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Estimation of the species diversity and evenness in mango under coastal Odisha climatic conditions

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Abstract

The present studies entitled “Studies on diversity of insect pollinators of mango (*Mangifera indica* L.) under coastal Odisha condition” have been undertaken during flowering season, 2018-2019 at OUAT orchard, Bhubaneswar, CHES, Bhubaneswar, Farmer’s field, Berhampur and Farmer’s field, Sakhigopal, so as to evince that the present status of various insect pollinators on mango inflorescence. The number of species varied between 9-17 with the diversity index of 0.7978-0.9053. The diversity was almost uniform in early (0.3936) and late flowering period (0.4921) as compared to mid flowering period (0.6987). Diversity (0.5019-0.5820) at different day hour i.e. 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. didn’t show significant variation.

Keywords: Estimation, species diversity, evenness, mango, climatic conditions

Introduction

Pollinator-subordinate products form a basic piece of human eating regimens (Eilers *et al.*, 2011) [4]. Albeit current cultivating practices have empowered overall higher yield efficiency (Aizen *et al.*, 2008) [1], decreases in pollinator dependent crop yields have been observed, frequently owing to isolation from natural habitat (Klein, Steffan-Dewenter and Tscharntke 2003) [6]. In perspective of the expanding interest for animal pollinated crops in human diet control plans, such efficiency misfortunes can quicken change of regular regions to cropland (Garibaldi *et al.*, 2009) [5].

Pollination of mango is a complex process where in the pollen contacts with the stigmatic surface and then migrates down the style (Ramirez and Davenport, 2012) [7] and a number of steps results in fusion of the generative cell, with the ovule within the ovary. Pollen viability depends on the temperature where the warm weather results in viability on the other side cool weather have negative impact on pollen development and tube growth to the ovule (Davenport, 2009) [3].

Materials and Methods

The present investigation on the insect pollinators of mango flower was carried out in the OUAT orchard, Bhubaneswar, CHES, Bhubaneswar, Farmer’s field, Berhampur and Farmer’s field, Sakhigopal during 2017-19. The soil type of the experimental area is lateritic and situated at 20.29° N and 85.82° E; 45m above MSL.

In order to study the diversity of different insect pollinators visiting mango flowers, observations were taken during the flowering period of the crop. Collection of pollinators was done at 10 days interval during the early, mid and late flowering period in twenty sweeps each time at 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. covering all around the tree by using a sweeping net of 15 cm radius. After collection of pollinators, they were killed by using Ethyl acetate and dry preserved as per Borror *et al.* (1981) [2]. Identification of pollinators was done by matching with previously identified fauna of pollinators (Identified by AICRP on Honeybees & Pollinators, OUAT, Bhubaneswar and Division of Entomology, I.A.R.I., New Delhi). Diversity of pollinators was estimated by separating them based on their order and family, counting each and utilizing appropriate tools.

Observation on the foraging activity of Indian honey bee, Little bee, Horse fly, Blow fly, House fly, Flesh fly, Stingless bee and Wasp visiting on the flowers of mango in open pollination plot were made during the early flowering stage i.e. at 10-30% flowering followed by mid flowering stage i.e. at 31-70% flowering stage followed by late flowering stage i.e. at 71-100% flowering stage during different time period of a day i.e. 08:00 a.m.-09:00, 11:00 a.m.-12:00, 01:00 p.m.-02:00 p.m. and 04:00 p.m.-05:00 p.m. The observation were taken based on the number of insect pollinators visiting mango flowers per 1m² per 5 minute at randomly selected 10 spots within the field and the mean data was recorded for the final result.

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The data were computed for the study of activity of pollinators during the cropping period and for estimation of activity of pollinators.

Results

Species Diversity Index and Evenness

Diversity of insect pollinators were estimated through Simpson's index (D), Simpson's index of diversity (SID) and Simpson's reciprocal index (1/D) used to measure the diversity of any taxa and equitability give the estimation of evenness and richness of the individual taxa in the ecosystem. Based on the above concept the diversity of the insect pollinators of the mango flowering period during 2018-2019 in terms of Diversity of species in which day after flowering of the mango i.e. at eight different days with weekly interval after flower emergence, diversity of species in which time period of the day i.e. 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. and diversity of species in which flowering period of the mango i.e. early flowering, mid flowering and late flowering period were calculated.

The diversity of the pollinators are estimated through the Simpson's index of diversity during various flowering periods of the crop (Table 1) revealed that the early, mid and late flowering period were represented by 10, 12 and 9 number of species with 29.25, 36.75 and 33.75 number of individuals respectively. It was further revealed that the species diversity was the maximum during mid flowering period (SID=0.9053) where as it was almost same during early (SID=0.7963) and late (SID=0.7978) flowering period.

The mid flowering period represented by 12 species of pollinators which exhibited the highest evenness (0.6987) indicating that the species were more evenly distributed compared to early and late flowering period.

Table 1: Species diversity and evenness of insect pollinators with respect to different flowering period on mango during 2018-19

Parameters	Early flowering	Mid flowering	Late flowering
Total number of species (n)	10	12	9
Total number of individuals (N)	29.25	36.75	33.75
Simpson's Index (D)	0.2036	0.0946	0.2021
Simpson's Index of diversity (SID)	0.7963	0.9053	0.7978
Simpson's reciprocal index (1/D)	4.9093	10.568	4.9468
Evenness (E ₀)	0.3936	0.6987	0.4921

The diversity of the pollinators are estimated through the Simpson's index of diversity during different time period of the day (Table 2) revealed that the 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. time period of a day were represented by 16, 15, 15 and 17 number of species with 29.97, 55.30, 31.97 and 19.96 number of individuals respectively. It was further revealed that the species diversity was the maximum during afternoon hour (SID=0.9460) where as it was almost same during 08:00 a.m. (SID=0.9060) and at 1:00 p.m. (SID=0.9140) and least being at 11:00 a.m. (SID=0.8831).

