

Biodiversity of Agriculturally Important Insects in North Eastern Himalaya: An Overview

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INTRODUCTION

Northeast India comprises eight states, viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. This region occupies 7.7% of India's total geographical area supporting 50% of the flora (ca. 8000 species) (Rao 1994), of which 31.58% (ca. 2526 species) is endemic (Nayar 1996). Therefore, it has been considered as one of the mega biodiversity hot spots (Mayer et al. 2000). It is a transitional zone between the Indian, Indo-Burma-Malaysian and Indo-Chinese regions. The region is also a part of the vavilovian centre of biodiversity and origin of many important cultivated plant species and some domesticated animals (Agarwal 1996). The region supports a rich biodiversity spanning from tropical rainforests to alpine shrubs. Takhtajan (1969) described the region as the 'Cradle of Flowering Plants' because of its diversified angiosperms. This rich biodiversity has a significant role in the maintenance of the ecosystem. Besides, the biodiversity of the region is used ethnologically by locals for various socio-economic and developmental purposes (Yumnam 2008). The region is rich in orchids, ferns, oaks (*Quercus* spp.), bamboos, rhododendrons (*Rhododendron* spp.), magnolias (*Magnolia* spp.), etc.

The Biodiversity Strategy and Action Plan for Northeast Eco-region recorded 3,624 species of insects and 50 molluscs from this region. Butterflies and moths are by far the best-studied invertebrate organisms of the region, which contributes the maximum number of species for this group in the country. One of the largest known tropical lepidoptera is the Atlas Moth (*Attacus atlas*), is very common in many parts of Northeast India. Apart from that, *Princeps polyctor ganesa*, a beautiful butterfly and *Erysmia pulchella* and *Nyctalemon patroclus* two beautiful moths also occur in the region (Chatterjee et al. 2006).

Honey bees, another important insect, that render very valuable ecological services like

pollinating wild and cultivated plant species besides producing honey, and their advanced eusocial behaviour has always been a source of fascination for mankind. Four indigenous species of honey bees are recognized from India, these are *Apis cerana*, *A. dorsata*, *A. florae* and *A. andreniformes*. Unfortunately, the bee pollination in the region is under threat, because the people in certain parts of Northeast India not only consume the honey and larvae of this insect, but also fry and eat the adult honey bees.

Hill agriculture is comparatively more vulnerable to insect pest infestation due to the occurrence of varied climatic conditions. Microclimatic specificity of some hilly pockets results in development of hot spot for certain pests. Meghalaya, a part of mega biodiversity hotspot and the agro climatic conditions are very conducive for the growth and multiplication of the insect fauna and their natural enemies. They pose serious problems with resultant low productivity in almost all the crops. Anecdotal evidences also indicate rise in losses, despite increasing use of chemical pesticides

INSECT PEST PROBLEM IN HILL AGRICULTURE

With the increase in the productivity and production of the agricultural crops, by intervention of high yielding varieties, agro-chemical, irrigation, monoculture etc., there have been tremendous changes in the pest scenario of the crops (Dhaliwal and Arora 2001; Atwal and Singh 1990). Despite the rich biodiversity in agriculturally important crops, wheat, maize and rice accounts for 60% of plant derived calories in human diet (Hawtin 1998). Monoculture of certain crops is considered as one of the major factors for increased insect pest problem. Mono-cropping of vegetable crops especially in the valley areas prompted the chances for outbreaks of many insect pests.

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MAJOR INSECT PESTS OF CROPS IN HILL AGRICULTURE

Crop wise important insect pests of the region are discussed below

Field Crops

Rice

Rice is the staple food crop and is grown extensively in valleys, terraces, upland, hill and jhum. In NEH region the rice crop is host to many species of insects; few of them cause severe economic damage and records 20 % yield losses to complete failure of the crop during epidemics. Yellow stem borer, leaf folder, case worm, hispa, gundhi bug, swarming caterpillar, thrips, gall midge, and army worm are the important pests prevalent in the region (Shylesha et al. 2006). The rainfed rice in the region is severely damaged by subterranean insects like root aphids and white grubs which are otherwise not a major problem of this crop in any other parts of India. Natural enemies play a major role in keeping the populations of these insect pests in the region under economic threshold level.

