

HYMENOPTEROUS PARASITES OF ECONOMIC IMPORTANCE IN S. INDIA

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The study of economic entomology has in these days attained such dimensions that various methods of control are being advocated for checking insects injurious to crops. The mechanical methods of control such as the use of insecticides, spraying, fumigation and other artificial devices such as the use of light traps, etc., have been in some cases found impracticable and uneconomical. In view of the poisonous nature of the insecticides themselves, the prohibitive cost of the treatments in some cases, the frequency and thoroughness with which these treatments have to be given, the promptness with which these have to be done, and the several meteorological factors that influence the success or failure of the results obtained and lastly the temporary and palliative nature of the results obtained, mechanical methods of control frequently become very much limited in their scope.

During recent years a new method of crop-pest control has sprung up known as the biological control of insect pests. It is a well known fact that almost every insect has at one stage or another, its parasite or predator. A parasite is one which becomes attached to the host, at some stage of its existence, and leads an ecto or endozoic existence gradually killing the host; whereas a predator is one which leads a free existence and preys on its victim killing the same immediately in most cases. Among insects, the phenomenon of parasitism is very highly developed in some of the groups of Hymenoptera, especially the Ichneumonoid families, Braconidae, Ichneumonidae, Chalcidae and Bethyridae and the Tachinids among the Diptera in the insect world.

The object of this paper is to record the different kinds of hymenopterous parasites so far found in the South Indian region possessing some economic importance and to set forth instances, where some of the insect hosts are controlled, to a greater or lesser extent by the natural enemies. A study of this was undertaken in order to get an idea as to the indigenous parasites that exist in the region with their respective hosts, the parasite or parasites that attack a particular host, the degree to which there is parasitism and the regions where they are obtained. This would help us in getting an idea as to the possibilities for breeding parasites and liberating them in numbers to control crop pests.

A list of hymenopterous parasites with their respective hosts has been given at the end noting their distribution. Work in these parasitic groups was begun in S. India by the senior author and lists were prepared by him, one in 1919 (2), a second one in 1921, (3) and the most recent one in the Bulletin of Entomological Research, (10). There are stray publications such as the Ann. & Mag. Nat. History., Proc. U. S. Nat. Mus., Jl. Bom. Nat. Hist. Socy., Bull. Ent. Res., etc. wherein S. Indian parasites have been described by such writers as Rohwer, Gahan, Girault, Crawford, Cameron, Silvestri, Grandi, Waterston, Wilkinson, Ferriere and a host of others.

Instances where crop pests are being controlled by natural enemies noted in South India are:

Nephantis serinopa, the black headed caterpillar is a very serious pest of coconut palms both in the East Coast as well as in the West Coast. And this is a classic example wherein natural enemies are used to a degree to control the pest. In the East Coast the pest is not serious probably on account of the presence of the parasites which have a favourable environment for successful multiplication; whereas in the West Coast probably on account of the secondary parasites the primary parasites have not asserted themselves. Hence breeding laboratories were opened at three different stations, viz., Calicut, Mangalore and Ponnani where the parasites were bred in large numbers and liberated. This pest has got parasites attacking the larval and the pupal stages. There is a Bethyloid, a Microbracon, an Apanteles and an Elasmid attacking the different stages of the larva; and a Chalcid, Eulophid and an Ichneumonid attacking the pupa in addition to a Tachinid fly. In spite of so many parasites attacking a single host at different stages of the pest, it has been found difficult to control the pest on account of the secondary parasites on every one of these. The coconut caterpillar complex has been well shown diagrammatically (11a).

The life history and habits of the larval parasite *Elasmus nephantidis*, R., has been worked out at greater detail (15).

