Sub-project 5

Management of Agriculturally Important Insects (arthropods/ invertebrates)

Lead Centre: NBAII, Bangalore

Background and rationale

Insects and many other arthropods evolved nearly 400 million years ago – much before flowering plants. Their diversity, adaptation and resilience is reflected in their radiation into almost all ecosystems of the world comprising more than half of all described species on earth.

All ecosystems from deserts to forests to soils and even aquatic systems are occupied by insects. Nearly 1 – 2 % affect crop plants as pests and as vectors of plant and animal diseases. The role played by insects as pollinators ensuring plant diversity, so vital for our agriculture in the coming years is not fully understood. Similarly in the field of soil biology and ecology hundreds of thousands of insects play vital roles in maintaining soil equilibrium. The microbial interaction and evolutionary mechanisms in insect – bacteria/ fungi / virus and mycoplasma systems and the role of many endosymbionts at the cellular level is only being realized as the years roll by.

Ecosystem function

Arthropod biodiversity is essential for the maintenance of ecosystem functions and evolutionary processes in agricultural systems. They store and cycle nutrients essential for crop growth such as carbon, nitrogen and oxygen. They absorb and breaks down pollutants, including organic wastes, pesticides and heavy metals and are essential for the sustainable utilization of our biological resources as well as for the maintenance of wellnourished humans in our country. Our long term aim must be to maintain a self-sustaining dynamic community of arthropods and their associated organisms with minimum human intervention.

Aquatic insects

With only 2.5 % of all water on earth being non-marine freshwater systems occupy only a very small part of the earth's surface. A mere 0.3 % of the earth's fresh water is freely available in rivers, streams, lakes and wetlands. In spite of this small fraction of fresh water being freely available, freshwater ecosystems support a rich and diverse insect / arthropod fauna.

Soil arthropods

Adequate attention has not been paid to the diversity of arthropod life in soils and associated litter. The diversity of soil arthropods and their importance in ecosystem functioning is just beginning to be understood. Relatively obscure groups like Collembola, mites and nematodes are all rich in soil species and are extremely important in breaking down organic material and

making nutrients available for plant growth. Termites, particularly in the tropics are critical for the production, turnover and enrichment of the soil. They also help aerate the soil and increase the flow of water, thus reducing runoff and soil erosion.

Pollinators

Bees and wasps are absolutely essential for the maintenance of diversity in flowering plants. Studies have shown that solitary bees are the dominant pollinators of angiosperms in semi – arid regions. It is widely recognized that honeybees alone cannot effectively pollinate all plants. The loss of bee diversity will not only result in the loss of flowering plant species but will also have other environmental repercussions as 30 per cent of human food comes from bee pollinated species.

Biological control

Hymenopteran parasitoids play a vital role in maintaining the balance of terrestrial ecosystems by regulating populations of phytophagous insects. They prevent herbivores from decimating plant hosts including our crop plants. The importance of hymenopteran parasitoids can be seen most clearly in biological control projects.The elimination of one or more species of parasitoids from an area under biological control could result in large scale outbreaks of pest populations and the consequent defoliation or death of crop plants.

In this direction the focus of studies led by the NBAII will be on pest insects, beneficials (including entomopathogenic nematodes, microbes and fungi) and insect vectors of plant diseases in terrestrial and aquatic habitats in agroecosystems.