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Diversity and morphometrics of fruit flies (Diptera: Tephritidae) in South Gujarat, India

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ABSTRACT: An extensive survey was conducted to find out the distribution of different fruit fly species in the Navsari district of Gujarat from January to December, 2022. Among different fruit fly species, *Bactrocera* spp., are widely distributed and caused significant damage to horticultural crops. Four fruit fly species *viz*., *Bactrocera dorsalis* (Hendel), *B. zonata* (Saunders), *B. correcta* (Bezzi), and *B. cucurbitae* (Coquillett), were recorded from six talukas, namely Navsari, Jalalpore, Gandevi, Chikhli, Khergam and Vansda. Among all species, *B. dorsalis* (53.87%) was the most abundant followed by *B. zonata* (19.92%) and *B. correcta* (2.91%). Whereas, *B. cucurbitae* was the most common in cucurbits with relative abundance of 23.30 per cent. The activity of fruit flies was observed throughout the year. However, the peak fruit fly population was observed between April to July and gradually decreased from September to December. Higher diversity index was recorded in Gandevi, followed by Navsari and Jalalpore. *Bactrocera dorsalis* was larger than *B. zonata* and *B. correcta*. However, female flies were bigger than their male counterparts among all fruit fly species.

Keywords: Abundance, *Bactrocera*, fruit flies, Gujarat, diversity

INTRODUCTION

Tephritidae is one of the largest, most diversified and fascinating acalyptrate families of Diptera and include fruit flies, which are serious pests of fruits and vegetables. The greatest diversity of fruit flies has been noticed in Oriental region followed by tropical and subtropical regions. Due to their habit of strutting around, vibrating their wings and flaunting their intricate wings and body markings, these flies are sometimes referred to as "peacock flies (Jena, 2023). In courting and agonistic displays, their intricate body and wing patterns act as visual releasers (Kapoor, 1993). According to David and Ramani (2011), 325 species of fruit flies belonging to 243 families and 79 genera are found in India. The tribe Dacini, with the genus *Bactrocera*, is important in India. From an economic point of view, *B. cucurbitae*, *B. dorsalis*, and *B. zonata,* are the most common pest species, while *B. correcta*, *B. diversa* (Coquillett) and *B. latifrons* (Hendel) are still restricted to specific areas (Kapoor, 2005). The activity of fruit flies observed throughout the year with peak activity coinciding with the maturity and harvesting of fruits (Jena *et al.*, 2022b, 2022c; Jena, 2023). The management of fruit flies is difficult as the most damaging stage is the larva which remains unexposed to the pesticides (Jena *et al.,* 2022a, 2022d). Even if insecticides are used repeatedly, consumers may be exposed to potential health risks. South Gujarat is the leading producer of fruits and vegetables in Gujarat. The agri-export zone for fruits and vegetables includes three districts: Surat, Navsari, and Valsad. Damage intensity was as high as 30 per cent in mango and sapota and 20-40 per cent in cucurbitaceous crops (Patel *et al.,* 2021). Furthermore, morphometric analysis is a useful technique in detecting morphological differences among organisms to distinguish closely related species including fruit flies, justify synonymies, demonstrate morphological variation along altitudinal or geographical gradients and propose new species (Adsavakulchai *et al.*, 1999). Due to their wide climate tolerance, polyphagous nature, high reproductive potential, multivoltine character and a great capacity for dissemination of fruit flies management is challenging. However, sanitation in conjunction with the use of lures, traps, and baits, proved to be the most effective methods of controlling fruit flies. These traps are highly specific, inexpensive, and environmentally friendly (Sureshbabu and Viraktamath, 2003). In this view, we have undertaken an extensive survey in the Navsari district of South Gujarat from January to December, 2022 to profile the distribution, diversity, species composition and species richness of fruit flies.

