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Ecological studies of insect pests from agricultural fields in Nashik district (M.S) India

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Abstract
With a focus on the scientific principles involved in the planning and carrying out of pest-related research, Insect Pest Management and Ecological Research examine the ecological research needed for the creation of ways to manage pest insects. Although the relationship between Integrated Pest Management (IPM) and ecology has long been understood, its specifics have remained ambiguous up until now. In this section, Gimme Walter creates the first overarching model of the IPM's entomological research requirements. By emphasizing pest scenarios, how to negotiate the variety of possibilities offered by current ecological. Investigates the ecological issues caused by polyphagous pests and beneficial species, as well as the ideas put forth to enhance insect biological management. It will therefore be a valuable tool for graduate students and researchers working in the fields of crop protection, entomology, insect pest management, and ecology.

Keywords: Pests, crops and entomology

Introduction

The current study investigates the relationships between pest abundance and species variety in the agricultural lands surrounding Nashik, Maharashtra. The study will record the variety of insects and the distribution of pest species among their host plants. The most diverse group of organisms on the planet, insects are essential to both the health of ecosystems and the running of the global economy. It is crucial to preserve the diversity of insects 18% of global agricultural productivity is destroyed by herbivorous insects. Pests pose significant security risks to agricultural practices. The characteristics of the agricultural community have an impact on insect numbers in general and pest populations in particular. The nature of these interactions within community complexity, however, is still poorly understood (Linta, 2020) [10].

Diversity indices indicated that of all the orders, Coleoptera was the most dominant group with a maximum number of pest species, followed by Hemiptera, next in the order was Lepidoptera followed by Orthoptera. The present work is the first of its kind to report the agricultural important insects and the pest. Between May and July, the damage to shoots and fruit ranged between 30.23% and 36.23% and 42.23% to 37.51%. Shoot damage was positively correlated with maximum and minimum temperatures, evaporation, and daylight hours, but relative humidity had a negative impact. Fruit damage demonstrated a negative correlation with relative humidity and a positive correlation with maximum and minimum temperatures as well as evaporation (Muthukumar and Kalyanasundarams, 2003) [13].

The incidence of leafhoppers *(Amrasca biguttula biguttula)* was highest in December and the 52nd Standard Week (SW), and lowest in March (12th SW). White fly *(Bemisia tabaci)* incidence peaked in January (2nd SW) and peaked in March (12th SW). While a positive link was found between mean relative humidity and total rainfall, both of these insects demonstrated a substantial negative correlation with maximum and lowest temperatures as well as wind speed (Mathur *et al*., 2012) [11].

Investigations on "Varietal screening of chilli against major sucking insect pests". Out of ten varieties of chilli screened against major sucking insect pests, none was found completely free from the attack of pests (Samota *et al*., 2018) [20].

There is little information on the spatial distribution of predatory fauna found in the Kharif crop agroecosystem. The spatial distribution of major predatory fauna discovered, namely Ladybird beetle, Stink bug, Green lacewing / Mallada, Earwigs, Syrphid fly, Preying Mantid, Assassin Bug, Robber fly, Hoverfly, Tiger Beetle, Dragonfly/ Damsel fly, and Spider species were studied on various kharif crop agroecosystems in Akola district of Maharashtra, India during Kharif, 2010. 154 specimens of predatory fauna associated with various important pests were collected from various Kharif crops agro-ecosystems during the study period. All of the kharif crops had spiders, stink bugs, and ladybird beetles, predatory spiders and ladybird beetles were both discovered (Bhausaheb and Samadhan, 2020) [3].

The current study was conducted in the mango orchards of the Indian Institute of Horticultural Research in 2014–2015 to examine the diversity and economic condition of Lepidopteran insect pests on two important kinds of mango, Totapuri and Alphonso (IIHR). There were a total of 13 lepidopteran species identified in this study's biodiversity of lepidopterans in the mango environment. The most dangerous Lepidopteran pest of mango, according to the degree of the infestation, is D. parabola, which attacks both tender leaves and new panicles (Soumya *et al*, 2017) [22].

