International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 09-01-2025, Accepted: 08-02-2025, Published: 24-02-2025
Volume 10, Issue 2, 2025, Page No. 135-138

Studies on pollinator insect diversity on various fruit crops from Aurangabad district of Maharashtra

Dhokane A B, Chavan R J
Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhaji Nagar, Maharashtra, India

Abstract
Pollinators have a key ecological role in supporting the majority of the world's plant diversity, as well as a sizeable portion of global agriculture, by facilitating plant reproduction. Therefore, pollinators are essential to maintaining both human food security and natural ecosystems, which is a unique position for such a varied group of living things. The investigation conducted in 2022–2024 found that several insect pollinators were found in various crops. It was discovered that pollinators were positively correlated with temperature and negatively correlated with rainfall and relative humidity. During the present investigations major pollinating insects of fruit crops belonging to different order were reported which includes (Hymenoptera) *Apies cerana indica Melipona*, (Hymenoptera) *Coccinella septumpunctata*, (Coleoptera) *Epuraea aestiva*, (coleoptera) *Nitiduild* beetle, (Diptera) flies and midges, (hawk moth) *Macroglossum stellatarum*, (Lepidoptera) moths and butterflies, (Thysanoptera) thrips etc.

Keywords: Diversity, pollinator insects, pollination, Aurangabad

Introduction
The variety of life on Earth, including microorganisms, plants, animals, and people, is referred to as biodiversity. Biodiversity is essential to human life because it fosters connections, communal security, material well-being, and the resilience of local economies. human health, social groups, and raw materials for production and sustenance. Pollinators are inextricably linked to human well-being because they promote food security, wild plant reproduction, crop productivity, and ecosystem health and function. The variety of pollinators may influence the quality of agricultural products. Insects, such as bees, wasps, ants (Hymenoptera), beetles (Coleoptera), butterflies and moths (Lepidoptera), and flies (Diptera), make up the majority of the 200,000 or so animal pollinators.

Entomophilous plants those that depend on insects for pollination frequently develop characteristics like vibrant petals, potent fragrances, nectar, or distinctive patterns in an effort to draw pollinators. Olleton *et al*. (2011) estimated that 87.5% of blooming plants reproduce by using animal pollinators. The maintenance of biological services including pollination, biological pest control, and nutrient cycling depends on the diversity and abundance of living things. The species diversity and composition have a major impact on ecosystem stability and function. (Downing 1994; Tilman and McCann 2000; Naeem *et al*. 1994) [3, 4, 5]. One of the most important processes for preserving and advancing biodiversity and life on Earth is pollination. Additionally, pollination improves crop production efficiency and quality. Unpollinated crops may yield less fruit of worse quality (McGregor, 1976) [6]. The first stage of a plant's sexual reproduction is pollination, which is the process by which the pollen grain is transferred from the anther to the stigma (Kearns *et al*. 1998) [7]. In essence, pollination is an ecosystem service that has developed over millions of years as a reciprocal link between pollinators and flowering plants. More than half of the estimated 1.5 million species of life on Earth are insects, accounting for a sizable portion of total biodiversity (Stork *et al*. 2015) [8].

Pollinator diversity and abundance are declining at a surprising rate on a global scale (IPBES 2016). It has been noted that pollination contributes to the production of over 75% of the world's crops. It's critical to concentrate on the relationships and interactions between species in light of the worldwide decline in biodiversity. Because of their reciprocal specialisation, pollinators greatly depend on flower diversity. Pollinator extinctions may be caused by decreases in plant diversity, such as those brought on by intensifying land usage. (Frund, Jochen, and others (2010). Alongside flowering plants, pollinators evolved, and many species are mutualistic. (Moulya *et al*., M.R. (2023) [11]. Interactions between plants and pollinators foster co-adaptive growth among insect-plant species and link food webs in intricate ecosystems. Williams *et al*., 1983; Gilbert and Raven, 1980). Pollinators provide vital ecological services that indirectly impact agricultural productivity (Robacker and Erickson,1988). The pollinator should make frequent trips to the specific blossom, and these visits should be a regular aspect of the animal's existence. Such a connection is largely form via by the use of attractants of some form, including pollen, nectar, protection, scent, oil, brood location, sexual attraction, etc. (Faegri and van der Pijl, 1980).

