



Common name: *Camponotus* parasitoid
Scientific name: *Camponotus chlorideae* Uchida
Family: Ichneumonidae
Order: Hymenoptera
Host insect (s): American bollworm
Nature of association: Larval parasitoid



Camponotus maggot

Common name: *Bracon* parasitoid
Scientific name: *Bracon greeni* Ashm.
Family: Braconidae
Order: Hymenoptera
Host insect (s): Pink bollworm
Nature of association: Larval parasitoid



Adult of *Bracon*

Insect pathogens of cotton insect pests

Scientific name: *Nomuraea rileyi*
Host insect (s): Semi looper & American bollworm
Nature of association: Pathogenic to larvae



N. rileyi fungus infected larva

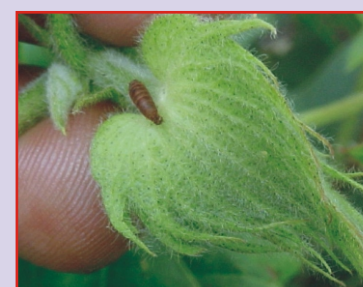


Camponotus pupa



Camponotus adult

Common name: *Rogas* parasitoid
Scientific name: *Rogas aligarhensis* Quadri
Family: Braconidae
Order: Hymenoptera
Host insect (s): Spotted bollworm
Nature of association: Larval parasitoid



Rogas pupa



Rogas adult

Scientific name: *Nuclear polyhedrosis virus*
Host insect (s): American bollworm
Nature of association: Pathogenic to larvae

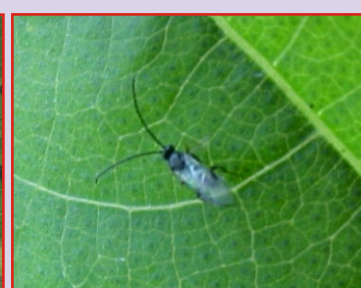


NPV infected larva

Common name: *Apanteles* parasitoid
Scientific name: *Apanteles angaleti* Mues.
Family: Braconidae
Order: Hymenoptera
Host insect (s): Pink bollworm
Nature of association: Larval parasitoid



Apanteles pupa



Apanteles adult

In addition to the above dominant natural mortality factors of cotton pests, there are many more natural control agents that are of less relative importance that add to the control of pests of the cotton ecosystem. Their conservation in the cropping systems needs strategies such as avoidance of insecticides and intercropping practices that do not destroy their population progression and encourage their multiplication, respectively.

In a situation where we have a record of more species of natural enemies than the harmful insects in the cotton ecosystem interference with chemicals should be thought of. Hence in deciding to use insecticides against any insect pest of cotton due consideration should be given to the occurrence of native natural enemies. Conservation of natural enemies of early season insect pests encourages the natural bioagents of bollworms and reduces the number of insecticidal sprays effectively.

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On the cotton crop, **sucking pests** viz., jassids (*Amrasca devastans* Dist.), aphids (*Aphis gossypii* Glover), whiteflies (*Bemisia tabaci* Gennadius) and thrips, (*Thrips tabaci* Lindeman) during early phase of crop growth and **bollworms** viz., *Earias insulana* (Boisd.), *E. vittella* (F.), *Helicoverpa armigera* (Hubner) and *Pectinophora gossypiella* (Saunders) during the mid and late seasons, are the key pests and their control is essential for good production of cotton crop. Pest management is an essential component for a sustainable cotton production system having two essential elements. First comprises of a series of measures that help in keeping the insect pests below action threshold levels and the second relating to the use of curative control utilising insecticides. The former component is eco-friendly, less costly and remunerative and the native natural enemies form a sub component under this category.

