Occurrence, Abundance and Control of the Major Insect Association with Medicinal Plant in Madhya Pardesh, India

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Abstract
In the present study the association of insects with some important medicinal plants of tropical region has been accessed. No species on earth exists in isolation but are interdependent with each other and their local environment. In natural ecosystems, plants and insects are intimately associated and continuously interact in a complex way as insects have several beneficial activities including defence and pollination while plants provide shelter, oviposition sites and food. Beetworm Moth (BM), *Hymenia recurvalis* F. is a major defoliator of *Amaranthus* species affecting severe harvest loss. Control with synthetic insecticide is being discouraged for its adverse effects. Information on sustainable management of BM with ecologically friendly methods is scanty. Three *Amaranthus* species: *A. cruentus, A. blitum* and *A. hybridus* were evaluated for insect diversity and abundance during wet and dry seasons of two years following standard procedures. Data collected were Leaf Area Damage (LAD) (cm2); Infestation per plant (I) and Field Abundance (FA). Three neem extracts: 0.125 g Aqueous Neem Leaf (ANL) w/v; 0.125 g Aqueous Neem Bark Ash (ANBA) w/v and Aqueous Modified ANL+ANBA (AMAN) (1:1) all at 3l/25 m2 were bioassayed against BM using λ-cyhalothrin at 2.5 ml/25m2 and water as controls. Data collected were analysed using descriptive statistics, ANOVA at P>0.05, Shannon index (H), Simpson index (1-D) and evenness. Sixty insect species from 29 families and 12 orders; comprising 31 defoliators, 12 predators, one pupa parasitoid (*Apanteles hymeneae*) and 16 non-economic species were encountered on *Amaranthus* species. The BM was the most damaging causing 69.4 ± 0.16% loss of foliage compared to control. The species abundance in both seasons was BM (2916.8 ± 138.83)>*Hypolixus truncatulus* (2262.7 ± 94.1) >*Lixus truncatulus* (2088.7 ± 36.4). Shannon (3.52), 1-D (0.96) and evenness index (0.65) of diversity were high with few dominant species. The AMAN at 3l/25 m2 w/v extract caused significant reduction of leaf damage (72 ± 0.05%) and field infestation (78 ± 0.06%) compared to the untreated control; but comparatively less effective by only 5% to λ-cyhalothrin; implying suitability as environmentally safe control measure.

Introduction
A wide variety of insect pests that included mealybugs, beetles and aphids, were recorded from 16 medicinal plants from Jabalpur area of Central India. Agrotis ypsilon, Leptoglossus zonatus, Helicoverpa armigera, Henosepilachna vigintiocto punctata and Aphis craccivora were the major insect pests infesting most of the commercial medicinal crops. While some of insects, i.e. Agrotis ypsilon, were infesting most of the crops, some insects were highly specific to the host plants, which included cotton mealybugs. A seasonal variation was recorded for most of the insect pests on medicinal plants. Most of the insects were found abundant during a temeperature range of 15-35°C, although some were abundant during the whole year. In the present study the association of insects with some important medicinal plants of tropical region has been accessed. No species on earth exists in isolation but are interdependent with each other and their local environment. In natural ecosystems, plants and insects are intimately associated and continuously interact in a complex way as insects have several beneficial activities including defence and pollination while plants provide shelter, oviposition sites and food. Some insects like wasps, bees, butterflies and ants help in pollination. As insects gather nectar from different plants of the same species, they also spread pollen from plant on which they previously feed which greatly increases plants ability to cross pollinate, maintaining and improving