Materials
Camera For photography
The Canon EOS 200D Mark ii camera is used an 18-megapixel high-picture-quality CMOS sensor and a potent DIGIC 4 image processor. Photographs of insect pollinator specimens were taken in the field. A range of lenses, including an 18–55 mm close-up lens for photo enlargement, were included with the camera.

Insect collecting net
Using an insect catching net provided by Research Scholar Equipment, pollinators were gathered. The insect gathering net has a nylon mesh bag (30 cm in diameter x 75 cm in depth) and a circular ring or hoop (30 cm in diameter) made

of iron. This circular ring is screwed onto the 75-cm-long iron pipe handle.

Plastic containers

Plastic containers of size 6.5x 4cm (length x diameter) were used for carrying insect pollinators to the laboratory and storing them temporary.

Methodology

To ensure thorough coverage of pest activity, sweepings were carried out continuously during these fruit crops' blooming season. In order to collect a variety of diurnal insect species, the sample was done once a week, from morning to dusk. To retain their physical qualities and guarantee their eligibility for further identification and investigation, all obtained specimens were meticulously kept as dry samples. This methodical technique made it possible to thoroughly examine the insect fauna connected to the crops that were in bloom throughout the study period.

Adult insect pollinators were collected from agricultural fields using an insect swept net in the morning and evening for a two-hour search procedure in order to study the diversity of insect pollinators. Compounds and ocular microscopes have been used in the lab to describe the insect pollinators. For the morphological characteristics, the head, thorax, abdomen, and their appendages were considered. The insect boxes contain properly labelled and maintained insect pollinators.

Pollinator flower visiting frequency have been studied at 5 minutes interval during the field visit throughout the course of study. The below table shows the fruit -crops and their pollinators

Study area

Aurangabad district is located in the central part of Maharashtra the district has total geographical area of 10,107 sq. Km. the soil in Aurangabad district is moderately alkaline with mean PH value of 7.89. Based on information from the Department of Agriculture & Farmers Welfare, Aurangabad district, Maharashtra, the total area devoted to fruit crops is roughly 41.32 thousand hectares, with the main fruits being sweet orange (Mosambi), mango, sapota, and custard apple. The study was conducted in Aurangabad district under different taluka level like Paithan, Kultabad, Sillod, Aurangabad etc the study period was carried out was in the year,2022,2023,2024 etc

Result & Discussion

In the current study, six (6) fruit crops from ten (10) tehsils of Aurangabad district were selected for the study of insect pollinator diversity. The study revealed that a total of eleven (11) pollinator species belonging to nine (09) genera were observed at the different location of Aurangabad district on selected fruit crops. The insect pollinator species belongs (4) orders *viz*., Coleoptera, Diptera, Hymenoptera, and Lepidoptera and 7 families. The following Table no.1 shows the information about the insect pollinators that were collected from the various fruit crops in Aurangabad district of Maharashtra.

Table 1: Table showing diversity of pollinator insect on fruit crop in Aurangabad district M.S India

Fruit crop	Pollinators	Order	Family	Flowering period	Timing for pollination
Mango (*Mangifera indica)*	1.*Apis cerana indica*, 2. *Melipona*, 3.*Coccinella septumpunctata* 4.*Episyrphusbalteatus*	i) Hymenoptera ii)Hymenoptera iii)Coloptera iv)Diptera	i)Apidae ii)Apidae iii)Coccinellida iv)Syriphidae	December-February	Morning
Papaya *(Carica papa)*	1.*Macroglossum stellatarum* (hawk moth), 2.*Camponotus vicinus*	I) Lepidoptera Hymenoptera	Sphingidae Formicidae	Thought the year	Morning – Evening
Custard- apple *(Annona squamosa)*	1.*Epuraeaaestiva* (Nitiduildae beetle) 2. *Lasius niger*	i.Coleoptera ii.Hymenoptera	I. Nitiduildae II.Formicidae	April-June	Morning – Evening
Sweet – lime *(Gossypium spp.)*	1.*Lasius Niger* 2.*Apies mellifera* 3.*Rhyncomya columbina*	I. Hymenoptera ii.Hymenoptera iii.Diptera	I. Formicidae ii. Apidae iii.Rhiniidae	January -March	Morning – Evening
Guava *(Psidium guajava)*	*Apies mellifera*	Hymenoptera	Apidae	February – July	Morning – Evening
Pomegranate *(Punica granatum)*	*Camponotus vicinus*, *Apis cerana indica*,	Hymenoptera Hymenoptera	Formicidae Apidae	March – April July – August	Morning

Diversity of Insect pollinator on Mango (*Mangifera indica)* in Aurangabad District.