We observed that there were few differences in insect pest abundance between Bt and non-Bt cotton fields. Ecological indices were computed to examine the community structure of insect pests. In total, 63 different insect pests were identified in both BT and non-Bt cotton fields. It may be concluded that climatic factors determine seasonal activity and infestation of different insect pests of cotton. The results of the present study would help develop efficient pest management strategies against insect pests of Bt-cotton and Non-Bt-cotton crops for increased yields, and profit, besides safely to the environment (Modala and Sravanthy, 2021) [12].

Cotton is a plant that's also typically grown as an annual. A main stem with a dominant apical bird recognizes the plant. These birds are extremely appealing to a variety of insects and pests. Around 150 insect and mite species have been reported attacking cotton Causing annual yield losses of 20-40%. Sucking pests such as jassid, white flies, thrips, and mites are among the most serious insect pests. These pests cause damage to flowers, green bolls, and tender shoots, resulting in a significant decrease in cotton yield and quality (Ahmed, 1991) [1].

Insect pest problems in agriculture have shown a considerable shift during the first decade of the twenty-first century due to the ecosystem and technological changes other insect pests like mealy bugs, particularly Phenacoccus solenopsis Tinsley on cotton; sugarcane woolly aphid, Ceratovacuna lanigera Zehntner on sugarcane; and tobacco caterpillar, Spodoptera litura (Fabricius), on several crops, has shown an increasing trend (Dhaliwal, *et al.*, 2011) [6].

Climate change has an impact on insect pests of rice both directly through physiological impacts caused by changes in temperature and precipitation and indirectly through effects caused by changes in host plant quality. Interdependent species, such as plants and the insects that pollinate them, do not necessarily adjust to changes simultaneously. Loss of genetic diversity in newly established host ranges tends to impact insect populations' capacity to adjust to changing climatic conditions involving new food sources, rivals, and natural enemies. Many minor pests rose to the position of large pests, whereas a few major pests reduced in size. Records show that numerous new pests have changed their hosts, and other invasive pests have also done so as a result of habitat changes (Rath. *et al.*, 2020) [16].

The current study, titled "Study on the Abundance of Insect Pests Associated with Brinjal *(Solanum melongena L.)* During the crop season, ten insect species from four orders and nine families were found attacking the brinjal crop, including Lepidopterans with Leucinodes *orbonalis, Eublemma olivacea, and Euzophera pertcella, Hemipterans* with *Amrasca biguttula biguttula, Bemisia tabaci, Urentius histericellus, and Aphis gossypii*, Orthoptera with Melanoplus differentialis and Coleopterans with Trachys herilla and Henosapilachna vigintioctopuncata were found attacking the brinjal crop from vegetative to reproductive stage. Among them, jassid *(Amrasca biguttula biguttula Ishida)*, whitefly *(Bemisia tabaci Gennadius)*, jassid *(Amrasca biguttula biguttula Ishida)* and fruit borer *(Leucinodes orbonalis Guenee)* were recorded as major pests. Other insect pests recorded on the crop were of less importance and less damage caused by them was found without much economic loss. *L. orbonalis, E. olivacea, E. pertcella, A. biguttula biguttula, B. tabaci, U. histericellus, A. gossypii, M. differentialis, T. herilla, and H. vigintioctopunctata* are some examples of these species Jassid, whiteflies, brinjal shoot and fruit borer, and whiteflies were identified as the main pests among these. These insects were the main pests responsible for a decrease in the nation's yield of brinjal. To control these dangerous pests, To reduce the use of chemical pesticides on brinjal, it is therefore important to conserve bio-control agents (Sushil *et al.*, 2019) [24].

Regular pests like shootflies and maize borers attack the crop throughout each of its three growth seasons. Kharif maize is frequently attacked by Chilo partellus. Additionally, there are around a dozen other pests that can cause significant crop loss and appear intermittent. Pest insects in maize crops might result in losses of between 5 and 15%. Because of maize's massive output of pollen grains, a large number of its natural enemies are likewise drawn to it (Pradyumn *et al.*, 2019) [15].

