



Role of Heteropteran Bugs in Agriculture

(*Pushpa Choudhary¹ and Man Mohan Sundria²)

¹Department of Entomology, Rajasthan College of Agriculture,
Maharana Pratap University of Agriculture and Technology, Udaipur 313 001

²Department of Entomology, College of Agriculture, Jodhpur,
Agriculture University, Jodhpur 342 304

*Corresponding Author's email: choudharypushpa812@gmail.com

Heteropteran, any member of the insect order Heteroptera, which comprises the so-called true bugs. (Some authorities use the name Hemiptera; others consider both the heteropterans and the homopterans to be suborders of the Hemiptera.) This large group of insects, consisting of more than 40,000 species, can be recognized by an X-shaped design on the back, which is formed by the wings at rest. A combination of features sucking mouthparts adapted to pierce plant or animal tissues and a hardened gula (underside of the head) separate the heteropterans from all other insect orders. Although most species of Heteroptera are terrestrial, a few are aquatic.

Some species, which feed on plant juices, are serious pests of cultivated crops. Other species are predacious and benefit humans by destroying various pests. There also are heteropterans that act as carriers of disease.

Distribution and abundance

Heteropterans are most abundant in the tropics, decreasing in both individuals and species to limits northward beyond the Arctic Circle and southward almost to the Antarctic Circle. Different species may be found on every major continent, and people or natural forces like the wind, birds, and floating trash can facilitate a species' migration to a new habitate. Although heteropterans have been carried throughout the world, only a few species have become established in many lands. Unique among insects are some water striders (Gerridae), which are at home on the open ocean between approximately 40° north latitude and 40° south latitude and may not approach land for several generations. More than 40,000 species of heteropterans are known. Most families containing 150 or more species are represented in every zoogeographic region.

The Heteroptera include a diverse assemblage of insects that have become adapted to a broad range of habitats — terrestrial, aquatic and semi-aquatic. Terrestrial species are often associated with plants. They feed in vascular tissues or on the nutrients stored within seeds. Other species live as scavengers in the soil or underground in caves or ant nests. Still others are predators on a variety of small arthropods. A few species even feed on the blood of vertebrates. Bed bugs, and other members of the family Cimicidae, live exclusively as ectoparasites on birds and mammals (including humans). Aquatic Heteroptera can be found on the surface of both fresh and salt water, near shorelines, or beneath the water surface in nearly all freshwater habitats. With only a few exceptions, these insects are predators of other aquatic organisms.

Their impact can vary based on species, environmental conditions, and the agricultural practices employed. Here are some of the roles that heteropteran bugs play in agriculture:

Plant damage

Some species of heteropteran bugs are agricultural pests that feed on plant sap using their piercing-sucking mouthparts. Examples include stink bugs, lygus bugs, and leaf-footed bugs. These pests can cause direct damage to crops by feeding on plant tissues, resulting in wilting, yellowing, and distortion of leaves, fruits, and other plant parts.

The major phytophagous families of Heteroptera are:

Miridae (Plant Bugs) — Most species feed on plants, but some are predaceous. This family includes numerous pests such as the tarnished plant bug (*Lygus lineolaris*).

Lygaeidae (Seed Bugs) — Most species are seed feeders, a few are predatory. This family includes the chinch bug, *Blissus leucopterus* a pest of small grains, and the bigeyed bug, *Geocoris bullatis*, a beneficial predator.

Pentatomidae (Stink Bugs) — Shield-shaped body with large, triangular scutellum. Most species are herbivores, some are predators. All have scent glands which can produce an unpleasant odor.

Predators of Pests

Some heteropteran bugs are beneficial predators of agricultural pests. For example, assassin bugs (Reduviidae family) are voracious predators that feed on a wide range of insect pests, including caterpillars, aphids, and other soft-bodied insects. They help in natural pest control, reducing the need for chemical pesticides. Common predatory bugs include: ambush bugs, assassin bugs, big-eyed bugs, damsel bugs, minute pirate bugs, and stink bugs.

Some families of terrestrial predators of heteropteran bugs include: Reduviidae (assassin bugs and ambush bugs), Nabidae (damsel bugs), Anthocoridae (minute pirate bugs)

The major families of aquatic predators include: Corixidae (water boatmen), Gerridae (water striders), Nepidae (water scorpions), Belostomatidae (giant water bugs), Naucoridae (creeping water bugs), Notonectidae (backswimmers).

Vector of Plant Diseases

The ability of piercing-sucking insects to transmit plant disease is closely linked to feeding mode and target tissue. The true bugs (Heteroptera) are generally considered to be of minimal importance as vectors of plant pathogens, although they share similar feeding behaviors with homopterans. Modes of feeding in Heteroptera include "lacerate-and-flush", intracellular penetration to vascular tissue, and an osmotic pump mechanism to acquire cell contents without penetrating the cell membrane. The relationship between heteropteran taxonomy, feeding mode, and the type of pathogens transmitted is explored through a literature survey of feeding behavior and vectoring capability. Transmission by true bugs of fungal pathogens, bacteria, viruses, phytoplasmas, and trypanosomatid flagellates summarized; no records exist of bugs transmitting spiroplasmas. Trypanosomatid flagellates of plants appear to be harbored or transmitted exclusively by Pentatomomorpha (Lygaeoidea, Coreoidea, Pentatomoidea, and Pyrrhocoroidea). Bacterial and fungal transmission occurs among families representing both infraorders of phytophagous Heteroptera, but Miridae (Cimicomorpha) are most closely associated with bacteria, whereas Pentatomidae and Coreidae (Pentatomomorpha) predominate in transmission of fungi. heteropterans in any survey of potential plant disease vectors is clear.

Pollination

While not as significant as bees or other specialized pollinators, certain heteropteran bugs can contribute to pollination by feeding on nectar or pollen. This activity can aid in the

pollination of some crops, although their role in this aspect is generally minor compared to other pollinators.

Example: *Syngonium schottianum* and other Araceae species is pollinated by plant bugs (Miridae; Heteroptera).

Decomposition and Nutrient Cycling

Insects play a vital role in nutrient cycling, the process by which nutrients are transferred from living organisms to the environment and then back to living organisms. Insects are especially important in nutrient cycling in tropical forests, where they can make up as much as 80% of the animal biomass. The loss of insects due to habitat loss, pollution, and climate change is a major threat to ecosystem health. Without insects, nutrient cycling would slow down, plants would not be able to grow as well, and the entire food web would be affected. Insects are truly the unsung heroes of ecosystem health, and we need to do more to protect them. Some heteropteran bugs, particularly those in aquatic habitats, play a role in decomposition and nutrient cycling. Water bugs (e.g., water boatmen and water striders) feed on organic matter in water bodies, helping to break down dead plant material and recycling nutrients in aquatic ecosystems.

Indicator Species

The presence or absence of certain heteropteran species can serve as indicators of ecosystem health in agricultural landscapes. Monitoring their populations can provide insights into the overall health of the ecosystem and the effectiveness of pest management practices.