their evolutionary fitness. Insects represent one Class of animals within the Phylum Arthropoda. If you do not immediately recognize an insect you may need to identify some arthropods to first determine if they are in fact insects before roceeding further. The Beetworm Moth, Hymenia recurvalis Fab. (Lepidoptera: Pyralidae) causes severe losses to Amaranthus species. The caterpillar rolls the leaf into distinctive leaf shelter and voraciously feed on the green matter. Severe attack results in complete skeletonisation and drying up of the leaves within a short time. This has necessitated the need to control the insect pest and other pests of Amaranthus species. The management of these insect pests has been through the use of insecticides. Dales [29] noted that the use of synthetic insecticides pose health risk and result in environmental pollution. Also, Schmutterer reported that the World Health Organization (WHO) had reported the poisoning of at least 3 million agricultural workers from which 20,000 deaths are recorded annually due to pesticide usage. Awasthi also noted that consumers of vegetables may be at risk from pesticide residues. Thus, research has been geared towards identifying non-chemical methods of pest control, which are safe, cheap, easy to

Study Area

In central India Madhya Pradesh. The centre was set up in the year 1995-1996. It is located 39 Kms towards north from state capital Bhopal within the geological coordinates of 23.0011°N, and 77.5819°E and at the elevation level of 449 m. It lies in the centre of several historical places like Bhojpur, Salkanpur, Delawadi and Bhimbetka rock shelters.

Objectives

- To undertake periodical survey for collection and observation on natural enemies of key insect pests of teak, their habit and habitat in different ecological types of teak forests of Madhya Pradesh.
- To study the status of natural enemies, their sampling and identification.
- To investigate the alternate hosts of natural enemies.

Sampling Method

The survey of Insects association with some important Medicinal plants was carried out in two seasons viz., post monsoon (September, October and November,2015) and winter season (December 2015 and January 2016). The surveying of insects was done by direct counting and their number and location was recorded in notebook. A Regular Zigzag pattern was followed for surveying insects. The collected specimens of insects were taken to the laboratory and were identified from the internet site, “Indian insect biodiversity.org”. Dragonflies and Damselflies were identified after Subramanian (2005).

Therefore, in view of the need to control the beet webworm moth, potential locked up in A. indica and the need to develop non-toxic, safe and effective biodegradable alternative to synthetic insecticides which could be deployed in a site specific IPM approach which in turn depends on adequate information on the pest as well as appropriate pest population estimates. Consequently, this study evaluates the biology and management of the leaf caterpillar, H. recurvalis (Lepidoptera:Pyralidae).

Parameters	**Measurement**
Experimental Area	13 m×11.5 m
Experimental Block Dimension	1 m×11.5 m
Experimental Plot Dimension	1 m×2.5 m
Alley	0.5 m
Test Plots	
Number of rows	4
Row length	2.5
Inter row spacing	30 cm
Number of replicates	4
Inter plant spacing	5cm
Row width	1m

Table 1: Field Parameters and Measurement.

Plate 1: Seedlings at 2 weeks after sowing: showing period of insect infestation.

Review of literature

Defoliation is a serious problem in nurseries, plantations and natural forests of teak and defoliators are main destructive pests of teak. The problem of severe epidemic defoliation is a regular phenomenon in teak, which are regularly and recurringly plagued by larvae of two well known pests of teak in India – Hyblaea puera Cramer (Lepidoptera : Hyblaeidae), popularly known as the teak defoliator, and Eutectona machaeralis (Walker) (Lepidoptera : Pyralidae), popularly known as the teak leaf skeletonizer (Tewari, 1992). In addition to defoliation, these insects also feed on the inflorescence and are responsible for poor seed formation and seed setting in teak during epidemic period (Roychoudhury et al., 2001). Unequivocal clarifications have been made on the distribution, biology, ecology, life history and population dynamics of H. puera and E. machaeralis, in different eco-zones of India (Beeson, 1941; Mathur, 1960; Nair, 1988), including Madhya Pradesh (Vaishampayan and Bahadur, 1983; Khan et al., 1988; Jain et al., 1995; Roychoudhury et al., 1995). Potentiality of these insect pests on teak defoliation is a well recognized problem in India, affecting adversely the tree growth and vigour, responsible for both qualitative and quantitative loss in timber production, besides causing certain abnormalities (Beeson, 1941). Continuous feeding of these insects on 5 young teak crop causes a loss of about 65% of the normal increment in growth and sometimes even the death of the defoliated trees (Champion, 1934). Recent study calculated a loss of 44% of potential volume growth of teak due to defoliation by only H. puera in 4-8 year old plantations in Kerala (Nair et al., 1985). Considering the magnitude of economic loss caused by H. puera and E. machaeralis, a great deal of experimentation have been made in past to control these pests (Beeson, 1941; Mathur, 1960; Nair, 1988), including aerial spraying of insecticides (Singh, 1980), but still it remains a burning problem. These pests cause a real menace and receive undivided attention of scientists and foresters to find out a long-term solution of the problem.