MATERIALS AND METHODS

The survey was carried out to find out the diversity of fruit fly species in six talukas of Navsari district (Navsari, Jalalpore, Gandevi, Chikhli, Vansda and Khergam) from January to December, 2022. During the peak season of

fruit fly infestation, the infested samples of fruits and vegetables were collected and methyl eugenol and Cue-lure based attractant-insecticide traps were also installed. Three locations were identified in each taluka based on the abundance of fruit orchards and vegetable farms. Two traps were installed in each location and hung vertically, 6 ft. above the ground level on tree branches. A total of six traps were installed in each taluka and trapped fruit fly samples were collected at monthly intervals and lures were changed at every 45 day interval to maintain the efficacy of the trapping system. The infested samples were brought to the laboratory and kept until the adult emergence. The fruit flies caught in the attractant traps were also brought to the laboratory and identified based on morphological description given by White and Elson-Harris (1992) and Drew and Raghu (2002). The total number of samples captured from each taluka and each month was averaged. Then, relative abundance (Relative abundance = (Number of individuals of one species/Number of individuals of all species) × 100) of each species and location was estimated. The species diversity of fruit flies of each taluka was quantified based on the samples collected during the study. Shannon-Wiener index (*H'*) (Shannon, 1948), species evenness (*J'*) (Pielou, 1966) and species richness (S) were also calculated. Furthermore, for making morphometric studies on adult mango fruit flies, collected specimens from traps (methyl-eugenol) and rearing cages were used. The species wise morphometric measurements of various body parts were recorded under Stereoscopic Trinocular Microscope fitted with a Brand Catcam-130 Camera (Make: Olympus SZ-61).

RESULTS AND DISCUSSION

During the survey, four fruit fly species namely, *B. dorsalis, B. zonata, B. correcta* and *B. cucurbitae* were recorded from Navsari district. Out of four species, three fruit fly species *viz. B. cucurbitae, B. dorsalis* and *B. zonata* were reported as major species. Whereas, one species *i.e., B. correcta* was reported as minor species. Adult males of *B. dorsalis, B. zonata* and *B. correcta* were found trapped in the methyl eugenol-based attractant traps while, *B. cucurbitae* males were trapped in cue-lure traps (Table 1). All flies collected belong to the subfamily Dacinae and tribe Dacini.

Table 1. Fruit fly diversity in different locations of Navsari district, Gujarat, India

Study sites	Locations	No. of traps	Species recorded	Host	Attractant trap
Navsari	3	6	*B. dorsalis*	Mango, Sapota, Banana, Guava, Jamun, Papaya	Methyl eugenol
			B. zonata	Mango, Sapota	
			B. correcta	Mango, Guava	
			B. cucurbitae	Cucurbits	Cue-lure
Jalalpore	3	6	*B. dorsalis*	Mango, Sapota, Banana, Guava, Jamun, Papaya	Methyl eugenol
			B. zonata	Mango, Sapota	
			B. correcta	Mango, Guava	
			B. cucurbitae	Cucurbits	Cue-lure
Gandevi	3	6	*B. dorsalis*	Mango, Sapota, Guava, Banana	Methyl eugenol
			B. zonata	Mango	
			B. correcta	Guava, Mango	
			B. cucurbitae	Cucurbits	Cue-lure
Chikhli	3	6	*B. dorsalis*	Mango, Sapota	Methyl eugenol
			B. zonata	Mango, Sapota	
			B. cucurbitae	Cucurbits	Cue-lure
Vansada	3	6	*B. dorsalis*	Mango, Sapota	Methyl eugenol
			B. zonata	Mango, Sapota	
			B. cucurbitae	Cucurbits	Cue-lure
Khergam	3	6	*B. dorsalis*	Mango, Sapota	Methyl eugenol
			B. zonata	Mango, Sapota	
			B. cucurbitae	Cucurbits	Cue-lure