In nature, control of insect pests occurs through biotic and abiotic forces. While abiotic factors are not under man's control, the biotic components depend very much on the manipulative management practices of the crop production system. The various biotic agents of the nature are predators, parasitoids, entomopathogens and insects on weed. In cotton ecosystem, different groups of predators and parasitoids are common. While the presence of predators and their predation can be noted visually, the occurrence of parasitoids could only be realised by observing the activity of adult parasitoids within the cropped area and more authentically by rearing the host insects collected from the field under laboratory. Nevertheless both the groups offer significant natural control of the insect pests of cotton. The identification and knowledge of such native natural biocontrol agents is critical to the recognition of their control effects on cotton pests. The non-insect predators executing control of cotton insects include spiders and birds. Spiders feed upon the jassids, aphids and all species of bollworm larvae. As the use of broad-spectrum insecticides like organophosphorus compounds for sucking pest control eliminates these arthropod natural enemies, strategy of using sucking pest tolerant genotypes in conjunction with native natural enemy exploitation is advocated.

Given hereunder is the list of commonly found native natural predators, parasitoids and pathogens attacking various cotton insect pests.

Common insect predators of cotton insect pests

Common name : Lady bird beetle
Scientific name : *Cheilomenes sexmaculata* (Fabricius)
Family : Coccinellidae
Order : Coleoptera
Host insect (s) : Aphids
Nature of association : Grubs & adults are predatory



Coccinellid eggs



Coccinellid grubs



Coccinellid pupae



Coccinellid adults

Common name : Hover fly
Scientific name : *Eupeodes confrater* (Wiedemann)
Family : Syrphidae
Order : Diptera
Host insect (s) : Aphids
Nature of association : Grubs are predatory



Syrphid maggot



Syrphid maggot feeding on aphids



Syrphid pupa



Syrphid adult

Common name : Aphid lion
Scientific name : *Chrysoperla carnea* (Stephans)
Family : Chrysopidae
Order : Neuroptera
Host insect (s) : Aphids, jassids, eggs & early instars of bollworms
Nature of association : Grubs are predatory



Chrysopid egg



Chrysopid grub



Chrysopid pupa



Chrysopid adult

Common name : Big eyed bug
Scientific name : *Geocoris ochropterus* (Fieber)
Family : Lygaeidae
Order : Hemiptera
Host insect (s) : Jassid nymphs & pink bollworm eggs
Nature of association : Nymphs and adults are predatory



Geocoris adult

Common name : Mirid bug
Scientific name : *Zanchius* sp.
Family : Miridae
Order : Hemiptera
Host insect (s) : Whiteflies
Nature of association : Nymphs and adults are predatory



Adult of *Zanchius* sp.

Common name : Spiders
Order : Arachnida
Host insect (s) : Jassids, aphids, mirids, whiteflies and all species of bollworms and defoliators' larvae
Nature of association : Nymphs & adults are predatory



Spiders

Common name : Pentatomid bug
Scientific name : *Eocanthocona furcellata* (Wolff)
Family : Pentatomidae
Order : Hemiptera
Host insect (s) : Larvae of bollworms and semi-looper
Nature of association : Nymphs and adults are predatory



Pentatomid bug feeding on looper

Common parasitoids of cotton ecosystem

Common name : Aphid parasitic wasp
Scientific name : *Aphelinus* sp.
Family : Aphelinidae
Order : Hymenoptera
Host insect (s) : Aphids
Nature of association : Nymphal and adult parasitoid



Mummified aphids parasitised by *Aphelinus*

Common name : Braconid parasitoid
Scientific name : *Microchelonus versatilis*
Family : Braconidae
Order : Hymenoptera
Host insect (s) : American bollworm
Nature of association : Egg- larval parasitoid



Adult of *M. versatilis*

Common name : Tachinids
Scientific name : *Palexorista laxa* Curran
Family : Tachinidae
Order : Diptera
Host insect (s) : Semi looper & American bollworm
Nature of association : Larval parasitoid



Tachinid-Pupa & adult

Common name : *Eriborus* parasitoid
Scientific name : *Eriborus argenteopilosus* (Cameron)
Family : Ichneumonidae
Order : Hymenoptera
Host insect (s) : Semi looper & American bollworm
Nature of association : Larval parasitoid



Adult of *E. argenteopilosus*