In the case of the paddy stem borer *Schoenobius incertellus* there are the egg parasites as well as the larval parasites. The chief egg parasites are—(1) *Trichogramma minutum*, R., (2) *Tetrastichus schoenobii*, Ferr. and (3) *Phanurus beneficiens*, Zehnt. Of these *Tetrastichus schoenobii* would appear to be most effective in that a single grub is able to kill 2 or 3 eggs of the host. These parasites are found during the months of February and March during the *dalva* or the second crop and this is the reason why the infestation is very low during this crop and the infestation very high during the *salva* or the first crop in the Circars. In addition to these there are the Braconid larval parasites *Tropobracon indicus*, R., *Microbracon* sp., and *Apanteles schoenobii* and the Ichneumonids *Goryphus maculipennis* and *Ischnojoppa luteolator*, F. But instances of these asserting themselves are not known.

Argyria sticticraspis. Hmpsn. The sugarcane borer is another in whose case in other parts of the world, biological methods of control are being carried on by utilising the egg parasite *Trichogramma minutum*, R. In India, so far the damage done to cane has not warranted a control of the pest in this direction. The egg parasite *Trichogramma minutum*, R. and *Phanurus* sp. are found in the Circars and among the larval parasite, *Stenobracon* sp.

Sesamia inferens. Wlk. the ragi borer is a clear instance where the parasites have proved of great utility under natural conditions. The infestation is high only in the *pairu* or cold weather crop and here the larval parasites check the pest. A braconid wasp keeps the pest under control. They are noticed from February to March and the percentage of parasitisation goes on increasing from February onwards till the percentage rises to 80% during the first week of March. Here is a case where the parasites have been found really useful in checking the pest at the right time unlike the egg parasites of the paddy stem borer.

Utetheisa pulchella. Linn. on Sannhemp: Egg parasites probably *Phanurus* sp. noticed on the eggs are very prominent and the parasitisation is very high during the second week of March. Eggs were collected at different periods to note the degree of parasitisation which went on rising from February to March. It was 57.24% during the last week of February; 63.82% during the first week of March and 87.88% during the 2nd week of March. In addition to these there are Tachinids parasitic on the larvae which are also high during these months; and a chalcid hyper-parasite was noticed on these Tachinid maggots.

Leaf miners on citrus: *Phyllocnistes citrella* Stn. Chalcid parasites were noticed on the pupae. Though the miners were prominent right through the year, the parasites were noticed only from February up to April. The percentage of parasitisation was worked out as 33.15. The parasites were not to be seen during the remaining part of the year.

The eggs of the Fulgorid *Pyrilla perpusilla* Wlk. which is found on cane shows parasitisation by Chalcids, Dryinids. *Pyrilla* in large numbers on the cane leaves cause sooty mould on account of the secretion of honey dew and the whole crop looks black and may be detrimental to the crop too; and the breeding of egg parasites and liberating them may be tried, this depending upon the degree to which the pest attacks the crop.

The cholam borer—*Chilo simplex* Butl. The list at the end would show that this has got Ichneumonids, a number of Braconids and a Chalcid parasite on it.

There are a number of scale insects and mealy bugs infesting many trees and plants and every one of these is attacked by a parasite or

another. Such serious scales as the *Pulvinaria maxima*, Green. on nim, *Ceroplastodes cajani* on *Zizyphus jujuba*, *Aspidiotus orientalis*, Newst. on tamarind, *Lecanium* species on cotton, sandal, etc., are a few instances where the parasites check them. The hymenopterous wasps especially of the super family Chalcidoidea are parasitic on the many species of Coccids. These lead an endozoic existence at least in the early stages and lead a free life in the adult stage. Parasitisation by these minute insects are not visible until after the adult parasites emerge when the exit-holes could be seen. In certain cases where the scales are transparent there will be abnormal colour. Study in these cases is rather difficult. A study of the parasites of Coccids would form a study by itself.

There are the several important crop pests of the Noctuid family often subject to parasites such as *Spodoptera mauritia*, Boisd. and *Cirphis albistigma* that attack paddy, *Prodenia litura* F.B. the tobacco caterpillar, *Achaea janata*, Linn. a serious pest on castor, *Eublemma olivaceae* Wlk. the brinjal leaf roller; and among the Pyralids several of the paddy pests, sugarcane pests, cotton and vegetable pests, have also parasites. The list at the end will give an idea as to the range of orders and families in which we find insect parasites. But for the existence of these parasites, all the crops would have been overrun by these pests and there will be no crops at all. Nature in her bounty and generosity is maintaining a balance, as it were, even without our consciousness, thus restricting the scope of these pests. This will give one an idea as to the utility of these little insects to man.