Maize

Maize is the second most important cereal crop in the region. It is primarily grown in the jhum land and terraced areas in the NEH region. Maize and small millets are generally less attacked by insect pests. Maize cob borer or earhead worm and the stem borer are the major pest of this crop. Termites, ear cutting caterpillars, field crickets and shoot fly, *Atherigona falcata* also infest in the early stage of crop and sometimes causes serious damage at early stage of the crop. Incidence of pink borer, *Sesamia inferens* is very low in the region. Apart from them, *Chilo partellus*, *Atherigona soccata*, blister beetle, white grubs and cutworms also infest the crop. The other insects viz. bihar hairy caterpillar (BHC), *Spilartia obliqua*, aphids *Rhaphalosiphum maidis*, leaf hoppers, white backed plant hoppers (WBPH), semiloopers, *Trichoplusia orichalcia*, tussel caterpillar, grasshoppers (*Crotogonus robertsoni*, *Oxya chinensis* and *Aularchis miliaris*), army worm, *Mythimna separata*, Elephant beetle, *Xylotrupes giddeon* and termites are of minor importance. In moisture stress area, cutworm (*Agrotis flammatra* and *Agrotis segetum*) infestation used to be higher.

Pulses

The important pulses grown in the region are pigeon pea, cowpea, rice beans, rajamash, bengal gram, mung bean, urd bean, lentil, fababean, lathyrus, etc. Due to favorable climatic conditions, pulse crop are infested with number of pests throughout the cropping season. Pigeon pea is infested mainly by pod boring weevil, *Apion clavipes*, Blister beetle (*Myllabris pustulata* and *M. Phalerata*) and pod borers (*Catechrysops cnejus*, *Etiella zinkenela* and *Helicoverpa armigera*). Out of these, pod-boring weevil is the major pest of this crop leading to almost 100% damage. Field pea is infested by cut worms (*Agrotis ipsilon*, *A. flamerata* and *Euxoa spinifera*), pea semilooper (*Plusia orichalcia*), pod borers (*Catechrysops cnejus* and *Etiella zinkenela*), aphid (*Acyrtosiphon pisum*), leaf miner (*Phytomyza atricornis*), Thrips (*Megaleurothrips usitatus*), Bihar hairy caterpillar (*Spilartia obliqua*) and stem fly (*Ophiomyia phaseoli*). The major pest of cowpea are stemfly, aphid, (*Aphis craccivora*), pod boring weevil and black bug (*Coptosoma cribraria*). The other pests like leaf folders (*Nacoleia vulgalia* and *N. diemenalis*), semilooper (*Trichoplusia ni*), jassids, flea beetle (*Monolepta signata*) and gray weevil are of minor importance.

Oilseeds

Nacoleia vulgalis, *N. diemenalis* and stemfly are the destructive pests of soybean. Groundnut is damaged by the *Amasacta moorei*, *A. albistriga*, *Spodoptera litura*, *Spilartia obliqua*, *Aproaerema modicella*, *Aphis craccivora*, *Myllabris pustulata*, *M. phalarata*, *Monolepta signata*, *Chaetochnema* spp., *Epicauta* spp. and soil born pests like *Holotrichia consanguinea*, *H. serrata* and termites are important. Rapeseed and Mustard are the second most important source of edible oil in the region. Many insect pests are found infesting mustard crop. Saw fly (*Athalia lugens proxima*), flea beetle (*Phyllotruta cruciferae*), diamondback moth (*Plutella xylostella*), pod borer (*Crociodolomia binotalis*), cabbage butterfly (*Pieris brassicae*), aphids (*Liphaphis erysimi*, *Brevicorne brassicae* and *Myzus persicae*) are important. Sesamum is attacked by shoot webber, pod borer (*Antigastra catalaunalis*), gall fly (*Aspondyla sesami*) and sphingid moth, (*Achaerontia styx*).

