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DIVERSITY OF DIPTERA AT AGRI-BIODIVERSITY PARK, HYDERABAD

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ABSTRACT

The diversity and abundance of Diptera at the Agri-biodiversity Park, Professor Jayashankar Telangana State Agricultural University, Hyderabad was studied from September 2019 to January 2020. Five collection methods (pitfall trap, yellow pan trap, manual collection, light trap and yellow sticky trap) were used and 6739 individuals under 27 families were collected. The results revealed that the most abundant family was Dolichopodidae (10.76%) followed by Sarcophagidae (10.19%) and Ceratopogonidae (8.92%). Yellow pan trap collected maximum number of individuals (2789), and revealed occurrence of maximum number of families (18). Shannon-Weiner diversity Index, Margalef's species richness index and Pielou's evenness index of the study area were 2.953, 2.949 and 0.896, respectively, indicating rich diversity of Diptera.

Key words: Diptera, Shannon-Weiner diversity, Margalef's species richness, Pielou's evenness, abundance, insect collection methods, Dolichopodidae, Sarcophagidae, Ceratopogonidae, yellow pan trap

The order Diptera, consisting of true flies, are found nearly everywhere from the northern to the southernmost pole because of their adaptation to extremely wide range of larval habitats. Their feeding habits have profound impact on ecosystems and the Earth as a whole (Skevington and Dang, 2002). The Indian Diptera fauna is represented by 87 families (Alfred et al., 1998). Despite their great ecological importance in human health, agriculture and forestry, forensic science, medicine and genetic studies, they are still an underexplored group in India. Only few dipteran families are known to have agricultural importance, and the diversity studies in agroecosystems are lacking in India. Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rajendranagar, Hyderabad, is the first Agricultural University in India to initiate the establishment of Agri-Biodiversity Park (ABP) in August 2008, in 60 ha area covered with jungle, scrub, hillocks, boulders, undulated rocky terrain with sloppy lands and diverse vegetation, such as herbs, shrubs, creepers, trees and grass species, and half of it is occupied by a pond (Khan and Krishna, 2017). The experimental site comes under the seventh Agro Climatic Zone of India i.e. Deccan Plateau, and in Telangana state it comes under the Southern Telangana Zone (STZ). The climate of Rajendranagar is very hot and rain falls during the monsoon season from June to September and post monsoon from October to December. It receives an average rainfall of 766 mm. Mostly the temperature averages around 26.7°C. The existing flora of this habitat includes tree species like *Tectona grandis*, *Butea monosperma, Syzygium cumini*, *Ficus* spp., *Pongamia pinnata, Madhuca longifolia*, *Albizia lebbeck*, *Senna/ Cassia* spp., *Dalbergia sissoo*, *Vachellia nilotica*, *Tamarindus indica*, *Annona reticulate*, *Azadirachta indica* and *Prosopis juliflora* besides a diverse species of shrubs, herbs and grasses. There was no earlier documentation of the dipteran fauna from this habitat and hence the present study.

MATERIALS AND METHODS

The sampling of dipteran flies was carried out from September 2019 to January 2020 at the Agri-biodiversity Park of PJTSAU, Rajendranagar, Hyderabad (17°18'N,78°24'E, 559 masl). Collection was carried out at weekly intervals with five sampling methods: (i) pitfall traps (n=50), (ii) yellow pan traps (n=30), (iii) light traps (n=5), (iv) yellow sticky traps (n=30) and (v) manual Collection. Soap water was used in pitfall traps (transparent plastic cups of 8 cm top dia and 10 cm height) and yellow pan traps (bright yellow-colored plastic basins with 18 cm dia and 3 cm depth) to kill the trapped insects. The traps were inspected in 24 hr (the next day) and the trapped insects were collected and preserved in containers with 70% alcohol. Manual collection was done every week for 2 hr (9 am- 12 noon) of random active sweepings at different points covering the whole area with a sweep net of 30 cm hoop dia and 80 cm handle length. A cotton