The highest number of male fruit flies were collected during May, 2022 with an average of 356.75, 289.00, and 265.75 male fruit flies/trap in Gandevi, Jalalpore and Navsari talukas, respectively. A similar trend was observed in Khergam and Vansda with an average of 208.33 and 197.00 male fruit flies/trap, respectively. Whereas, in Chikhli, the fruit fly population was high, with an average of 203.50 male fruit flies/trap in June (Fig. 1). The peak population was recorded from May to July, 2022 in all the talukas as this was the time for mango and sapota fruiting coinciding with the cucurbit crops *viz.,* cucumber, little gourd, pointed gourd *etc.* A more or less similar finding was made by Nandre and Shukla (2014), who reported the maximum activity of fruit flies (172.10 flies/trap) during March to August and lower during December and January (11.10 to 21.30 flies/trap) in sapota orchard at Gandevi, South Gujarat. While, Das et al. (2017) noticed that during 4th week of April, the mean fruit fly population was 10.67 male fruit flies/trap/week in the case of *B. cucurbitae*.

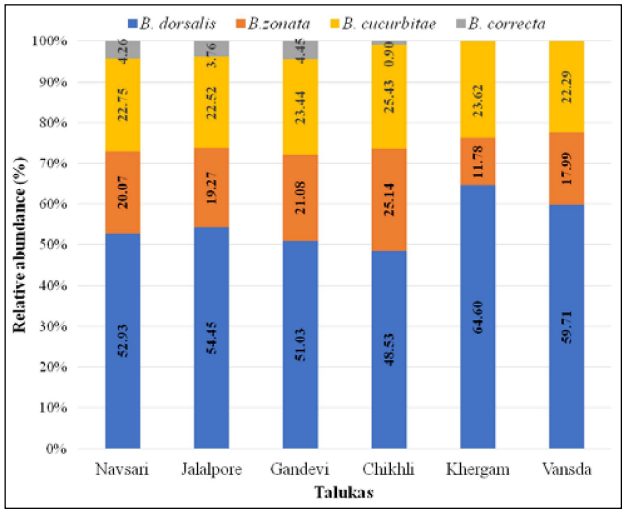


Fig. 1. Average fruit fly samples captured during January-December, 2022 in different Talukas of Navsari district in Gujarat. The value represents average numbers of fruit flies trapped per trap from each taluka and month (N=12).

In the present study, *B. dorsalis* (53.87%) was the most abundant in all the talukas, followed by *B. zonata* (19.92%) and *B. correcta* (2.91%) in fruit crops. Whereas, *B. cucurbitae* was the most common in cucurbits with a relative abundance of 23.30 per cent (Fig. 2). The present findings were in close affinity with earlier work of Nandre and Shukla (2012), who recorded three species of fruit flies *viz., B. dorsalis*, *B. zonata* and *B. correcta* in sapota orchards at Navsari using methyl eugenol traps with *B. dorsalis* being the most predominant species (65.14%), followed by *B. zonata* (32.87%), and *B. correcta* (1.97%). Also, Bisane (2017) investigated the population diversity and cyclicity of fruit fly, *Bactrocera spp.* using a modified "Nauroji Stonehouse" fruit fly trap and revealed that *B. dorsalis* was the dominating species with more than 95% population over *B. correcta* and *B. zonata*. Borah (1998) reported 39.10 per cent fruit damage by *B. cucurbitae* to the cucumber crop grown during *kharif* season, whereas on the *rabi* and summer season crops, the damage was 77.60 and 20.30 per cent, respectively.