Vegetables and spices

Agro-climatic conditions are quite conducive for vegetable cultivation and more than 20 vegetables belonging to cruciferous (cole crops), solanaceous, cucurbitaceous, leguminous, tuber crops and leafy vegetables are grown in the region. Vegetables like cabbage, cauliflower, radish, brinjal, tomato, okra, chilies, pumpkin, bottlegourd, cucumber, radish, carrot, spinach, beans and cowpea are commonly grown in *jhum* and low land.

Cruciferous crops

Cole crops are extensively grown throughout the year except for winter months. Cole crops, viz. cabbage, cauliflower, radish, knol-khol and gobhi sarson are attacked by a large number of insect pests like cabbage butterfly (*Pieris brassicae*, *P. candida* and *P. napae*), aphids (*Brevicoryne brassicae* and *Lipaphis erysimi*), diamond back moth (*Plutella xylostella*), cabbage head borer (*Hellula undalis*), semilooper (*Plusia orichalcea*), cabbage semilooper (*Plusia orichalcea*, *Trichoplusia ni*), cutworm (*Agrotis flammata*), flea beetle (*Phyllotreta cruciferae*), painted bug (*Bagrada cruciferarum*), leaf webber (*Crosidolomia binotalis*), cut worm (*Agrotis ipsilon*) and saw fly (*Athalia lugens proxima*). Among these, cabbage butterfly and aphids are the most important pests.

Solanaceous crops

Brinjal

Insect pests are the major constraints in the production of brinjal throughout the region and pests responsible for quality and quantity deterioration are the fruit and shoot borer (*Leucinodes orbonalis*), jassid (*Amrasca biguttula biguttula*), aphids (*Aphis gossypii*), white spotted flea beetle (*Monolepta signat* and *Chaetocnema basalis*), leaf miner (*Phytomyza atricornis*) and white fly (*Bemisia tabaci*). Infestation of these pests starts one week after transplanting. The population of jassids is generally high in the second week of August. Flea beetles are active and high in number in first week of August to second week of November.

Tomato

Cultivation of this crop is very limited and high rainfall does not permit its successful cultivation due to high incidence of pest and diseases. This

crop is infested by fruit borer (*Helicoverpa armigera*), aphid (*Myzus persicae*), cutworm (*Agrotis ipsilon*), jassids (*Amrasca biguttula biguttula*) and white fly (*Bemisia tabaci*), of which fruit borer is a major pest causing severe damage to the fruits thereby resulting in low yield.

Malvaceous crops

Okra

This crop is grown widely in the *jhum* as well as in low-lying areas of the region. Mostly indigenous tall varieties with fruits having prominent ridges are grown. Major insect pests of the crop are fruit and shoot borer (*Earias vitella* and *Earias insulana*). The blister beetle (*Mylabris pustulata*) and oil beetle (*Epicauta* spp.) are found to damage okra severely and cause more than 40 per cent losses. Other pests infesting this crop are jassids (*Amrasca biguttula biguttula*), semi looper (*Anomis flava*), (*Aconitia graselli*), leaf roller (*Sylepta derogata*), bihar hairy caterpillar (*Diacrisia oblique*) and fruit bugs (*Dysdercus cingulatus* and *Oxycaraenus hyalipennis*).

Spices

The NEH region has potential for spices cultivation; nevertheless, ginger and turmeric are the most widely cultivated crops across the hill slopes and valley. Apart from them, large cardamom is also cultivated and confined to Sikkim and Arunachal Pradesh only.

Ginger and Turmeric

Stem borer (*Dichochrosis punctiferalis*) and shoot boring weevil (*Prodiectes haemeticus*) are important insect pests of ginger and cause damage upto 35%. *P. haemeticus* damage starts, after the stem borer damage in August. Rhizome borer (*Libnotes punctipennis*) is a major pest of turmeric. Ginger rhizome maggots are a minor pest of ginger. Other insect pests, viz. leaf feeders, chrysomelid beetles, thrips, skipper and lacewing bugs are of minor status.

