Diversity of Hymenopteran predators and parasitoids in Assam Agricultural University Campus, Jorhat

Ritu Ranjan Taye, Manha Bathari, Shimantini Borkatakai and Ataur Rahman

Abstract
Predators and parasitoids play a major role in maintaining a balance in nature and controlling prey population below the level causing economic damage. A preliminary study to explore the diversity of Hymenopteran predators and parasitoids was carried out from different ecosystems of Assam Agricultural University, Jorhat campus during 2014 to 2016. During the course of the present study it was observed that larval parasitoids represented by 6 families and 23 species was the most dominant followed by predators (5 families and 20 species) and egg parasitoids (5 families and 13 species). The study suggested the presence of a wide array of natural enemies which may be of great value in the biological control. Therefore, great emphasis is required for the conservation and augmentation of rich natural enemy fauna in the Jorhat district of Assam.

Keywords: Diversity, Hymenopteran, predators, parasitoids, Jorhat

1. Introduction
Hymenoptera is the third largest order of insects, comprising the sawflies, wasps, bees, and ants and over 150,000 species of hymenoptera have been recognized [1]. Except in the polar regions, they are abundant in most habitats, particularly in tropical and subtropical regions [2]. Collectively, the Hymenoptera are most important to humans as pollinators of wild and cultivated flowering plants, as natural enemies (Predator, parasite and parasitoids) of destructive insects and as makers of honey. The order places an important role in biological control of insect pest as 75% of the total species are predators and parasitoids [3, 4]. The predator is an organism which feeds upon other organisms (prey) that are usually smaller and weaker than itself, frequently devouring them completely and rapidly while a parasitoid is an organism that spends a significant portion of its life attached to or within a single host organism in a relationship where the host is ultimately killed. The diversity and radiation of the Hymenoptera relies on the successful parasitoid mode of life, which is present in the majority of families of this order [5]. Predator and parasitoid are important organisms in the natural and human modified environments. They act as natural enemies of arthropod and can be used as biological control agents against insect pests in agro-ecosystems. With increasing hazards due to indiscriminate use of pesticides, the only answer to mitigate these ill-effects is use of safe alternatives. Amongst them, use of natural enemies as biological control agents is the most effective, environmentally sound and cost-effective pest management approach to control insect pests [6].

Keeping in view the importance of biocontrol agents in pest management, a faunal survey was carried out on predator and parasitoids and more particularly Hymenopta at Assam Agricultural University, Jorhat campus in order to record the faunal biodiversity in selected habitats.

2. Materials and Methods
2.1 Location, Constitution and Area
A survey was conducted to explore the diversity of Hymenopteran predators and parasitoids from different ecosystems at Assam Agricultural University, Jorhat campus during 2014 to 2016. Four different types of habitats were selected on the basis of agroecological situation to get an insight of the best possible insect diversity. Assam Agricultural University is located at
Jorhat (26.75°N and 94.22°E) being considered as the semi-arid region with summer temperature: 25°–35°C and winter temperature: 22°–10°C. As far as vegetation structure of Jorhat is concerned, the district is comprised of wide types of agricultural land to forest areas.

2.2 Study sites chosen were:
1. Instruction cum Research farm, AAU, Jorhat
2. Horticultural Orchard, AAU, Jorhat
3. Plantation Crop Garden, AAU, Jorhat and
4. Residential areas, AAU campus, etc.

2.3 Methods adopted for the study
Surveys were carried out at an interval of 3 to 4 days every month and insects were collected by following sweep net and hand picking methods of the collection. The samples were collected separately and brought to the laboratory, where these samples were observed under the stereo-binocular microscope.
Preservation of collected insect specimens was done by following both dry and wet mounts. Specimens were rinsed in 75% ethyl alcohol and were identified by using existing literature or got them compared with type specimens maintained in the Department of Entomology, AAU, Jorhat.

2.4 Statistical Analysis
Collected data were analysed using PASW statistics 18 and were identified by using existing literature or got them compared with type specimens maintained in the Department of Entomology, AAU, Jorhat.