Data Analysis

PHYLUM ARTHROPODA

ORDER – COLEOPTERA

(07 FAMILY, 12 SPECIES RECORDED DURING THE STUDY)

Total 12 insects species of beetles and weevils were collected during the study from various medicinal plants.

The insects collected from Order Coleoptera belonged to the families

Attelabidae, Cerambycidae, Coccinellidae, Scarabaeidae, Curculionidae, Bostrichidae, Scutelleridae.

ORDER – HEMIPTERA

(05 FAMILY, 10 SPECIES RECORDED DURING THE STUDY)

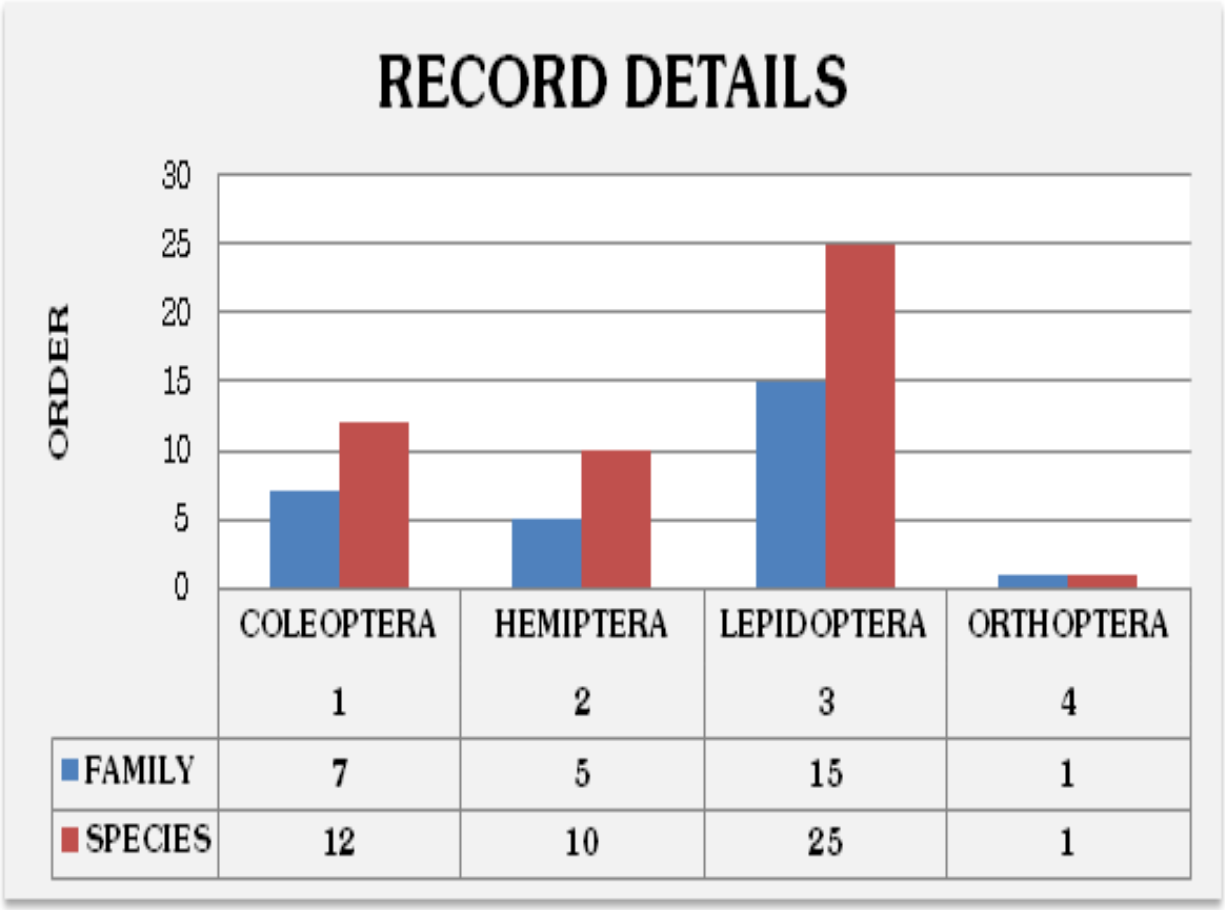
Total 10 insect species of bugs were identified during the study. The insects collected from Order hemiptera were from families.