General considerations. The general life history of these parasitic wasps may be stated thus. The adult is a free living insect. It goes in search of the right host and lays an egg or eggs. The eggs may be laid singly or in an eggmass on or in the body of a caterpillar, maggot or grub. The parasites are provided with an apparatus at the tail end called the ovipositor which is used for inserting the eggs. They are even so adapted that these can be thrust from outside into the body of larvae inside the plant stems. The hatched out larvae may lead an ectozoic or endozoic existence and feed upon the tissues and vital organs of the host bringing about the gradual death of the host. The grubs after feeding on the host may come out, and spin cocoons on the surface of the host very often as in the case of Braconid wasps.

These minute wasps which we find in thousands are widely different in structure and habit and a study of these would bring to light many interesting points which would help us in the efficient utility of these parasites toward insect pest control. These may be ectozoic or endozoic and most of these are parasitic only in their larval stages. The list at the end will show that a particular species of parasite may have different hosts; a number of species may attack a single host simultaneously; some may be polyphagous; and some restricted only to particular hosts. In the case of the black scale

Saissetia nigra in California there are 51 species recorded on it. The original parasites are in some cases attacked by secondary parasites and this phenomenon is called hyper-parasitism. Some attack insects belonging to different orders or families or even groups and different stages of the hosts. We have species of *Apanteles* attacking larvae of different orders. These parasites attack the different stages of the host. There are egg parasites, larval parasites, and pupal parasites. Thus it could be seen that the host may be attacked at any stage or in all stages. There is the Trichogrammid—*Trichogramma minutum*, R., attacking the eggmasses of *Schoenobius*, *Argyria* and *Diatraea*. There is *Phanurus beneficentis*, Zehnt, attacking the eggmasses of *Schoenobius* and *Scirpophaga*. Similarly there are instances of larval parasites. Many of the Braconids and Ichneumonids are larval parasites. Among the pupal parasites there is the Chalcid *Pluristropis epilachneae*, Roh attacking the pupa of *Epilachna*, *Tetrastichus ayyari*, *Chilo simplex*, *Acanthojappa* sp., *Melunitis ismene* and so on. Among the hyper parasites we have *Perilampus microgastris*, Ferr., on *Microgastris indicus*, Wlk., *Apanteles machaeralis*, Wlk., and a Braconid parasite on *Nephantis serinopa*, M., *Mesochorus plusciphilus*, V., on *Apanteles plusiae*, Vier, and *Marietti* sp. on some of the parasites on Coccids. Specialisation has gone to such a degree that many of the Eurytomids are phytophagous and the Chalcid family *Agaonidae* live on seeds of figs. Members of the family Eurytomidae attack galls. There is the seed chalcid *Bruchophagus mellipes*, Gahan, boring into *Sesbania* seeds.

In certain cases where we notice more than one species attacking a host and where the parasites lead an endozoic life it requires a more careful and thorough study as we should be able to distinguish between the primaries and secondaries. There are instances of parasitism wherein they are parasitic on the predators of the host themselves in which case they are not beneficial. There is *Aphrastobracon flavipennis*, Ashm. which is parasitic upon *Eublemma* which is a predator on Coccids; similarly there is *Elasmus indicus* found with the Coccid *Anomalococcus indicus* which is probably predaceous on *Eublemma*. This clearly shows that a clear understanding of the interrelations of the host and the parasite are necessary.