The bottle gourd, *Lagenaria siceraria (Malina) Standl*, is a well-liked vegetable in certain Asian nations, including India. The two most prevalent pests were discovered to be the red pumpkin beetle *(Aulacophora foveicollis)* and the epilachna beetle *(Henosepilachna vigintioctopunctata)*, which appeared from the early to mid-crop growth stage (6.2 - 35.6% damage) and from the mid-to-late crop growth stage (16.3 - 45.6% damage). Inflicting between 7.5 and 19.2% leaf damage, the green semilooper *(Trichoplusia ni)* attacked the crop during its peak vegetative development stage. The study also showed that various climatic factors had a substantial impact on the establishment and expansion of insect populations, as well as the resulting damages (Sagarika and Saha, 2017) [18].

During the kharif-rabi season of 2019-20, the incidence of various insect pests and associated natural enemies was observed on a drumstick at a farmer's field in the village. During the study, ten insect pest species were observed causing damage to the drumstick crop at various stages of growth. The leaf caterpillar, *N. blitealis*, is one of the most common insects of the drumstick and can be found all year on variety PKM -1. During the second week of April, a maximum population of 4.31 larvae/branches was recorded. The months of February to April were more favorable for the development of leaf caterpillars (Tamraj and Gupta, 2020) [25]

Grape being a perennial fruit crop is a host for more than a hundred insect pests. 24 species of insect pests from seven orders and two species of mite pests were recovered. Six species of Coleoptera, six species of Lepidoptera, four species of Hemiptera, three species of Hymenoptera, three species of Thysanoptera, one species of Isoptera, one species of Diptera, and two species of Acari were discovered. According to the findings of this study, the pest complex in grapes includes sucking insect pests such as thrips, hoppers, mealybugs, and beetle pests such as stem borer, stem girdler, flea beetles, chafer beetles, shot hole borer, and several lepidopteron and mites (Sunitha, 2017) [23].

During the 2014-15 kharif and rabi seasons, a field experiment was conducted to document the population estimation and seasonal incidence of minor insect pests on bitter gourd (*Momordica charantia L.*) The study discovered 24 species of insect pests attacking the crop at various stages of development; they belonged to five different Orders, namely Coleoptera, Hemiptera, Thysanoptora, Lepidoptera, and Diptera. Along with insect pests, five different predator species were discovered. On sucking pests

and defoliators, population estimation and seasonal incidence have been tabulated and calculated (Rathod *et al*., 2017) [17].

During the kharif and rabbi seasons of 2014–15, a field experiment was carried out to record the population estimation and seasonal incidence of a minor on bitter gourd (*Momordica*), insects and pests *L. charantia*. The investigation turned up 24 insect species. Pests were discovered attacking the crop in various they were in various growth stages and belonged to five different Orders namely, Lepidoptera, Thysanoptera, Coleoptera, and Hemiptera and Diptera. In addition to insect pests, five distinct predator species are also present. Population estimated, tabulated, and calculated seasonal incidence of defoliators and sucking pests (Thippaiah and Jayaram, 2017) [26].

The edible root of the biennial herb known as carrot, Daucus carota, belongs to the *Apiaceae* family. which continues to be the center of diversity for D. carota, is where the carrot is thought to have first appeared. The production of carrots is being restricted by several major insect pests, including the aster leafhopper, flea beetle, aphid, carrot weevil, carrot rust fly, and cutworm. There is little information available on carrot insect pests (Saha *et al*., 2015) [19].

Cereals play an important role in global area, production, and diet composition. These crops suffer as a result of insect pests, which are a major limiting factor in their production. Global warming, unusual weather, shifting cropping patterns, and technological adoption all affect insect abundance, distribution, and pest-related losses over time and space. This chapter examines the status of insect pests of important cereal crops in India, including rice, wheat, maize, sorghum, and pearl millet. In addition, emerging insect pests of cereals in India and university work on insect pest management in cereals are highlighted. The chapter also summarises management practices for important insect pests of cereal crops (Jakhar *et al*., 2018) [9].