Pseudococcidae, Eurybrachidae, Miridae, Membracidae, Coccidae.

ORDER – LEPIDOPTERA
(15 FAMILY, 25 SPECIES RECORDED DURING THE STUDY)
Most of the insects from this order were collected as larvae, although adults could also be identified. Maximum number of insects (25) were collected from this order. The insects collected of Order Lepidoptera were found to be of various families, including Riodinidae, Noctuidae, Thyrididae, Pieridae, Erebidae, Sphingidae, Lycaenidae, Psychidae, Crambidae, Eucosmidae, Erebidae, Geometridae, Nymphalidae, Sphingidae, Acrididae.

ORDER - ORTHOPTERA
(01 FAMILY, 01 SPECIES RECORDED DURING THE STUDY)
Only one member of insect pest was identified feeding on medicinal plants during the study, which belonged to the family Pyrgomorphidae.

Fig1.1(Source:Primary)



Results and Discussion

Occurrence and abundance of insect diversity associated with Amaranthus species in Madhya Pradesh. The overall mean of spectral analysis of species and abundance associated with Amaranthus sp. respectively. The peak frequency (0.3897) during wet season was not significantly (P>0.05) higher than peak frequency (0.3114) during dry season in the two years.

Abundance and diversity of insects associated with Amaranthus sp. in the wet season The diurnal insects associated with Amaranthus sp. in Ibadan varied significantly in the wet seasons of 2009 and 2010 as presented in Table 2 total of 37, 593.2 ± 16.38 individuals in 2009 and 36,464.0 ± 15.85 in 2010 comprising adults and immature stages of different insects from The information recorded with respect to occurrence of different insects along with temperature variation on different medicinal plants during study period is shown in Tables 1-8. The temperature during the present study varied from 26.9°C to 38.5°C with a mean temperature of 33.3°C during the post monsoon season however it varied from 21.1°C to 27.5°C with mean temperature of 24.6°C during the early winter season. The medicinal plants viz., Clitoria ternatea, Acorus calamus, Asparagus racemosus, Stachytarpheta indica, Mimosa pudica, Hedychium coronarium, Bixa orellana and Rauvolfia serpentina were visited by insect species from nine different families viz., saturniidae and Sphinigade (Moths), Nymphalidae (Butterflies), Acrididae (Grasshoppers), Araneidae (Spiders), Coenagrionidae (Damselflies), Libellulidae (Dragonflies), Vespidae (Wasps) and Apidae (Bees). Clitoria ternatea, commonly known as butterfly pea belongs to family Fabaceae, and is being used from centuries as a memory enhancer, anti-stressor, antidepressant, anticonvulsant, tranquilizing and as a sedative agent (Mukherjee et al., 2008). Acorus calamus commonly known as Sweet flag belongs to family Acoraceae is a memory enhancer, and is widely employed in modern herbal medicine due to its sedative, laxative, diuretic, and carminative properties (preventing formation of gases in gastrointestinal tract) (Gualtiero, 1990). Asparagus racemosus commonly known as Shatavari belongs to family Asparagacea. It is generally used as a uterine tonic, as a galactogogue (to improve breast milk), in hyperacidity and as a best general health tonic. Stachytarpheta indica is commonly known as Indian snakeweed and belongs to family Verbenaceae. It is an abrotifacient (causing abortion) and used for treating intestinal worms, venereal diseases, ulcers, dropsy and stomach ailments. Mimosa pudica, commonly known as Touch-me-not belongs to family