Thus we could see how varied are the nature and kind of parasitisation, the habits of these parasites and the relationship between them and the hosts. A study of the natural enemies available in South India brings to light the following interesting points. Parasites are not found throughout the season but are found only during particular seasons, e. g., in the case of *Schoenobius* we have the egg parasites from January to March during the summer months at Samalkota; similarly we find the larval parasites from January to March in the case of the ragi borer and the egg and larval parasites of Sannhemp caterpillar and the Chalcid parasites of the citrus leaf miner could be

had only during the months of January to March. Here we find some interesting features. One is that parasites are found only during particular seasons; in these cases cited they are found only during the months of February—March; in some cases they are useful in controlling the pest as in the case of Ragi borer; in some cases though the crop exists during two seasons and the pest also is found the parasite could be found in abundance only during the second crop as in the case of *Schoenobius* and similarly in the case of *Utethesi* on Sannhemp and the citrus leaf miner *Phyllocnistes*. In the case of *Nephantis* in the West coast it becomes serious in certain seasons but the pest becomes controlled as soon as the parasites assert themselves. Thus it could be seen that there are certain meteorological and other factors that now and then put the parasites under check.

Before initiating "Biological methods of control" it is incumbent upon us to know before-hand the indigenous parasites that exist in the area with the respective hosts; and their host relations; the number and kind of parasites that attack a particular host and the number of hosts which a particular species attacks; the secondary parasites that may be found on the original parasites; the different stages of hosts that are attacked by the parasites; the seasonal abundance of these parasites and their numerical relation with that of the host; and the factor or factors that are responsible for the success or failure for the multiplication of these. All these points require elucidation. Then one should be able to eliminate the adverse factors and attempt at successful breeding of the parasites and liberating them, the kind of cages to be utilised depending upon the nature of parasites—whether egg or larval.

The list of parasites given below will show how vast the field is and how there is plenty of scope for utilising the parasites in the control of crop pests. In view of the complexity of this method of control it requires a careful study before any one starts on the work of biological control; and in this connection one may be referred to such eminent men like Howard, Thompson, Smith, Burgess, Jones and a host of others who are doing a good deal of work on insect parasites and biological methods of control. A good deal of literature by these men has accumulated and would prove very interesting study in this new line of work.

The list does not by any means profess to be complete but it is just given to show the richness of parasites found on the several major crop pests thereby showing one that there is a vast and wide field of study of great economic importance as well as of deep academic interest. It may also be added that the list gives only those South Indian forms of economic importance and does not deal with the numerous parasitic forms which affect other insects in various ways.

List of Hymenopterous Parasites of Economic Importance noted in South India.

Host family.	Host insect.	Parasitic insect.	Parasite family.	Distribution.
LEPIDOPTERA				
Hesperiidae	<i>Parnara mathias</i> (Rice skipper)	<i>Xanthopimpla immaculata</i> , Mc	Ichneumonidae	Palur (South Arcot), Madras & Coimbatore.
	do.	<i>Clinocentrus</i> sp.	Braconidae	
	do.	<i>Eupheromatus parvareae</i> , Gah.	Pteromalidae	Nellore, Karvetnagar, Coimbatore.
	do. (on pupa)	<i>Ischnojoppa lutaator</i> , F.	Ichneumonidae	
Lasiocampidae	<i>Taragama siva</i> (on Acacia)	<i>Henicospilus reticulatus</i> , Gahr.	do.	Coimbatore.
	<i>Taragama dorsalis</i>	<i>Apanteles taragamae</i> , Vier.	Braconidae	Bangalore.
	<i>Lasiocampid larva</i>	<i>Chalcis argentifrons</i> , Asp.	Chalcididae	Coimbatore.
	<i>Trabala visinus</i>	<i>Microdus fumipennis</i> , Bing.	Braconidae	
Limacodidae	<i>Parasa lepida</i> (on castor)	<i>Clinocentrus</i> sp.	do.	Coimbatore.
	do.	<i>Stomatocerus ayyari</i> , Gah.	Chalcididae	Coimbatore.
	do. & <i>Thosca</i> sp.	<i>Eurytoma parasca</i> , Gah.	Eurytomidae	Coimbatore.
	<i>Contheyla rotunda</i> (on coconut palm)	<i>Alciodes</i> sp.	Braconidae	Malabar.
	<i>Natada nararia</i> (on <i>Pithecolobium</i>)	<i>Protapanteles</i> sp.	do.	Coimbatore.
Lymantridae	<i>Olene mendosa</i>	<i>Goryphus</i> sp.	Ichneumonidae	Coimbatore.
	<i>Euproctis fraterna</i> (on castor)	<i>Henicospilus (reticulatus?)</i>	do.	Coimbatore.
	do. (rose leaves)	<i>Disophrys</i> sp.	Braconidae	Madras.
	<i>Euproctis scintillans</i> and <i>E. fraterna</i> (on larva)	<i>Henicospilus mordaxius</i> , G	Ichneumonidae	Saidapet and Coimbatore.
	<i>Euproctis scintillans</i> (on gogu)	<i>Protapanteles</i> sp.	Braconidae	Coimbatore.