swab dipped in ethyl acetate was used to anesthetize the collected insects. Light traps fitted with collecting bottles (containing 50% alcohol) were operated in evening (6 to 9 pm) to collect nocturnal insects. Yellow sticky traps (25x 10cm dimension, installed at about 3 m height) were also inspected every 24 hr and the trapped flies were counted directly with a magnifying hand lens (5x). The collected specimens were sorted, identified up to family level with the key by Triplehorn and Johnson (2005) under a stereozoom binocular microscope and again preserved in glass containers with 70% alcohol, mentioning the type of trap and date of collection. Hard bodied insects were dry preserved by pinning in insect boxes. Shannon-Wiener Diversity index, Margalef's species richness index and Pielou's Evenness Index were computed by using the software; PAST (Paleontological Statistics Tool) version 3.25. The relative abundance of each family was also calculated by the formula: Relative abundance (%) = ni × 100/ N (where, N: the total number of individuals in all families and ni: the number of individuals in i^{th} family).

RESULTS AND DISCUSSION

A total of 6739 dipterans under 27 families (10 Nematocera, 17 Brachycera) were collected. These reveal that maximum were trapped with yellow pan (2789) followed by light (2428), yellow sticky (751) and pitfall traps (387); the least were obtained with manual collection (384); maximum number of 18 families were obtained with yellow pan trap. These data indicate that the yellow pan trap is an efficient method for trapping dipterans. Devigne and Biseau (2014) also found yellow pan trap to be second most effective, next to malaise trap. Among the 27 families of Diptera collected, family Dolichopodidae (RA=10.76%) was found to be the most abundant, whereas Sciomyzidae (RA=0.12%) was found to be the least abundant. Families like Dolichopodidae, Sarcophagidae, Ceratopogonidae, Cecidomyiidae, Calliphoridae, Chironomidae and Phoridae were highly abundant (RA > 5%). Families like Muscidae, Pipunculidae, Asilidae, Culicidae, Bombyliidae, Syrphidae, Sciaridae. Tipulidae, Tachinidae, Mycetophilidae, Scatopsidae, Psychodidae, Stratiomyidae and Hybotidae were moderately abundant (RA=1-5%). While families like Tephritidae, Sepsidae, Celyphidae, Tabanidae, Bibionidae and Sciomyzidae were less abundant (RA < 1%) (Figs. 1, 2; Table 1)

Eleven dipteran families (Tipulidae, Stratiomyidae, Tabanidae, Bombyliidae, Asilidae, Syrphidae, Sciomyzidae, Muscidae, Calliphoridae and Sarcophagidae) reported from Barnawapara Wildlife Sanctuary, Chhattisgarh by Halder et al. (2019) were found to be in match with currently reported families. Similarly, Gayen (2019) and Roy et al. (2014) recorded 17 families and 6 families, respectively, and all families of both the studies were also been reported in the present study. Mitra et al. (2015) and Dhamorikar (2017) reported 44 and 50 families of dipterans from Himachal Pradesh and Mumbai, respectively. Mitra and Parui (2012) reported 14 families of true flies from Bibhutibhusan Wildlife Sanctuary, West Bengal with 12 families common with the present study. Khairiyah et al. (2013) observed 2381 dipterans under seven families from an oil palm plantation in Malaysia and Cecidomyiidae was found to be the most abundant family. Mitra et al. (2015) found Syrphidae as the most abundant, followed by Culicidae from Himachal Pradesh. Harinath et al. (2015) reported few species under Culicidae, Muscidae, Sarcophagidae, Calliphoridae and Syrphidae from Lankamalleswara reserve forest in the Eastern Ghats of Southern Andhra Pradesh.

The Shannon-Weiner diversity, Margalef's species richness and Pielou's evenness indices for the dipteran fauna of the study area were 2.953, 2.949 and 0.896, respectively, indicating their good diversity and richness