Table 1: Diversity and relative abundance of predator and parasitoids collected during the study in Jorhat district of Assam

<table>
<thead>
<tr>
<th>Predators/parasitoids</th>
<th>Family</th>
<th>Scientific name</th>
<th>Relative abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crabronidae</td>
<td>Sceurion caementarium</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Eumenidae</td>
<td>Eumenus sp.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>Formicidae</td>
<td>Aita spp.</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dorylus molestus</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Myrmicaria brunea</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oecophylla suaragdina</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solenopsis sp.</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tetraponeria rafonigra</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Sphecidae</td>
<td>Chalybion sp.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Euodynerus sp.</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Icaria ferruginea</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phimenes flavopictum</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>Vespidae</td>
<td>Polistes fuscatus</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Polistes hebraeus</td>
<td>+++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Polysta sp.</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vespa magnifica.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vespa cineta.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vespa orientalis.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>Larval Parasitoids</td>
<td>Braconidae</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apanteles glomeratus</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aulosaphes sp.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bracon hebator.</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotesia flavipes</td>
<td>+++</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Macrocentrus sp.</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mysosoma chinensis</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

3. Results and Discussion
The diversity of the predators and parasitoids collected during the study is listed in table 1. During the study, 20 species of predators belonging to 5 families viz., Crabronidae, Eumenidae, Formicidae, Sphexidae and Vespidae, 23 species of larval parasitoids belonging to 6 families viz., Braconidae, Bethylidae, Chalcididae, Cersaphronidae, Ichneumonomidae and Tiphidae and 13 species of egg parasitoids belonging to 5 families viz., Eulophidae, Eurytomidae, Heloridae, Scelionidae and Chrochogrammatidae were identified.
Among the predators, family Vespidae represented by 7 genera and 10 species were most dominant followed by family Formicidae (6 genera and 6 species) and Sphexidae (2 genera and 2 species) while family Crabronidae and Eumenidae comprises of one species each. Similarly, among larval parasitoids, family Braconidae (9 genera and 9 species) were most dominant followed by family Ichneumonidae (7 genera and 8 species). The egg parasitoids were dominated by family Scelionidae represented by 2 genera and 6 species. 30 species of parasitoids and 26 species of predators of rice insect pests have been reported from Jorhat district of Assam [8]; 82 species of insect distributed over 47 genera belonging to 17 families of order hymenoptera were reported from Amba Reserved Forest, Maharashtra in the years 2007-2009 [9]. The family Formicidae was dominant with 39 species followed by family Eumenidae with 11 species. The families Vespidae, Xylocopidae and Apidae contained 4 species respectively. Whereas families namely Ichneumonidae, Braconidae and Bethylidae contained 3 species respectively [9]. Elpino-Campos et al., encountered 29 species of social wasps species distributed in 10 genera [10]. 24 species of Hymenopteran parasites of economically important crop pests have been listed from Kolhapur District, Maharashtra [11]. Altitudinal diversity of ants have been studied in Himalayan regions and 199 species have been recorded [12]. A study on the diversity and distribution pattern of Hymenopteran insects in Jorhat district, Assam, reported insects belonging to 21 families, 42 genera, and 50 species [13].
Scutibracon hispae +
Tropobracon sp. +

Bethylidae
Goniotus sp. +

Chalcididae
Brachymeria ovata +
Brachymeria excarinata +

Ceraphronidae
Aphanogmus manilae +

Ichneumonidae
Amauromorpha accepta +
Campoletis chlorideae ++
Enicosipilus sp. +
Ischnojoppa luteator ++
Isotima javensis ++
Temelucha sp. ++
Xanthopimpla flavolineata ++
Xanthopimpla punctata ++

Tiphidae
Agrionymia sp. +
Tiphid femorata +

Eulophidae
Chrysonotomyia sp. +
Elasmus sp. ++
Tetrastichus schoenobii +

Eurytomidae
Eurytoma sp. +

Heloridae
Helorus sp. +

Scolionidae
Gryon sp. ++
Telenomous dignus ++
Telenomous remus ++
Telenomous rovai +
Telenomus cyrus +
Telenomus sp. +

Trichogrammatidae
Trichogramma chilonis ++
Trichogramma japonicum ++

Egg Parasitoids

+ Less common
++ Common
+++ Abundant

4. Conclusion
The use of pesticides in agricultural ecosystems has resulted in environmental pollution, the decrease of arthropod diversity, the impoverishment of ecosystem and the emergence of pests resistant to pesticides. Biological control using natural enemies is an alternative pest control strategy that is currently being developed to replace the role of pesticides that tend to harm the environment and public health. The study suggested the presence of a wide array of natural enemies which may be of great value in the biological control. Therefore, great emphasis is required for the conservation and augmentation of rich natural enemy fauna in the Jorhat district of Assam. However, seasonal incidence and relative abundance of predator/parasitoid–prey relationship has to be worked out to know the real impact of these naturally occurring bio-control agents.

5. Acknowledgement
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6. Reference