Sphingidae	<i>Orgyia postica</i> (on larva) <i>Psalis scuiris</i> (on pupa) <i>Polyptychus dentatus</i> (on Cardia) (egg parasite) <i>Daphnis nerii</i> (on larva) <i>Macroglossum</i> sp. (an undescribed species) (on larva)	<i>Aphantodes (Protaphantodes) colemani</i> , Vier. <i>Protaphantodes</i> sp. <i>Anæstatus coimbatorensis</i> , Gir. <i>Troporhoges utaculipennis</i> , Cam. <i>Microplitis</i> sp.	do. do. Chalcididae Braconidae do.	Mysore. Coimbatore. Coimbatore. Coimbatore. Coimbatore.
Noctuidae	<i>Achaea janata</i> , Linn. (on larva) do. do. do. do. (on castor) do.	<i>Tetrastichus ophiusæ</i> , Craw. <i>Microtorfidea hissonata</i> , Vier. <i>Zamosochorus orientalis</i> , Vier. <i>Microplitis</i> sp. <i>Paniscus ocellaris</i> , Th. <i>Microplitis ensirus</i> , Lyb.	Eulophidae: Ichneumonidae. do. Braconidae. Ichneumonidae. Braconidae.	Mysore. Mysore. do. S. India. Coimbatore. All over S. India. ("a specific and effective parasite on the castor semi-looper") Coimbatore. do. Mysore. Coimbatore. do. Mysore. Bangalore.
	<i>Proclitus litura</i> (on larva) do. do. do. do. <i>Plusia peponis</i> do. <i>Plusia signata</i> <i>Plusia agramma</i> (on snake gourd) <i>Carea subtilis</i> (on Eugenia) <i>Adisura atkinsoni</i> (on lab-lab)	<i>Euplectrus leucostomus</i> , Roh. <i>Hemicospilus</i> sp. <i>Aphantodes proclivæ</i> , Vier. <i>Diocles argenteopilosa</i> , Cam. <i>Chelonus</i> or <i>Chelonella</i> sp. <i>Aphantodes plusiæ</i> , Vier. <i>Mesochorus plusiiphilus</i> , Vier. (a hyper parasite on <i>Plusia</i>) <i>Paracopidosomopsis javæ</i> , Gir. <i>Ceraphron atkinsonii</i> , Gir. <i>Tumidicoxioidea jambulana</i> , Gir. <i>Microbracon</i> sp.	Eulophidae. Ichneumonidae. Braconidae. Ichneumonidae. Braconidae. do. Ichneumonidae Encyrtidae. Proctotrypidæ. Chalcididae. Braconidae.	Coimbatore. do. Coimbatore. do. Mysore. Coimbatore. do. Mysore. Bangalore. Coimbatore. do. do. do.

