

Biosystematic studies on hymenopterous parasitoids associated with insect pests of vegetables ecosystem

ABSTRACT

Vegetables play a major role in Indian agriculture as they ensure food and nutritional security of the country, as well as enhance the per capita income of the farmers. Globally, India ranks second in vegetable production, with a contribution of 15.4%. Vegetables are mankind's most affordable source of vitamins and minerals needed for good health. Vegetable production is affected by various biotic stresses like pests and diseases, resulting in huge economic losses. Insect pests attack almost all plant parts at all growth stages. It is estimated that global losses in vegetable production amount to 27.7%, of which 8.7% are due to insect pests that have the potential to cause more losses if unchecked. Reliance on pesticides has led to environmental contamination, pest resistance and resurgence issues. Generally, natural enemies often have an important role to play. Hymenopterous parasitoids are abundant in vegetable ecosystems and can be utilized for biological control.

The present study was undertaken with the objectives of documentation of parasitoids associated with major insect pests of vegetable crops, study of diagnostic morphological characters for various families, genera and species of parasitoids, comprehensive analysis and consolidation of the earlier findings, all leading to the formulation of a key for the identification of the important hymenopteran parasitoids associated with major insect pests of vegetable.

A checklist of Hymenopterous parasitoids associated with important vegetable insect pests augmented with valid names, their synonyms, details of their host/alternate host, stage parasitized, distribution along with relevant references, etc. It includes a total of 109 species under 65 genera associated with various stages of important insect pests and under four superfamilies viz., Ichneumonoidea, Chalcidoidea, Platygastroidea and Cynipoidea of order Hymenoptera.

Studies were carried out at ICAR-IARI fields during consecutive crop seasons from November 2021 to October 2020. Around 2000 specimens were collected/reared from various pest stages; 18 families of Hymenoptera parasitoids were recorded.

Identification of the collected specimens revealed 41 species as new records for New Delhi; 6 species as first records for India; seven new host records viz., *Apanteles hemara* and *Brachymeria hime* on *Leucinodes orbonalis*; *Apanteles mohandasi* on *Plutella xylostella*; *Bracon carpomyiae* on *Bactrocera tryoni*; *Opius indicus* and *Stenomesus japonicus* on *Liriomyza sativae*, and *Aphelopus indicus* on leafhoppers.

Further, 30 species were reported for the first time in a vegetable ecosystem. Hyperparasitoids adversely affect the parasitoids, and three species recorded included *Alloxysta pleuralis* on *Binodoxys indicus*; *Pachyneuron aphids* on *Myzus persicae*, and *Aphanogmus fijiensis* on larvae of *Microplitis manilae*. Taxonomic studies on 55 species under 41 genera led to formulation of an illustrated diagnostic key for important parasitoids associated with vegetables.

All descriptions were supplemented with new characters and morphometric ratios based on measurements of 39 diagnostic characters. Sixty-five plates with more than 325 Illustrations are also included.

Calculation of various diversity indices indicated that diversity and abundance of parasitoids was higher for organic than conventional ecosystems, leading to a higher percentage of parasitism. However, the parasitism significantly varied depending on the environmental conditions. A significant positive correlation was observed between parasitism and fruit infestation rate. Our findings supported the view that insecticides in conventional

fields negatively impacted the parasitoids. Therefore, conservation and augmentation of these parasitoids will reduce reliance on insecticides in IPM programs.