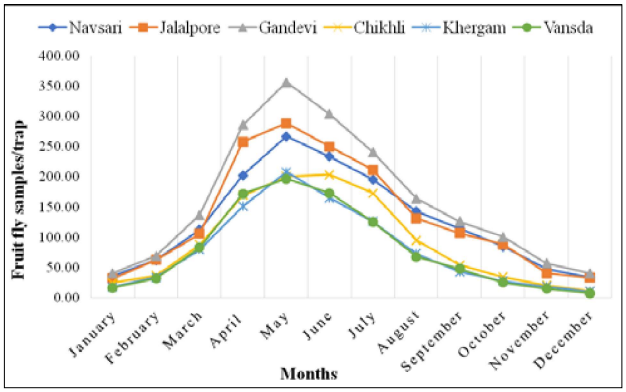


Fig. 2. Relative abundance (%) of fruit fly species observed during January-December, 2022 in different Talukas of Navsari district in Gujarat. The value represents abundance (%) of fruit fly species from total fruit fly samples collected from each Taluka for 12 months

The diversity indices and richness of fruit flies in each taluka were estimated. Shannon diversity index was maximum in Gandevi (1.15) followed by Navsari (1.13), Jalalpore (1.11), and Chikhli taluka (1.09), respectively. However, diversity index was minimum for Vansda (0.92) and Khergam (0.87), respectively (Table 2). Species evenness was found high in Vansda (0.84) followed by Gandevi (0.83) and Navsari (0.82). However, Jalalpore and Khergam showed similar results (0.80) and species evenness was lowest in Chikhli (0.79), respectively.

Morphometric studies on mango fruit flies

1. Bactrocera dorsalis

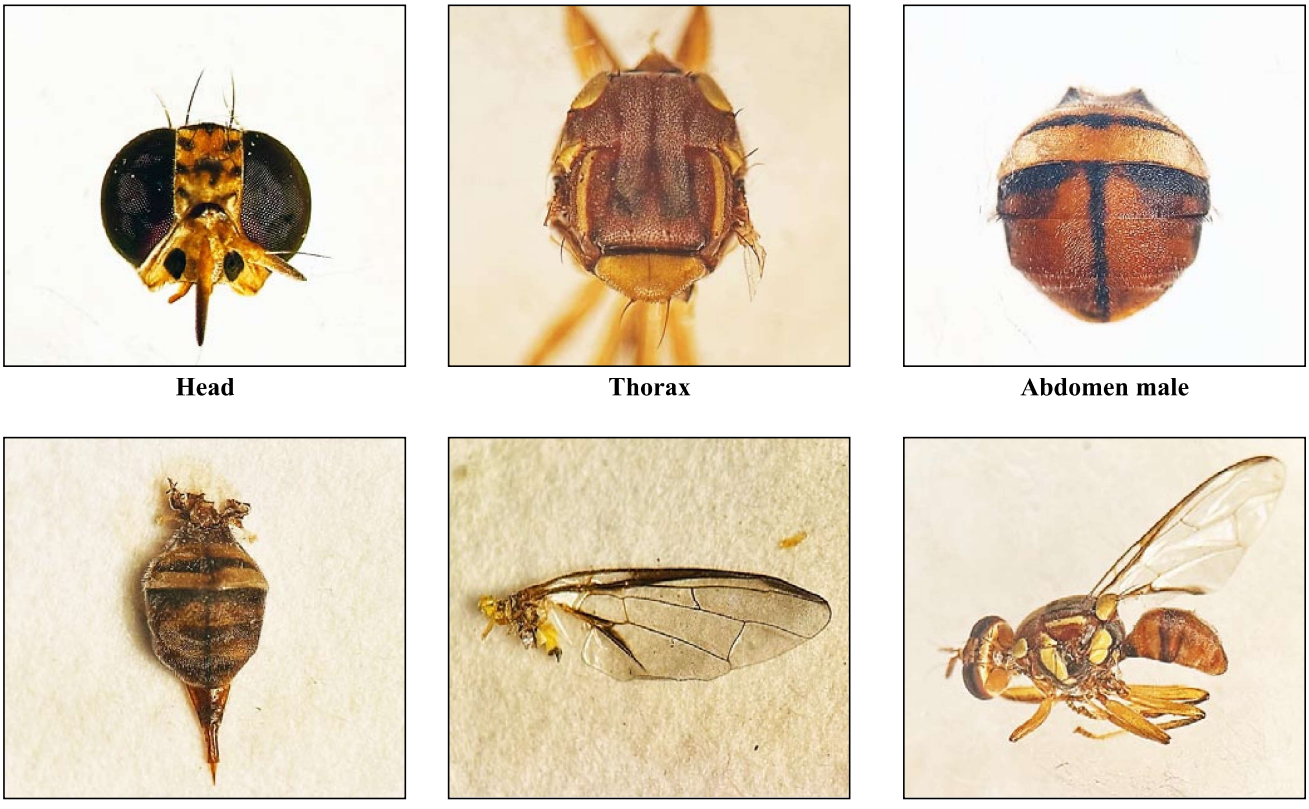
Description: Face yellowish with two separate medium-sized circular black spots. Scutum black with red-brown areas of varying shapes and sizes. Two broad parallel sided lateral postsutural vittae ends at intera-alar setae, medial postsutural vittae absent. Scutellum entirely yellow coloured except for narrow basal band and two apical setae. Wing with a distinct brown costal band continuous from cell Sc to wing apex, confluent with vein R_{2+3}, crossveins r-m and dm-cu not covered by any markings. Abdomen predominantly orange red with prominent T shaped mark. Male with pecten