The red pumpkin beetle (*Aulacophora foveicollis*) is the most common Coleopteran insect pest in cucurbitaceous crops. It has the potential to cause 30 to 100% yield losses in a variety of cucurbit crops. Various chemicals can be used to control the red pumpkin beetle in cucurbitaceous crops. Various researchers reported that the use of chemicals such as Carbaryl and monocrotophos was most effective against the red pumpkin beetle. Carbofuran at 0.5% a.i./ha applied to the soil is most effective against the red pumpkin beetle during the seedling stage. Carbofuran in granule form is most effective against red pumpkin beetle in soil application and seed treatment, with no negative effects on seed germination in muskmelon and bottle gourd (Gharde, 2018) [7].

The actual survey was conducted from September 15, 2020 to March 15, 2021. Throughout the research period, A total of 25 species of agricultural insect pests were collected and identified from 29 different sampling sites across seven counties, and villages. They are classified into four orders: *Orthoptera, Hemiptera, Coleoptera, and Lepidoptera. Gryllidae, Gryllotalpidae, Acrididae, Tettigoniidae, Pyrgomorphidae, and Pyrgomorphidae are among the 12 families. Pentatomidae, Pseudococcidae, Coreidae, Chrysomelidae, Scarabaeidae, Cupedidae, and Sphingidae* are the families of insects. Biological stresses such as insect pests, diseases, and weeds reduce yield by 20-100%. The lush crop growth, soft and succulent foliage, and abundant food, space, and shelter attract many insects (Shweta and Siddarth, 2020) [21].

Thrips tabaci Lindeman (*Thysanoptera: Thripidae*) is a well-known onion pest all over the world. Onion thrips are the culprits. Both direct and indirect onion damage is caused by feeding and ovipositing on leaves, which may result in unmarketable green onions (*scallions*) and reduced dry bulb onion size. Onion thrips can also transmit plant pathogens that reduce the size and quality of onion bulbs. Iris yellow spot virus is one of the most economically damaging onion pathogens transmitted by onion thrips (*Bunyaviridae: Tospovirus*) (Harsimran *et al*., 2015) [8].

India is an agricultural country where 65 percent population is dependent on agriculture. Vegetables have many important functions in people's everyday life. Being nutritional benefits and of short duration, vegetable crops allow enough scope for increasing the intensity of cropping Of the various salad vegetables grown, carrot, radish and beet are the important salad vegetables. The present paper entitled "Economic Analysis of Production of beet in Maharashtra" was undertaken with the specific objectives viz; i. To estimate cost and return structure in beet cultivation ii. To estimate resource use productivity and resource use efficiency in beet production and iii. To examine the constraints in beet production (Pokharkar *et al*., 2020) [14].

Tomato (*Lycopersicon esculentum Mill*.) is one of the most popular and commercially important vegetable crops cultivated throughout India. Among the factors responsible for the lower yield, insect pests are the major ones. The higher natural enemy population were found simultaneously with higher insect pest populations recorded in the field i.e. from February to March (Bimal *et al*.,2019) [4].

However, the level of infestation varies depending on the weather conditions. Depending on a variety of biotic and abiotic factors (temperature, relative humidity, etc.) humidity, sunshine hours, and wind speed (natural enemies). As a result, continuous field surveys of insect pest populations are required (Borse *et al*., 2019) [5].

Herbivorous insects devastate 18% of global agricultural production. Insect pests are created by humans manipulating habitats, where crops are selected for larger size, higher yields, and nutritious value, and are cultivated in monocultures for maximum production. This creates an ideal environment for herbivorous insect population growth (Astrid, 2018) [2].

Materials and methods

Materials Required: Types of insect Pests and Crops

Method

Removal Trapping methods were employed for sampling insects. Removal Trapping methods generally involve different approaches such as Pitfall trap, Quick trap method, Sweeping method, Cage method, etc.