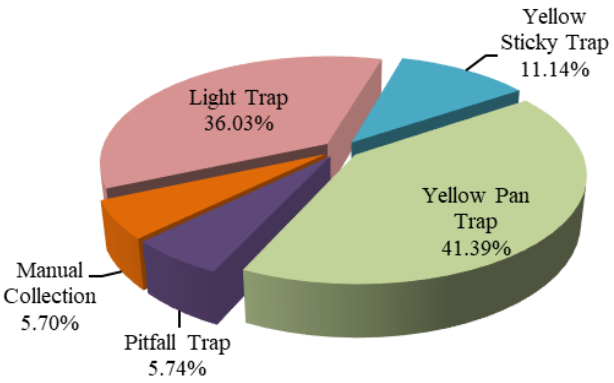

Fig. 1. Dipterans vs. collection methods

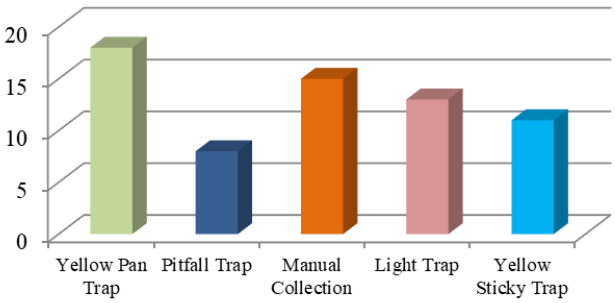

Fig. 2. Dipteran families vs collection methods

Table 1. Methods of collection vs. relative abundance of families of Diptera

S. No.	Families	Methods of collection	No. of individuals	Relative abundance (%)
1	Asilidae	YPT, PT, MC	320	4.75
2	Bibionidae	MC	11	0.16
3	Bombyliidae	YPT, MC, YST	285	4.23
4	Calliphoridae	YPT, PT, MC, YST	407	6.04
5	Cecidomyiidae	YPT, LT, YST	486	7.21
6	Celyphidae	MC	20	0.30
7	Ceratopogonidae	LT	601	8.92
8	Chironomidae	YPT, PT, LT	406	6.02
9	Culicidae	YPT, PT, MC, LT, YST	312	4.63
10	Dolichopodidae	YPT, MC, YST	725	10.76
11	Hybotidae	YPT, LT	85	1.26
12	Muscidae	YPT, PT, MC, YST	328	4.87
13	Mycetophilidae	LT	142	2.11
14	Phoridae	YPT, PT, LT	350	5.19
15	Pipunculidae	YPT, LT	324	4.81
16	Psychodidae	YPT, LT	113	1.68
17	Sarcophagidae	YPT, PT, MC, YST	687	10.19
18	Scatopsidae	LT	118	1.75
19	Sciaridae	LT	206	3.06
20	Sciomyzidae	MC	8	0.12
21	Sepsidae	MC, LT	40	0.59
22	Stratiomyidae	YPT, PT	87	1.29
23	Syrphidae	YPT, MC, YST	265	3.93
24	Tabanidae	MC	12	0.18
25	Tachinidae	YPT, MC, YST	143	2.12
26	Tephritidae	YPT, YST	53	0.79
27	Tipulidae	YPT, MC, LT, YST	205	3.04
	Total		6739	

(LT- Light trap; MC- Manual collection method; PT- Pitfall trap; YPT- Yellow pan trap; YST- Yellow sticky trap)

in the study area. Dipterans are among the most common flower-visiting insects and are also considered as primitive pollinators (Kevan and Baker, 1983). Nectar is one of the most important foods for the majority of adult dipterans to meet the energy requirements for flight in dispersing, finding mates, mating, and searching sites for oviposition (Larson et al*.,* 2001). The flower-visiting dipteran families recorded in the present study are Syrphidae, Bombyliidae, Stratiomyidae, Tabanidae, Sciomyzidae, Calliphoridae, Muscidae, Sarcophagidae, Tephritidae, Tachinidae, Cecidomyiidae, Ceratopogonidae, Pipunculidae, Phoridae, Bibionidae, Chironomidae, Culicidae, Tipulidae and Mycetophilidae. Many families of Diptera are detritivorous in their larval and/or adult stage and such dipteran families recorded in the present study include: Stratiomyidae, Syrphidae, Calliphoridae, Muscidae, Sarcophagidae, Tipulidae, Mycetophilidae and Sciaridae. Predatory dipteran groups of Asilidae, Syrphidae and Dolichopodidae (feed on springtails, aphids and other small soft-bodied insects) and some parasitoid families viz*.,* Tachinidae, Bombyliidae (parasites of grasshopper eggs, solitary bees and wasps), Pipunculidae (parasites of leaf hoppers and plant hoppers) and Phoridae (parasites of social insects) were observed in the area.

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