Table 2. Diversity indices of fruit fly population in different talukas of Navsari district

Taluka	Shannon diversity index (H')	Species evenness (J')	Species richness (S)
Navsari	1.13	0.82	4
Jalalpore	1.11	0.80	4
Gandevi	1.15	0.83	4
Chikhli	1.09	0.79	4
Khergam	0.87	0.80	3
Vansda	0.92	0.84	3

on third abdominal tergum whereas female adults had a tapering ovipositor for laying eggs in host fruits. All femora yellow with rows of long setae on fore femora and without any fuscous/dark marking (Plate 1). These findings were similar to the description given by Drew and Raghu (2002), White and Elson-Harris (1992) and Narayanan and Batra (1960).

The morphometric studies on mango fruit flies revealed that adult female fruit flies were bigger in size as compared to male fruit flies in all the three species *viz., B. dorsalis, B. zonata* and *B. correcta* infesting mango. The average body length for male and female of *B. dorsalis* was 6.28 ± 0.55 and 7.55 ± 0.80 mm, respectively. Whereas, the average body width (wing expanse) was 12.30 ± 0.97 and 13.11 ± 0.80 mm for male and female fruit flies, respectively (Table 3). The above findings on body length and width of *B. dorsalis* were in close conformity with Jena et al. (2022d), who revealed that the length and width (wing expanse) of male adult varied from 4.91 to 7.23 mm and 10.10 to 12.65 mm, while female adult was found to vary from 6.70 to 8.98 mm and 12.20 to 16.50 mm, respectively.



Head **Thorax** **Abdomen male**

Abdomen female **Forewing** **Lateral view**

Plate 1: *Bactrocera dorsalis*

Table 3. Morphometrics of *B. dorsalis*

Body characters	Adult male (mm)			Adult female (mm)		
	Min.	Max.	Avg. ± SD	Min.	Max.	Avg. ± SD
Body length	5.30	7.31	6.28 ± 0.55	6.47	8.96	7.55 ± 0.80
Body width	10.45	13.66	12.30 ± 0.97	12.07	14.63	13.11 ± 0.80
Fore leg length	4.17	5.26	4.76 ± 0.33	4.56	5.27	4.89 ± 0.22
Mid leg length	5.65	6.68	6.22 ± 0.28	5.95	6.89	6.45 ± 0.30
Hind leg length	5.02	5.93	5.36 ± 0.27	5.23	6.07	5.64 ± 0.28