1. Pitfall trap

Is usually a traditional method used for sampling (ground-dwelling) Invertebrates. A pitfall trap consists basically of a glass, plastic, or metal container, sunk into the soil so that the mouth is leveled with the soil surface. Many ground-dwelling animals fall into the trap and are unable to escape.

2. Sweep sampling method

The sweep sampling method was employed to catch those insect groups which dwell in the herb and shrub layers of the forest vegetation by using a sweep net having a mouth diameter of 40 cm. Sweeping activities were done in each site mainly in the morning hours. This method is suitable for sampling insects in ground layer vegetation. The major limitation of the sweep sampling method was its unsuitability for sampling insects in the thorny and thick bushes of the forest.

3. Cage method

The sampling was done randomly at ten different spots in all the study sites. The Distance between the two adjacent spots was maintained at a range of 10-15m. Care was taken not to disturb the area before the cage was dropped on the ground. The adult insects trapped inside the cage were collected by handpicking the collected insects were sorted out and later classified up to family and species level and counted. The insects were oven dried at 60°C for 72 hrs. Till constant weight was obtained.

4. Light Trapping

A fluorescent Light Trap Device was used for the light trapping method in which the light source was a fluorescent tube (18 watts) powered by a 12 Volt Battery. The insects thus attracted towards the light were made slipped down into the collecting chamber of the trap where insects were immobilized by using a Killing Jar placed inside the chamber of the trapping device. The trap was operated for four hours in the nighttime. The insect catching in the light trap is influenced by several factors viz. rain, wind velocity, moonlight, etc**.**

5. Feeding Experiment

In the feeding experiment, a stock of newly hatched larvae of insects was maintained in the laboratory in a cage covered with Nylon Net. The larvae were allowed to feed on the tender leaves of the host plants.

Area of the Study

Location- Nashik (Year 2022-23)