Host family.	Host insect.	Parasitic insect.	Parasite family.	Distribution.	
LEPIDOPTERA (Contd.) Noctuidae (Contd.)	<i>Cirphis</i> sp.	<i>Meteorus</i> sp.	Braconidae	South Arcot.	
	<i>Cirphis albistigma</i> (on paddy)	<i>Xanthopimpla</i> sp.	Ichneumonidae	Palur (S. Arcot).	
	<i>Spodoptera mauritia</i> do.	<i>Chelonus</i> sp.	Braconidae	Malabar.	
	do. (on barley) (on pupa).	<i>Charops</i> sp.	Ichneumonidae do.	South India. Ootacamund.	
	<i>Earias fabia</i>	<i>Microbracon lefroyi</i> , <i>Dudg. & Gough.</i>	Braconidae	Ramnad.	
	<i>Perigaea capensis</i>	<i>Euplectrus euflexiae</i> , <i>Roh.</i>	Eulophidae	Coimbatore.	
	do. (infesting saf- flower plants)	<i>Heterogamus percurranis</i> , <i>Lyle.</i>	Braconidae	do.	
	do.	<i>Protapanteles</i> sp.	do.	do.	
	<i>Eublemma olivaceae</i> (Brinjal leaf roller)	<i>Microdus</i> sp.	do.	do.	
	do.	<i>Hymenobosmena</i> sp.	Ichneumonidae	do.	
	<i>Eublemma scitula</i>	<i>Aphrastobracon flavipennis</i> , <i>Ash.</i>	Braconidae	S. India.	
	<i>A Noctuid larva</i> (on maize stalk)	<i>Cremastus noxiosus</i> , <i>Mort.</i>	Ichneumonidae	Coimbatore.	
	Pyralidae	<i>Chilo simplex</i> (on Sorghum)	<i>Xanthopimpla pedator</i> , <i>F.</i>	do.	do.
		do.	<i>Iphiaulax</i> sp.	Braconidae	Coimbatore, Kurnool
do.		<i>Merionotus</i> sp.	do.	Coimbatore.	
do.		<i>Aphantates flavipes</i> , <i>Cam.</i>	do.	Poona.	
do.		<i>Aphantates (Stenobleura)</i> sp.	do.	Godavari & Coimbatore	
do.		<i>Iphiaulax spilocephalus</i> , <i>Cam.</i>	do.	S. India.	
do.		<i>Glyptomorpha (Bracon) deesae</i> , <i>Cam.</i>	do.	do	
do.		<i>Aphantates</i> sp. (probably new).	do.	Mandya.	
do.		<i>Microbracon ciliocida</i> <i>Ramakrishna.</i>	do.	S. India.	

do.	<i>Xanthopimpla mursei</i> .	Ichneumonidae	All over India.
do. (on pupa)	<i>Tetrastichus ayyari</i> , Roh.	Eulophidae.	Coimbatore.
<i>Schoenohius</i> (eggmass)	<i>Tetrastichus schoenobii</i> , F.	do.	Hebbal, Mysore
do.	<i>Phanurus benificiens</i> , Zehnt.	Scelionidae.	do.
do.	<i>Trichogramma minutum</i> , R.	Trichogrammidae.	do.
do. (larva)	<i>Tropobracon indicus</i> , R.	Braconidae.	do.
do.	<i>Microbracon</i> sp.	do.	do.
do.	<i>Goryphus maculipennis</i> , Cam.	Ichneumonidae.	Godaveri Dt.
do.	<i>Apanteles schoenobii</i> , W.	Braconidae.	Hebbal, Mysore.
do.	<i>Ischnojoppa luteator</i> , F.	Ichneumonidae.	Very common in Coimbatore & all S. India.
<i>Scirpophaga</i> (eggmass)	<i>Phanurus benificiens</i> , Zehnt.	Scelionidae	Bangalore.
<i>Diatraea</i> (eggmass)	<i>Trichogramma minutum</i> , R.	Trichogrammidae.	Hebbal, Mysore.
<i>Sylepta derogata</i> (cotton leaf roller)	<i>Neopimpla sylepta</i> , Vier.	Ichneumonidae	Mysore.
do.	<i>Microtoridea lissonata</i> , Vier.	do.	do.
do.	<i>Elasmus indicus</i> , Roh.	Elasmidae.	S. India.
<i>Euzophera perticella</i>	<i>Pristomerus eucophera</i> , Vier.	Ichneumonidae.	Bangalore.
<i>Leucinodes orbonalis</i> (brinjal fruit borer)	<i>Pristomerus tataricus</i> , Mort.	do.	Attur, Chinglepet.
<i>Euzophera perticella</i>	<i>Paniscerotoma</i> sp.	Braconidae.	Coimbatore.
<i>Pyrausta nacheeratis</i>	<i>Apanteles nacheeratis</i> , Wik.	do.	Nilambur, Madras.
<i>Gnapholocrocis mediuales</i> (Paddy leaf-roller)	<i>Cardiochiles</i> sp.	do.	Ganjam.
<i>Eticla zinckenella</i>	<i>Phanerotoma</i> sp.	do.	Coimbatore.
(Infesting sunnhemp)	<i>Microbracon</i> sp.	do.	do.
<i>Crocidaemia binotalis</i> (on Radish)	<i>Microbracon lefroyi</i> , Dud & Gough.	do.	S. India.
do. (pest of cruciferous plants)	<i>Microbracon neltens Ramakrishna</i> .	do.	do.