The number of pollinators per 20 swipes at 01:00 p.m. and 04:00 p.m. represented by 15 and 17 species of pollinators which exhibited almost same evenness (0.5820, 0.5806) respectively indicating that the species were more evenly distributed compared to morning hour at 08:00 a.m. and 11:00 a.m. having 16 and 15 species of pollinators with almost similar evenness (0.5034, 0.5019) respectively.

Table 2: Species diversity and evenness of insect pollinators on mango with respect to different time period of the day during 2018-19

Parameters	No. of pollinators/20 swipes			
	08:00 a.m.	11:00 a.m.	01:00 p.m.	04:00 p.m.
Total number of species (n)	16	15	15	17
Total number of individuals (N)	29.97	55.30	31.97	19.96
Simpson's Index (D)	0.0939	0.1168	0.0859	0.0539
Simpson's Index of diversity (SID)	0.9060	0.8831	0.9140	0.9460
Simpson's reciprocal index (1/D)	10.6486	8.5589	11.6357	18.5488
Evenness (E ₀)	0.5034	0.5019	0.5820	0.5806

Discussions

Species diversity index and evenness

The diversity of the pollinators are estimated through the Simpson's index of diversity during various flowering periods of the crop revealed that the early, mid and late flowering period were represented by 10, 12 and 9 number of species with 29.25, 36.75 and 33.75 number of individuals respectively. It was further revealed that the species diversity was the maximum during mid flowering period (SID=0.9053) where as it was almost same during early (SID=0.7963) and late (SID=0.7978) flowering period.

The mid flowering period represented by 12 species of pollinators which exhibited the highest evenness (0.6987) indicating that the species were more evenly distributed compared to early and late flowering period.

The diversity of the pollinators are estimated through the Simpson's index of diversity during various flowering periods of the crop revealed that the 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. time period of a day were represented by 16, 15, 15 and 17 number of species with 29.97, 55.3, 31.97 and 19.96 number of individuals respectively. It was further revealed that the species diversity was the maximum during afternoon hour (SID=0.9460) where as it was almost same during 08:00 a.m. (SID=0.9060) and at 1:00 p.m. (SID=0.9140) and least being at 11:00 a.m. (SID=0.8831).

The number of pollinators per 20 swipes at 01:00 p.m. and 04:00 p.m. represented by 15 and 17 species of pollinators which exhibited almost same evenness (0.5820, 0.586) respectively indicating that the species were more evenly distributed compared to morning hour at 08:00 a.m. and 11:00 a.m. having 16 and 15 species of pollinators with almost similar evenness (0.5034, 0.5019) respectively.

Due to less crop diversity near the field, the species diversity of the pollinators didn't vary much and they have almost similar diversity and evenness. There is no specific literature published yet to discuss further on results achieved for the diversity of the insect pollinators in mango.

Conclusions

The research work entitled "Studies on diversity of insect pollinators of mango (*Mangifera indica* L.) under coastal Odisha condition" have been undertaken during 2018-2019 at Ouat orchard, Bhubaneswar, CHES, Bhubaneswar, Farmer's field, Berhampur and Farmer's field, Sakhigopal.

The number of species varied between 9-17 with the diversity index of 0.7978-0.9053. The diversity was almost uniform in early (0.3936) and late flowering period (0.4921) as compared to mid flowering period (0.6987). Diversity (0.5019-0.5820) at different day hour i.e. 08:00 a.m., 11:00 a.m., 01:00 p.m. and 04:00 p.m. didn't show significant variation.

As such it is concluded from the present investigation that the mango inflorescence attracted a good number of insect pollinators and their intensity of visit varied with blooming period of the crop. The occurrence of Dipterans was noticed to be higher during early period of flowering while during late flowering period Hymenopterans took the place of dominance under coastal Odisha condition.

References

1. Aizen MA, Garibaldi LA, Cunningham SA, Klein AM. Long term global trends in crop yield and production reveal no current pollination shortage but increasing pollinator dependency, *Current Biology*. 2008; 18:1572-1575.
2. Borror DJ, DeLong DM, Triplehorn CA. *Collecting, Preserving and Studying Insects, An Introduction to the study of Insects* (seventh edition), Charles A. Triplehorn and Norman F-Johnson, 1981, 745-778.
3. Davenport TL. Reproductive physiology. In: Litz, R.E. (Ed.), *The Mango: Botany, Production and Uses*, 2nd ed. CAB International, Wallingford, UK, 2009, 97-169.
4. Eilers EJ, Kremen C, Greenleaf SS, Garber AK, Klein AM. Contribution of pollinator mediated crops to nutrients in the Human food supply, *PLoS ONE*. 2011; 6(6):e21363.
5. Garibaldi LA, Aizen MA, Cunningham SA, Klein AM. How much does agriculture depend on pollinators? Lessons from long term trends in crop production, *Annals of Botany*. 2009; 103(9):1579-1588.
6. Klein AM, Steffan-Dewenter I, Tscharntke T. Pollination of *Coffea canephora* in relation to local and regional agroforestry management, *Journal of Applied Ecology*. 2003; 40(5):837-845.
7. Ramírez F, Davenport TL. Mangoes in Colombia. In: Valavi S G, Rajmohan K, Govil J N, Peter KV, Thottappilly G (Eds.), *Mango: Cultivation in Different Countries*, Studium Press LLC, Houston, TX. 2012; 2:346-358.