SYNOPSIS OF THE THESIS
"STUDIES ON THE BIOECOLOGICAL ASPECTS OF PARASITOIDS ON IMPORTANT CROP PESTS"

SYNOPSIS

The class Insecta is one of the largest groups comprising about approximately 800,000 species all over the world, represented by about 80% of all the rest of the animals combined (Richard and Davies, 1984) and far exceeds the total number of species in the entire animal kingdom. The struggle between man and insects began long before the dawn of the civilization and will continue as long as the human race endures.

Insects occur in all the zoogeographical regions and have developed special adaptations to survive under different environmental conditions. The food resources of the insects are variable and during feeding they cause extensive damage on which they feed. Most of the insect species are phytophagous and some appear as noxious pests of variety of crops, forests, etc. Some of the insect species are associated with human being and livestock as pests or vectors and transmite various dreadful diseases. Some occur as beneficilals viz., silkworms, honeybees, pollinators, parasitoids, predators, scavengers etc.

During the introductory period of modern insecticides, entomologists all over the world were engaged in testing a
variety of toxic chemicals with the narrow goal of finding compounds that would kill the greatest percentage of pests. The insecticides though kill the insects but are also hazardous to man, livestock, beneficials and even the environment, finally upset the natural balance. All these forced entomologists to search for a new, safe alternative to management of the pests.

In Integrated Pest Management (IPM) the biocontrol is practically effective and more economic, protective for crops, man and the environment. It is defined as an artificial manipulation of natural biological phenomena for the purpose of reducing or checking destructive populations of insects and other animals or plants. In another word, it might be termed "Biological warfare" against the enemies of man.

Biological control has been generally based on the utility of the parasitoids, predators and pathogenic microbes and more recently on competing species in the destruction or suppression of undesirable insects.

Biological control offers certain advantages that many other methods of insect control do not. It is inherently safe, since there is usually little or no danger involved during its application and that no toxic residues contaminate the environment and also do not destroy beneficial animals and only suppress the populations of harmful insects. In
past, environmental pollution with use of insecticides for pest management has became a matter of great concern. Highly residual insecticides can pass well beyond their intended targets and it becomes concentrated in stepwise fashion along a food chain based on the simple idea. Biological control provides long-lasting control, it is quite economical in the long term and the pest is usually not likely to develop resistance to the controlling agent. Introduction, conservation and augmentation of the parasitoids and predators have been manipulated for use in the biological control.

The *Helicoverpa armigera* Hubner and *Spodoptera litura* Fabricius are amongst the major pests in India and other few countries also, causing extensive losses to variety of crops. Thus polyphagous pests such as *H. armigera* and *S. litura* have attracted a great deal of attention in recent years because of their wide host range, the severity of damage they cause to crops, their resistance to commonly used insecticides and their sporadic outbreak which frequently result in total crop loss. *H. armigera* and *S. litura* cause extensive damage specially to cereals, pulses, vegetables, oil seeds, fibre crops etc. and affect the world economy based on crop production.

Amongst the major groups of entomophagous insect parasitoids Braconidae, Trichogrammatidae, Ichneumonidae, Scelionidae and Tachinidae are recognised by large number of
species. Though taxonomy, distribution etc. of these parasitoids have been attempted, little is known to Science about their biocontrol utilization. Keeping in view the importance of these beneficial flies in the Integrated Pest Management, the present investigations on the impact of key parasitoids on *H. armigera* and *S. litura* have been carried out.

The thesis deals with the "STUDIES ON THE BIOECOLOGICAL ASPECTS OF PARASITOIDS ON IMPORTANT CROP PESTS". Present study in the form of thesis was attempted to investigate the impact of egg parasitoids *viz.*, *Trichogrammatoidea armigera* Nagraja and *Trichogramma brasiiliensis* Ashmead on the host, *Helicoverpa armigera* Hubner; and *Trichogramma chilonis* Ishii, and *Telenomus remus* Nixon on the host, *Spodoptera litura* Fabricius. This work has been mainly focussed on the practical utility of the parasitoids for the control of the noxious pests, *H. armigera* and *S. litura* which will finally result in suppression of pest population and increase in the crop yield.