Host family.	Host insect.	Parasitic insect.	Parasite family.	Distribution.
LEPIDOPTERA				
(Contd.)				
Pyralidae	<i>Antigaster catalanalis</i> (Gingelly leaf-caterpillar)	<i>Hymenobosmina</i> sp.	Ichneumonidae.	Coimbatore.
(Contd.)	<i>Dichacrocis</i> (on castor seed)	<i>Diocles trochanterata</i> , Morl.	do.	do.
	<i>Pyralid larva</i> (boring into the fruit & pods of <i>Pongamia glabra</i>)	<i>Microbracon pictus</i> , Ramakrishna.	Braconidae.	do.
	<i>Scirpophaga</i> (egg-mass)	<i>Phanurus beneficiens</i> , Zehnt.	Scelionidae.	(Bangalore)
	<i>Diatraea</i> (egg-mass)	<i>Trichogramma minutum</i> , R.	Trichogrammidae.	Hebbal, Mysore.
Pterophoridae	<i>Evelastis atomasa</i> (on Red-gram)	<i>Protaphanteles</i> sp.	Braconidae.	Hebbal, Mysore.
	<i>Stomopteryxnerteria</i>			
Gelechiidae	<i>Platyedra</i> (cotton Bollworm)	<i>Cheloneilla</i> sp.	do.	South Arcot.
	do.	<i>Microbracon lefroyi</i> , Dudg & Gough.	do.	India.
	<i>Ptilorinaea blapsigona</i> (on brinjal bud)	<i>Chelonus</i> or <i>chelonella</i> sp.	do.	South India.
	<i>Nephantis serinopa</i>	<i>Microbracon incarnatus</i> , Ramakrishna.	do.	do.
Xyloryctidae	do.			
	do. (on pupa)	<i>Elasmus nephantidis</i> , Roh.	Elasmidae.	do.
	do.	<i>Stomatocerus sulcatiscutellum</i> , Gri.	Chalcididae.	do.
	do.	<i>Trichospilus pupivora</i> , Ferr.	Eulophidae.	Cochin.
	<i>Cyphostichia coarcta</i>	<i>Xanthopimpla punctata</i> , F.	Ichneumonidae.	Calicut.
Gracillariidae	<i>Gracillaria soyella</i> (on Red gram)	<i>Euryscotolus Coimbatorensis</i> Roh.	Eulophidae.	Coimbatore.
		<i>Amplesiella indica</i> , Gir.	Chalcididae.	India.
Hypsidae	<i>Nyctomera lactinisa</i> (on larva)	<i>Euplectrus nyctemeræ</i> , Craw.	Eulophidae.	Bangalore.