The study on the diversity of insect pollinators of mango was carried out in major mango producing areas of Aurangabad district in the year 2022 to 2024. The insect pollinator on mango were surveyed in major mango producing area *viz*; paithan, karmad Aurangabad etc the pollination period of mango is from December to February. The process of pollination is carried out from 6 am to 9 am in the morning and 5 pm to 8 pm in evening the basic pollinators which pollinate mango are as follows *Apis cerena indica* which is commonly known as the Indian hive bee which belongs to (family Apidae and order Hymenoptera), *Melipona* which is commonly known as stingless bee which belongs to (family Apidae and order Hymenoptera), *Episyrphu sbalteatus* which is commonly known as marmalade hoverfly belongs to (family syriphidae and order Diptera). Melipona sp. and Syrphus sp. Rhynchaenus were the two main pollination insects of mangos, according to Singh (1988).

Diversity of Insect pollinator on papaya (*Carica papa*) in Aurangabad District.

The study on the diversity of insect pollinators of papaya was carried out in major papaya producing areas of Aurangabad district in the year 2022 to 2024. The insect pollinators on papaya were surveyed in major papaya producing area *viz*; paithan, karmad, Aurangabad, kultabad, sillodS etc. The period of pollination on papaya is through the year it is studied that the timing of pollination is from

morning 6Am – 9Am and in the evening 5Pm - 7Pm. The basic pollinator species the visit papaya plant are as follows *Macroglossum stellatarum* basically known as (hawk moth which belongs to (family Sphingidae and order lepidoptera), *Thrips tabaci, Camponotus vicinus* commonly known as carpenter ant which belong to (family Formicidae and order Hymenoptera). Several studies have observed the variety of insect visitation to papaya blossoms (Free, 1993) [15]. (Martins (2007) [16].

Diversity of Insect pollinator on custard-apple (*Annona squamosa)* in Aurangabad District.

The study on the diversity of insect pollinators of custard-apple was carried out in major custard-apple producing areas of Aurangabad district in the year 2022 to 2024. The pollinators on custard-apple were surveyed in major custard-apple producing area are as follow Daulatabad, kultabad sillod, Aurangabad etc. the period of pollination on custard-apple is from April – June and the timing of pollination is from 6AM -10AM in the morning and 5PM-7PM in the evening. The basic pollinators of custard-apple are as follows *Epuraea aestiva* commonly known as sap beetle or (Nitiduildae beetle) which belongs to (family Nitiduildae and order Coleoptera) etc. During anther dehiscence, these beetles can move pollen from the stamens to the stigmas on the same flower or to other flowers. McGregor's (1976) [6] investigation in Australia and Israel identified nitidulid beetles as the primary insect pollen-carriers. These beetles can transmit pollen from stamens to stigmas in the same flower or other blooms simultaneously of another dehiscence.

Diversity of Insect pollinator on Citrus-lemon (*Gossypium spp)* in Aurangabad District.

The study on the diversity of insect pollinators of sweet-lime was carried out in major sweet-lime producing areas of Aurangabad district in the year 2022 to 2024. The pollinators on sweet-lime were surveyed in major sweet-lime producing area are as follows Aurangabad, paithan, kultabad, karmad etc. The period of pollination on sweet-lime is from January -March and the timing of pollination is from 6AM-8AM in the morning and 4PM-7PM in the evening. the common pollinators of sweet lime are as follows *Lasius Niger* which is commonly known as black garden ant which belongs to (family Formicidae and order Hymenoptera) apis melefera commonly known as western honey-bee which belongs to (family Apidae and order Hymenoptera), *Rhyncomya columbina* which belongs to(family Rhiniidae and order Diptera). According to Krezdorn (1970), this does not imply that pollination is not required in citrus. Despite the fact that cross-pollination is necessary, using honey bees continues to be the most reliable, efficient, and cost-effective way to guarantee sufficient harvests.