2. *Bactrocera zonata*

Description: Face fulvous with two medium sized circulars to oval black spots in antennal furrow. Scutum orange brown to red-brown with a pale fuscous pattern posteriorly with lateral yellow or orange postsutural stripes, scutellum entirely pale yellow coloured except for a narrow dark red-brown basal band and with two apical scutellar setae. Wing lacks a complete costal band (reduced to an isolated apical spot), cubital stripe absent but with a very tiny pale fuscous tint in the cell cup. Abdomen orange brown with dark hind margins on terga 3 -5 and dark posterolateral margins on terga 4 and 5, spots on tergum 5 dark reddish brown. Male with pecten on third abdominal tergum. Legs fulvous and mid tibiae having an apical black spur. The hindwings are modified into halteres. Male consists of rounded abdomen with pecten and female with pointed ovipositor. Aristate type of antennae were present. Females were bigger than males in size (Plate 2). These findings were similar to the description given by Drew and Raghu (2002), White and Elson-Harris (1992). Also, Jena and Patel (2022a) revealed that the abdominal end of male was rounded with pecten while, it was developed in to pointed ovipositor in case of female.

The average body length for male and female of *B. zonata* was 4.75 ± 0.29 and 6.09± 0.32 mm, respectively, whereas the average body width (wing expanse) was 10.65 ± 0.99 and 11.81 ± 0.82 mm for male and female fruit flies, respectively (Table 4). The above findings were more or less similar to Jena and Patel (2022a) who found that the length and width (wing expanse) of male adult varied from 4.20 to 5.10 mm and 8.42 to 11.40 mm, while female adult was found to vary from 5.32 to 6.21 mm and 10.40 to 12.60 mm, respectively.

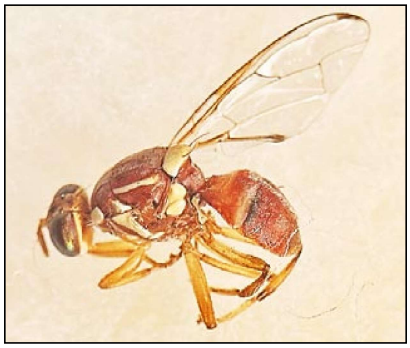
Head

Thorax

Abdomen male

Abdomen female

Forewing



Lateral view

Plate 2: *Bactrocera zonata*

Table 4. Morphometrics of *B. zonata*

Body characters	Adult male (mm)			Adult female (mm)		
	Min.	Max.	Avg. ± SD	Min.	Max.	Avg. ± SD
Body length	4.25	5.24	4.75 ± 0.29	5.73	6.82	6.09 ± 0.32
Body width	8.86	11.95	10.65 ± 0.99	10.33	12.95	11.81 ± 0.82
Fore leg length	3.96	4.61	4.21 ± 0.22	4.11	4.93	4.47 ± 0.23
Mid leg length	5.15	6.07	5.65 ± 0.32	5.45	6.10	5.79 ± 0.22
Hind leg length	4.65	5.35	5.06 ± 0.19	4.45	5.50	**1.11** 0.28

Bactrocera correcta

Description: Face fulvous with small black longitudinally oval to circular spots on antennal furrow meeting in the middle just above the mouth opening. Scutum predominantly black, anterior supra-alar setae present, two yellow lateral postsutural vittae ending beyond intra alar setae, prescutellar setae present. Scutellum completely yellow with narrow basal black band and two apical scutellar setae. Legs fulvous, hind tibiae with keel like process on posterodorsal surface near apex. Wings with a reduced pattern, coastal band from cell Sc to r_1, confluent with R_{2+3}, broken in cell r_{2+3}, leaving an apical dark spot in cell r_{2+3} and r_{4+5} cubital streak contained with cell cup, base of cell br without my microtrichia. Abdomen dark brown with a median longitudinal dark band on terga 3 -5. Male with pecten on third abdominal tergum (Plate 3). These findings were similar to description given by Drew and Raghu (2002), White and Elson-Harris (1992).