The cultures of parasitoids *viz.*, *T. armigera*, *T. brasiiliensis* and *T. chilonis* were obtained from National Centre for Integrated Pest Management, Hyderabad and that of *T. remus* was obtained from Biological Control Centre, National Centre for Integrated Pest Management, Bangalore. In addition, the culture of the laboratory host, *Corcyra*
*cephalonica* (Stainton) was obtained from National Centre for Integrated Pest Management, Hyderabad and cultures of hosts, *H. armigera* and *S. litura* were developed on the larvae collected from various crop fields of Aurangabad District.

The introduction of the thesis embodies review of the past work, systematic position, distribution and related account of the parasitoids and hosts and importance of the present study. The investigations carried out are arranged into SIX CHAPTERS of the thesis.

The First chapter of thesis highlights the effect of temperature on the development and longevity of three parasitoids *viz.*, *T. armigera*, *T. brasiliensis* and *T. remus*, first two are egg parasitoids on *H. armigera* and last one is egg parasitoid on *S. litura*. The temperatures ranging between 20 ± 1°C to 35 ± 1°C were maintained in the B.O.D. incubator and it was noted that 25 ± 1°C is the most suitable temperature for development and longevity of above parasitoids. This has been investigated in view of the mass scale rearing of the parasitoids for the biocontrol programme.

The Second chapter embodies one of the recent findings on the life tables and intrinsic rates of increase of three parasitoids *viz.*, *T. armigera*, *T. brasiliensis* and *T. remus*. This work has been based on the mean longevity, mean fecundity, number of individuals alive at each age interval
and number of female offsprings produced per female on which the life tables and intrinsic rates of increase were constructed. The values of $r_m$ were 0.361, 0.345 and 0.371, respectively of the above parasitoids.

Third chapter deals with the studies on behavioural aspects like mating, oviposition and adult emergence of *T. armigera*, *T. brasiliensis* and *T. remus*.

Fourth chapter contains experimental results arranged into three parts:

1. Parasitism in relation to host age,
2. Parasitism in relation to host density and

Parasitism in relation to different host age was studied by subjecting eggs of 0-1, 1-2, 2-3, and 3-4 days old of *H. armigera* and *S. litura* to *T. armigera*, *T. brasiliensis* and *T. chilonis*, *T. remus* respectively. These findings revealed that age group of 0-1 day old host eggs was more suitable age group for maximum parasitism of above parasitoids.

For parasitism by *T. armigera*, *T. brasiliensis* and *T. chilonis* and *T. remus*, in relation to different host densities viz., 25, 50, 75, 100 and 125 eggs of *H. armigera* and *S. litura* were subjected to 10 parasitoid females of the above
parasitoids. These findings enlighten the suitable number of the hosts for maximum parasitism. The host density 75 was suitable for percent parasitism of above 3 parasitoids and for the fourth it was 100.

Influence of certain dietary combinations on longevity of adult parasitoids **viz., T. armigera, T. brasiiliensis** and **T. remus** have been determined by feeding different concentrations of honey, sucrose, glucose and only water to find out most suitable food for maximum longevity. The most suitable food was 50% honey solution for above parasitoids.

In the chapter Fifth the influence of different host plants **viz.,** cotton (**Gossypius** sp.), tomato (**Lycopersicon esculentum** Mill.) brinjal (**Solanum melongena** L.) and chilli (**Capsicum anoma** L.) on percent parasitism of **H. armigera** by **T. armigera** and **T. brasiiliensis**, were ascertained. **T. armigera** and **T. brasiiliensis** possess strong preference to cotton and tomato for more parasitism of host.

The sixth chapter deals with studies on insecticide tolerance in **T. armigera** and **T. brasiiliensis**. Here, five different commonly used insecticides **viz.,** Fenvalerate, Cypermethrin, Endosulfan, Phosphamidon and Methyl parathion have been tested to see their effect on the above parasitoids. The Fenvalerate and Cypermethrin are moderately
toxic since partial survival of the parasitoids was seen after exposure for one hour and rest of three are highly toxic to the above parasitoids.