Fabaceae. Britt and Burkhart, 1997 reported that aqueous extract of the roots of Mimosa pudica shows significant neutralizing effects on the lethality of the monocled cobra (Naja kaouthia), and appears to inhibit the mytoxicity and enzyme activity of cobra venom. Hedychium coronarium commonly known as white ginger lily belongs to the family Zingiberaceae. Its rhizome is used in the treatment of diabetes. The plant also possesses analgesic and neuropharmacological, anti-Inflammatory, antimicrobial and cytotoxic activities (Ramaroo and Gurjar 1990). Bixa orellana belongs to family Bixaceae and is commonly known as Lipstick tree. Seeds of this plant have been used as a condiment as well as laxative, cardiotonic, hypotensive, expectorant, and antibiotic. Rauvolfia serpentina is commonly known as Sarpagandha. It belongs to family Apocynaceae. Reserpine an alkaloid isolated from Rauvolfia serpentina is widely being used as an antihypertensive drug. Recent researches have proved that Rauvolfia serpentina exhibits profound activity towards drug-resistant tumor cells (Abdelfateh and Efferth 2015). Tropical forests contribute 25% of the world's medicinal products and nearly half of the currently used plant-derived prescription drugs (Jaganath and Ng, 2000). In large segment of the Madhya Pradesh, rural and ethnic communities still rely on traditional medicines, which are derived from wild plant products. Medicinal plants have great scope to achieve net higher returns in international agri business , which has an estimated growth rate of about 5-10%. However, medicinal plants, like other agricultural crops, are largely hampered by the attack of insect-pests, diseases and weeds. Natural resources of medicinal plants are narrowing, apart from the insect pest attacks, due to deforestation, extensive exploitation and lack of proper knowledge on those problems among the majority of the people.

Collection of insect species from medicinal plants




Conclusion

Based on the results obtained from the present study, as well as in view of the literature survey, following conclusions were drawn from the study :

1. A wide variety of insect pests that included mealybugs, beetles and aphids, were recorded from 16 medicinal plants from Jabalpur area of Central India.
2. Agrotis ypsilon, Leptoglossus zonatus, Helicoverpa armigera, Henosepilachna vigintiocto punctata and Aphis craccivora were the major insect pests infesting most of the commercial medicinal crops.
3. While some of insects, i.e. Agrotis ypsilon, were infesting most of the crops, some insects were highly specific to the host plants, which included cotton mealybugs.
4. A seasonal variation was recorded for most of the insect pests on medicinal plants. Most of the insects were found abundant during a temeperature range of 15-35°C, although some were abundant during the whole year.
5. The insect natural enemies, which were not pests themselves (adults only, as their larvae or catterpiller are known to infest other plants) were also recorded, which can be used for biological control agents in the fields of medicinal plants. However, more extensive work is needed before this aproach can be practised.
6. Most of the medicinal plants, i.e. babool, jamun, and neem are not being cultivated in farms, but the usuful parts are obtained from the nature itself, and hence no pest management of these plants is being followed.

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