For *B. correcta* the average body length for male and female fruit flies was 4.71 ± 0.27 and 5.61 ± 0.35 mm, respectively, whereas the average body width was 10.08 ± 0.92 and 11.54 ± 0.77 mm for male and female fruit flies, respectively (Table 5). Weems and Fasulo (2004) depicted that *B. correcta* was approximately 5.40 mm in length.

Table 5. Morphometrics of *B. correcta*

Body characters	Adult male (mm)			Adult female (mm)		
	Min.	Max.	Avg. ± SD	Min.	Max.	Avg. ± SD
Body length	4.30	5.10	4.71 ± 0.27	5.25	6.35	5.61 ± 0.35
Body width	8.20	11.50	10.08 ± 0.92	10.11	12.45	11.54 ± 0.77
Fore leg length	3.65	4.45	4.01 ± 0.23	4.05	4.65	4.35 ± 0.19
Mid leg length	4.90	5.98	5.41 ± 0.33	5.24	6.01	5.67 ± 0.23
Hind leg length	4.28	5.20	4.89 ± 0.28	4.12	5.35	4.91 ± 0.4

Note: Observations for body length and width were recorded at 0.67X while, for legs observation were recorded at 1.5X.

CONCLUSION

Four species (*B. dorsalis, B. zonata, B. correcta* and *B. cucurbitae*) of fruit flies were recorded from different talukas of the Navsari district. *Bactrocera dorsalis* was the most abundant species, followed by *B. zonata* and *B. correcta* in all Talukas in fruit crops. Whereas, *B. cucurbitae* was the most dominant in the cucurbit crop ecosystem. *Bactrocera dorsalis* was larger than *B. zonata* and *B. correcta*. However, female flies were bigger than their male counterparts among all fruit fly species. Forecasting and analyzing the geographic distribution of the fruit fly population will make it easier to conduct suitable control methods to decrease the pest population under field conditions.

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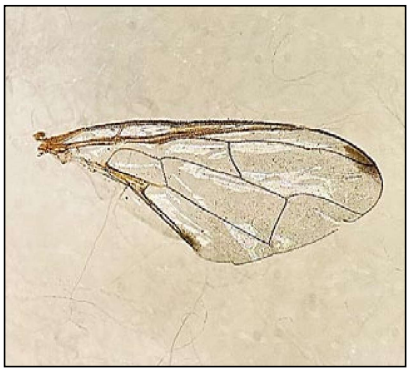
Head

Thorax

Abdomen male

Abdomen female



Forewing

Lateral view

Plate 3: ***Bactrocera. correcta***

REFERENCES

Adsavakulchai, A., Baimai, V., Prachyabrued, W., Grote, P. J. and Lertlum, S. 1999. Morphometric study for identification of the *Bactrocera dorsalis* complex (Diptera: Tephritidae) using wing image analysis. *Biotropica*, **13**: 37-48.

Bisane, K. D. 2017. Population diversity and cyclicity of fruit fly (*Bactrocera* spp.) in sapota orchard under South Gujarat condition. *Indian Journal of Ecology*, **44**(2): 369-374.

Borah, R. K. 1998. Evaluation of an insecticide schedule for the control of red pumpkin beetle and fruit fly of red pumpkin in the hills zone of Assam. *Indian Journal of Entomology*, **60**(4): 417-419.

Das, U. K., Kashar, N., Okram, S., Jha, S. and Karmakar, S. 2017. Seasonal activity, weather relations and biology of melon fly (*Bactrocera cucurbitae* Coquillett) on pumpkin. *Journal of Ecology and Environment*, **35**(3): 1634-1638.

David, K. J. and Ramani, S. 2011. An illustrated key to fruit flies (Diptera: Tephritidae) from peninsular India and Andaman and Nicobar Islands. *Zootaxa,* **3021**(1): 1-31.

Drew, R. A. I. and Raghu, S. 2002. The fruit fly fauna (Diptera: Tephritidae: Dacinae) of the rainforest habitat of the western ghats, India. *Raffles Bulletin of Zoology*, **50**(2): 327-352.