Insect-pests of fruit crops

Mango and Banana

The vast diversity of agro-ecosystem in which mango is grown and which is subjected to the attack by more than 200 species of insect pests and 70

diseases causing in the range of 20-60% losses. Common insect pests of mango in the region are, leaf hoppers (*Idioscopus clypealis*, *I. nitidus* and *Amritodus atkinsoni*); Mealy bugs (*Drosicha mangiferae*); Inflorescence midge (*Erosomyia indica*); Fruit fly (*Bactrocera dorsalis*, *B. zonata* and *B. diversa*); Leaf webber (*Orthaga euadrusalis*); Stone weevil (*Sternochetus mangiferae*); Stem borer (*Batocera rufomaculata*); Shoot gall psylla (*Apsylla cistellata*) and Scale insects (*Chloropulvinaria polygonata*). Banana crop is attacked by Rhizome weevil, *Cosmopolites sordidu*; Pseudostem borer, *Odoiporus longicollis*; Aphids, *Pentalonia nigronervosa* and Flea beetle, *Nodostoma subcastatum*.

Citrus

Around 250 species of insects are reported in citrus ecosystem, out of these 42 species are more common in NER. Among these, the trunk borer, *Anoplophora versteegi* is the major pest of citrus in the region. Citrus psylla, *Diaphorina citri* and black aphids (*Toxoptera aurantii* and *T. citricidus*) are found causing citrus greening and citrus tristeza, respectively in lower and mid hills of the region. Leaf miner, *Phyllocnistis citrella* is also equally important and damages at nursery and plants during each new flush. The fruit sucking bug, *Rhynchocoris humeralis* is another serious pest more predominant in Mizoram. In severe infestation, dropping of immature fruits is commonly seen. Other pests of economic importance includes lemon butterfly, leaf mining beetles, tobacco caterpillars, leaf folder, looper, mealy bugs, scales, orange shoot borer, bark eating caterpillar, fruit sucking moths and fruit flies etc.

Guava

Major pest of guava in the NEH region includes trunk borer, *Aristobia testudo* (Coleoptera: Cerambycidae). *A. testudo* is a most destructive pest of Litchi in China and severe incidence of this beetle was first observed in Meghalaya on guava during 1997 and recently the same pest has also found in pigeon-pea during adult stage. About three species of fruit fly, *Bactrocera dorsalis*, *B. cucurbitae* and *B. tau* (Diptera, Tephritidae) found to attack on guava fruits; where former species is most dominant than later. Maximum activity of fruit flies is observed during August to December and in peak during September. Two species of bark eating

caterpillars, *Indarbela quadrinotata* and *I. tetraonis* are commonly found in the region. Sucking pests includes Mealy scale, *Chloropulvinaria psidii* (Hemiptera, Coccidae), Mealy bugs *Ferrisia virgata*, *Plannococcus citri*, *P. lilacinus* (Hemiptera, Pseudococcidae), Tea mosquito bugs, *Helopeltis antonii* (Hemiptera: Miridae), aphids, jassids etc. Besides, recently elephant beetles of genus *Xylotrupes* (Coleoptera: Scarabidae) is found to be a new threat to the guava farming in the region.

Pineapple and Areca nut

Major pests of pine apple in the region are mealy bugs, *Dysmicoccus brevipes*, Fruit eating beetle, *Carpophilus dimidiatus*. Termites *Odontotermes* spp. infestation has also been noticed in upland conditions. The areca nut palm is attacked by over 90 insects and non-insect pests which damage the foliage, roots stems inflorescence and nuts. Spindle bug, *Carvalhoia arecae*; mites, *Raoiella indica* and *Oligonychus indicus*; root grub, *Leucopholis lepidophora*; inflorescence caterpillar and pentatamid bug, *Hapylomorpha marmorea* are the major insect pests of areca nut.

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