51mm), Bharuch (0.55 mm), Navsari (0.56 mm) and Surat districts (0.59 mm). The hind wing breadth of *Trigona* was reported to be of 0.53 mm in Orissa (Patnaik and Prasad, 2007) and 0.63 mm in Kerala (Devanesan *et al.*, 2009), which is more or less similar to present findings.

The significantly highest extent of hamuli was observed in bees of Narmada district (0.17 mm) which was at par with that of Bharuch district (0.16 mm). The significantly minimum extent of hamuli was recorded

in stingless bees of Dang district (0.14 mm) which was at par with Navsari (0.15mm), Surat (0.15 mm), Tapi (0.15 mm) and Valsad districts (0.15 mm). Devanesan *et al.* (2009) reported it as 0.22 mm which differs from the present findings.

The data recorded on number of hamuli of *T. lavicepes* in different districts of South Gujarat revealed that stingless bees of all districts possess equal number of hamuli (5.00) which confirms findings of Patnaik and Prasad (2007); Danaraddi and Shashidhar (2009) and Devanesan *et al.* (2009).

The significantly highest hind leg length was observed in bees of Navsari district (3.95 mm) which was followed by Valsad (3.65 mm) and Narmada districts (3.60 mm). The hind leg length of bees of Tapi district (3.45 mm), Bharuch district (3.33 mm) and Surat district (3.34 mm) were at par with each other. The significantly minimum hind leg length was recorded in bees of the Dang district (3.32 mm). Devanesan *et al.* (2009) reported it as 4.56 mm which differs from the present findings. As regards to hind leg breadth, it was significantly highest in bees of Navsari districts (0.46 mm) which was at par with Tapi (0.45 mm) and Valsad districts (0.44 mm). The significantly minimum hind leg breadth was recorded in stingless bees of Narmada district (0.29 mm).

The significantly highest abdomen length was observed in stingless bees of Bharuch district (1.70 mm) which was at par with Valsad (1.54 mm) and Tapi districts (1.51 mm). The significantly minimum abdomen length was recorded in stingless bees of Navsari district (1.10 mm).

REFERENCES

- Araujo, E.D., Costa, M., Chaud, N.J. and Fower, H.G. (2004).** Body size and flight distance in stingless bees (Hymenoptera: meliponinae): Influence of flight range and possible ecological implications. *Brazilian J. Biol.*, **64** (3b): 563-568.
- Danaraddi, C.S. and Shashidhar, V. (2009).** Morphological studies on the stingless bee, *Trigona iridipennis* Smith. *J. Agric. Sci.*, **22**(4): 796-797.
- Devanesan, S., Shailaja, K.K., Rakhee, M., Bennet, R. and Premilla, K.S. (2003).** Morphometric characters of queen and workers of stingless bees, *Trigona irridipennis* Smith. *Insect Environ.*, **9** (4): 154-155.
- Deavanesan, S., Shailalja, K.K. and Premila, K.S. (2009).** Status paper on stingless bee *Trigona irridipennis* Smith

Published by AICRP on Honeybees and Pollinators, 15p

Kuberappa, G.C., Gajanana, S., Mohite, S.S. and Kencharaddi, R.N. (2005). Bio-metrical variations among populations of stingless bees, in Karnataka. *Indian Bee J.*, **67**(3&4): 145- 149.

Pallavi, P.N. (2011). Morphometrics of honeybee species occurring in south Gujarat and effect of bee pollination on yield of coriander, *Coriandrum sativum* Linnaeus. M.Sc. (Ag.) Thesis, Navsari Agricultural University, Navsari, GUJARAT (INDIA).

Patnaik, H.P. and Prasad, V.D. (2007). Morphometric characters of stingless bee, *Trigona iridipennis* Smith. *J. Pl. Prot. Environ.*, **4** (2) : 20-23.

Patricia, Vit, Silvia, R.M., Pedro and David, Roubik (2013). Pot-honey: *A legacy of stingless bees*. pp: 3-17, Publisher-Springer, NEW YORK, U.S.A.

Wille, A. (1983). Biology of stingless bees. *Ann. Rev. Ent.*, **28**: 41-64.

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