Diversity of Insect pollinator on Guava *(Psidium guajava)* in Aurangabad District.

The study on the diversity of insect pollinators of guava was carried out in major guava producing areas of Aurangabad district in the year 2022 to 2024. The pollinators on guava were surveyed in major guava producing area are as follows Daulatabad, kultabad, Aurangabad, sillod, karmad, etc. The period of pollination on guava is from February to July and the timing of pollination is from morning 8AM-10AM and 3PM- 7PM in the evening. the pollinators on guava are as follows *Apies mellifera* which belongs to and (family Apidae and order Hymenoptera), *Apis dorsata* which is commonly known as Rock bee. While Vinod *et al*. (2018) [22] noted that insect pollinators that visited guava blooms belonged to the order Hymenoptera, Diptera, and Lepidoptera, Kadam *et al*. (2012) [21] stated that insect pollinators on guava belonged to the order Hymenoptera, Diptera, and Coleoptera. According to Abrol (2015) [20], guava flowers are somewhat reliant on bees, including honeybees, bumble bees, and wild bees, which are members of the order Hymenoptera and family Apidae. The Indian bee, or Apis cerena indica, is a member of the same family.

Diversity of Insect pollinator on Pomegranate *(Carica papa)* in Aurangabad District.

The study on the diversity of insect pollinators of guava was carried out in major Pomegranate producing areas of Aurangabad district in the year 2022 to 2024. The pollinators on guava were surveyed in major guava producing area are as follows Daulatabad, kultabad (bhatji), Aurangabad, Paithan, karmad, Gangapur etc. the period of pollination is from march to April and July to august and the timing of pollination is as follows 7AM to 10AM in the morning and 4PM to 7PM in the evening. the pollinators of pomegranate as follows *Camponotus vicinus* commonly known as carpenter ant which belongs to (family Formicidae and order Hymenoptera), Apis *cerana indica*, which is commonly known as Indian bee belongs to (family Apidae and order Hymenoptera). According to Tao *et al*. (2010) and Derin and Eti (2001) [19], bee pollination considerably enhances pomegranate quality as compared to self-pollination.