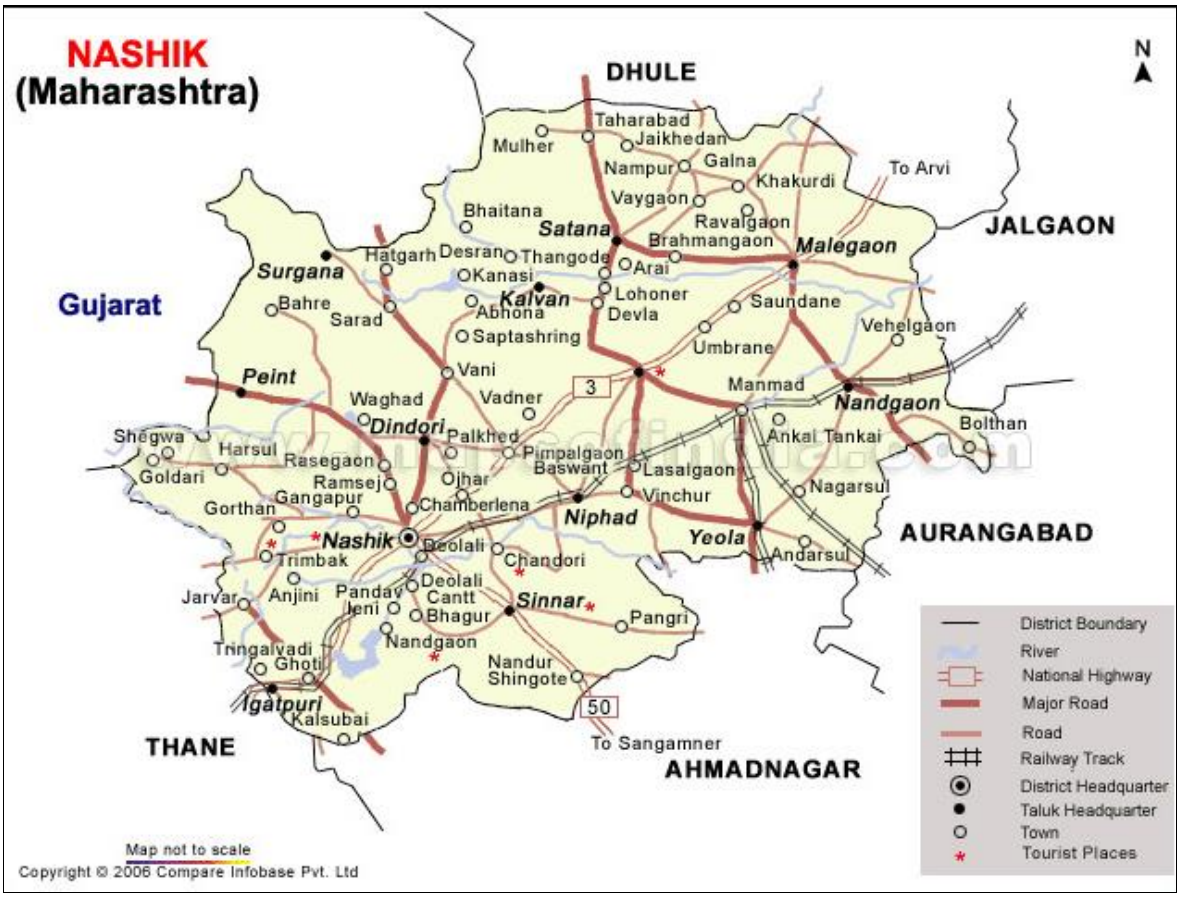

Fig 1

Geographical area	15,63,000
Cultivable area	8,64,000
Average kharif crop area	6,63,200
Average Rabi Crop area	1,36,500
Actual sown area	6,58,763
Forest	3,40,000
Uncultivable area	23,000

Nashik is one of the ancient cities of Maharashtra which is Located on the bank of the Godavari River. It has rich in Agriculture and is a city in the northern region of the Indian state of Maharashtra. Situated on the banks of river Godavari, Nashik is the fourth largest city in Maharashtra, after Mumbai, Pune and Nagpur. Nashik is well known for being one of the Hindu pilgrimage sites of the Kumbh Mela, which is held every 12 years. Nashik is located about 190 km north of the state capital Mumbai. The city is called the "Wine Capital of India" as more than half of India's vineyards and wineries are located here. Around 90% of all Indian wine comes from the Nashik Valley. Nashik is one of the fastest-growing cities in India Nashik district is located between 18.33 degrees & 20.53 degrees

north latitude& between 73.16 degrees & 75.16-degree east longitude at the northwest part of Maharashtra state, at 565 meters above means sea level. Recently two tahsils are created in the strict making the total tahsils 15. Out of 15 blocks in the district, as many as 8 blocks viz. Surgana, Peth, Igatpuri, Kalwan, Baglan, Dindori, Triambakeshwar & Nashik are tribal blocks.

In the last 20 years, the grapes have acquired dominance in the agricultural economy of the district. Due to water shortage in Kalwan, Deola, Malegaon blocks, the farmers have shifted to pomegranate from sugarcane & grape crops. Some progressive farmers are cultivating flowers in greenhouses. These developments also indicate that the farmers in the district adopt new technologies & methods of cultivation.

Five Region selected for Agriculture Insect Pests in Nashik district

A. Niphad
B. Nandur Madhmeshwar
C. Triambakeshwar
D. Palkhed (Mirchi)
E. Satana

Conclusions

In the agricultural lands surrounding Nashik, Maharashtra, the current study looks into the links between insect abundance and species variety. The study will keep track of the different bug species and how often different pest species are found among the host plants. Insects, the most varied class of organisms on earth, are crucial to the sustainability of ecosystems and the operation of the world economy. The diversity of insects must be protected. One of Maharashtra's historic cities, Nashik is situated on the Godavari River. A city in the northern part of the Indian state of Maharashtra is rich in agriculture. In the Nashik district, Niphad, Nandur Madhmeshwar, Triambakeshwar, Palkhed (Mirchi), and Satana were chosen as the top five regions for agricultural insect pests. Removal and trapping Generally speaking, there are a variety of trapping techniques used for sampling insects, including pitfall traps, quick traps, sweeping methods, and cage methods.

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