Jena, M. K. and Patel, S. R. 2023. Evaluation of different hosts for the mass rearing of peach fruit fly, *Bactrocera zonata* (Saunders) (Tephritidae: Diptera). *Journal of Experimental Zoology*, India, **26**: 1743-1746.

Jena, M. K. and Patel, S. R. 2022a. Biology and Morphometrics of peach fruit fly, *Bactrocera zonata* (Saunders) on Mango. *Pest Management in Horticultural Ecosystem*, **28**(02): 87-97. https://doi.org/10.5958/0974-4541.2022.00044.3

Jena, M. K., Patel, S. R. and Mohapatra, B. 2022b. Population Dynamics of *Bactrocera zonata* (Saunders) (Diptera: Tephretidae) on *Mangifera indica* (L.) (Anacardiaceae) and Correlation

with Weather Parameters. *International Journal of Environment and Climate Change*, **12**(12): 1708-1714. https://doi.org/10.9734/IJECC/2022/v12i1131101)

Jena, M. K. 2023. Standardization of mass rearing technique for the fruit fly. Lambert Academic Publishing, Omniscriptum S.R.L. 120 High Road, East Finchley, London, N29ED, United Kingdom, 148 p. https://doi.org/10.13140/RG.2.2.10951.27047)

Jena, M. K., Patel, S. R. and Patel, Z. K. 2022c. Population Dynamics of Fruit Fly, *B. dorsalis* (Hendle) on Mango and Correlation with Weather Parameters. *International Journal of Environment and Climate Change*, **12**(12): 1630-1638. https://doi.org/10.9734/IJECC/2022/v12i121614

Jena, M. K., Patel, S. R. and Sahoo, S. 2022d. Biological and morphometric studies of fruit flies infesting fruit crops with special reference to *Bactrocera dorsalis*: A Review. *Journal of Emerging Technology and Innovative Research*, **9**(2): 22-34.

Kapoor, V. C. 1993. "Indian fruit flies (Insecta: Diptera: Tephritidae)", Oxford and IBH publishing Co. Pvt. Ltd. New Delhi, India, pp.1-2.

Kapoor, V. C. 2005. Taxonomy and Biology of Economically Important Fruit Flies of India. Biotaxonomy of Tephritoidea, *Israel Journal of Entomology*, **35-36**: 459-475.

Nandre, A. S. and Shukla, A. 2012. Composition of fruit fly *Bactrocera* species in Navsari district in sapota. *Uttar Pradesh Journal of Zoology*, **32**(2): 253-255.

Narayanan, E. S. and Batra, H. N. 1960. Fruit flies and their control, ICAR, Monograph, 68p.

Patel, S. R., Patel, Z. P., Patel, K. M. and Shinde, C. U. 2021. Surveillance of tephritid fruit flies in the sapota orchards of South Gujarat. *Insights of Environment*, **24**(1): 124-128.

Pielou, E. C. 1966. The measurement of diversity in different types of biological collections. *Journal of Theoritical Biology*, **13**: 131-144.

Shannon, C. E. 1948. A mathematical theory of communication. *The Bell System Technical Journal*, **27**: 379-423.

Sureshbabu, K. and Viraktamath, S. 2003. Species diversity and population dynamics of fruit flies (Diptera: Tephritidae) on mango in Northern Karnataka. *Pest Management and Economic Zoology*, **11**: 103-110.

Weems, H. V. Jr. and Fasulo, T. R. 2004. Guava Fruit Fly, *Bactrocera correcta* (Bezzi) (Insecta: Diptera: Tephritidae). *EDIS*, 15 p.

White, I. M. and Elson-Harris, M. M. 1992. Fruit flies of Economic Significance: Their Identification and Bionomics. Centre for Agriculture and Biosciences International, Wallingford, U.K., 601 p.

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