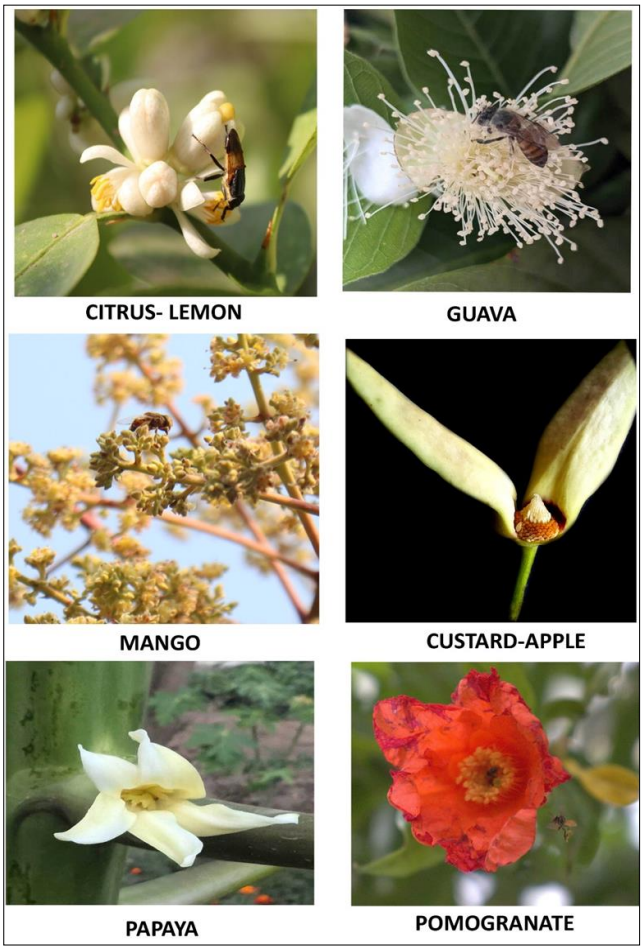

Plate 1: Pollinator insect on fruit crop in Aurangabad district of M.S India

Conclusion

The study highlights the diversity and foraging behaviour of key insect pollinators on various fruit crops in the Aurangabad District. Among the observed species, of different order bees, wasps, ants (Hymenoptera), beetles (Coleoptera), butterflies and moths (Lepidoptera), and flies (Diptera). Environmental factors such as temperature and nectar availability influenced the efficiency of pollinators. Different pollinators from different order complement each other, collectively ensuring high pollination efficiency, which is crucial for the productivity of horticultural crops like guava, mango, citrus lemon, pomegranate, custard-apple and papaya etc. The findings underscore the necessity of conserving pollinator habitats and minimizing pesticide use to sustain pollinator populations. Promoting diverse flowering plants and adopting pollinator-friendly agricultural practices can enhance crop yields and biodiversity, ensuring ecological and agricultural sustainability.

References

1. Ollerton J, Winfree R, Tarrant S. How many flowering plants are pollinated by animals? Oikos,2011:120(3):321-326.
2. Philpott SM, Uno S, Maldonado J. The importance of ants and high-shade management to coffee pollination and fruit weight in Chiapas, Mexico. Arthropod Divers Conserv, 2006, 473-487.
3. McCann KS. The diversity–stability debate. Nature,2000:405(6783):228-233.
4. Tilman D, Downing JA. Biodiversity and stability in grasslands. Nature,1994:367(6461):363-365.
5. Naeem S, Thompson LJ, Lawler SP, Lawton JH, Woodfin RM. Declining biodiversity can alter the performance of ecosystems. Nature,1994:368(6473):734-737.
6. McGregor SE. Insect pollination of cultivated crop plants. Agric Res Serv, US Department of Agriculture, 1976, 496.
7. Kearns CA, Inouye DW, Waser NM. Endangered mutualisms: the conservation of plant-pollinator interactions. Annu Rev Ecol Syst,1998:29(1):83-112.
8. Stork NE, McBroom J, Gely C, Hamilton AJ. New approaches narrow global species estimates for beetles, insects, and terrestrial arthropods. Proc Natl Acad Sci,2015:112(24):7519-7523.
9. Faegri K, Pijl LV. The principles of pollination ecology, 1979.
10. Fründ J, Linsenmair KE, Blüthgen N. Pollinator diversity and specialization in relation to flower diversity. Oikos,2010:119(10):1581-1590.
11. Moulya MR, Jagadish KS, Belavad V, Eswarappa G, Sringeswara AN. Diversity of Floral Resources of Stingless Bee, Tetragonula nr. pagdeni (Hymenoptera: Apidae: Meliponini). Mysore J Agric Sci, 2023, 57(1).
12. Dicks LV, Viana B, Bommarco R, Brosi B, Arizmendi MDC, Cunningham SA, *et al*. Ten policies for pollinators. Science,2016:354(6315):975-976.
13. Krezdorn AH. Pollination requirements of Citrus. Citrus Indus, 1972.
14. Gajendra Singh D. Insect pollinators of mango and their role in fruit setting. In: II International Symposium on Mango 231, 1985, 629-632.
15. Free JB. Insect pollination of crops, 1993.
16. Martins DJ, Johnson SD. Hawkmoth pollination of aerangoid orchids in Kenya, with special reference to nectar sugar concentration gradients in the floral spurs. Am J Bot,2007:94(4):650-659.
17. McGregor SE. Insect pollination of cultivated crop plants. Agric Res Serv, US Department of Agriculture, 1976, 496.
18. De-shuang T, Xia D, Kun D, Xue-wen Z, Yu-sheng Y. Study on the effects of pollination by honey-bees on pomegranate (Punica granatum L.). J Bee,2010:3:10-11.
19. Derin K, Eti S. Determination of pollen quality, quantity and effect of cross pollination on the fruit set and quality in the pomegranate. Turk J Agric For,2001:25(3):169-173.
20. Abrol DP, Abrol DP. Pollination and fruit productivity. In: Pollination Biology, Vol. 1: Pests and pollinators of fruit crops, 2015, 25-58.
21. Kadam DM, Kaushik P, Kumar R. Evaluation of guava products quality. Int J Food Sci Nutr Eng,2012:2(1):7-11.
22. Vinod M, Sattagi H. Pollinator fauna and their relative abundance in guava under organic and conventional farming systems. J Exp Zool India,2018:21:1173-1179.