	Disophrys sp.	Braconidae.	Coimbatore.
Arctiade	<i>Hypsa ficus</i> (on <i>Ficus indicus</i>) <i>Larva</i> of? <i>Craconotus albistriga</i>	do. do.	Mysore. do.
Papilionidae	<i>Diacrisia obliqua confusa</i> Hairy caterpillars. <i>Fapillio denoleus</i> E. <i>P. polytes</i> .	do. Ichneumonidae Braconidae	Nilambur, Madras. S. India. Mysore.
Notodontidae	<i>Stauropus alternus</i>	do.	do.
Glyphiptery- giadae	<i>Phyodes rutilata</i>	do.	do.
Eucosmidae	<i>Argyroptoc illephila</i> do.	do.	do.
Saturnidae	<i>Cricula trifenestralis</i>	Bethylidae.	do.
Zeuzeridae	<i>Azygophleps scalaris</i>	Ichneumonidae	S. India.
Psychidae	On different plants	do.	Coimbatore.
Nymphalidae	<i>Psychid larva</i> <i>Melanitis</i> (on paddy) on pupa	do.	do.
Bombycidae	<i>Ocinara</i>	do.	Coimbatore.
Lycaenidae	<i>Viorchola</i> (on soapnut fruit)	do.	do.
COLEOPTERA			
Curculionidae	<i>Alicides affaber</i> (attacking <i>Hibiscus cannabinus</i> stem borning weevil) <i>Alicides bubo</i> (on the grub) <i>Acicnemis</i> sp. (on the grubs) <i>Calandrus oryzae</i> (Rice weevil) <i>Aspidomorpha</i> (on grubs)	Braconidae do. do. Pteromalidae Eulophidae.	Coimbatore. do. Salem. All over S. India. Bangalore.
Cassididae			

Host family.	Host insect.	Parasitic insect.	Parasite family.	Distribution.
COLEOPTERA (Contd.)				
Buprestidae	<i>Buprestid</i> borer ✓ <i>Sphenoptera</i> spp. (on larvae boring into groundnut, cotton & pulses)	<i>Vipis gracilis</i> , <i>Ramakrisna</i> . <i>Glyptomorpha (phiantax) smacenus</i> Cam.	Braconidae. do.	Coimbatore. Coimbatore, Bellary.
Pinidae	<i>Sitotropha</i> (infesting stored Coriander)	<i>Meraporus vandinei</i> , <i>Tuck.</i> = <i>Aplastomorpha cotandrae</i> , <i>How.</i> <i>Bruchocida orientalis</i> , <i>Craw.</i> <i>Bruchobius colemani</i> , <i>Craw.</i>	Super. Chalcidoidea.	Madras.
Bruchidae	<i>Bruchus chinensis</i> (on larva) do.		Eupelmidae. Pteromalida	Bangalore. Bangalore & Coimbatore.
Bostrychidae	<i>Dinoderus</i> (shot-hole borer in bamboo frame work)	<i>Spathius</i> sp.	Braconidae	Coimbatore.
Coccinellidae	<i>Epilacina</i> (grubs) do. (on pupa)	<i>Pleurotropus foveolatus</i> , <i>Craw.</i> <i>Pleurotropus epiacinae</i> , <i>Roh.</i> <i>Homalotylus flaminus</i> (<i>Dalm.</i>) <i>Tetrastichus colemani</i> , <i>Craw.</i>	Eulophidae. do.	Bangalore. Coimbatore.
Chrysomelidae	<i>Coccinellid</i> grubs <i>Aspilomorpha militaris</i> (on larva)		do.	Bangalore.
Cerambycidae	<i>Xylotrichus</i> .	<i>Metaphina</i> sp. (probably new.)	Eupelmidae.	do.
DIPTERA				
Anthomyiidae	<i>Chokim</i> maggot	<i>Tetrastichus nyenitarsus</i> , <i>Roh.</i> <i>Diahasminorpha conperii</i> , <i>Vier.</i> <i>Baityaulax trybaeniplaya Ramakrisna</i> .	Eulophidae. Broconidae.	Coimbatore. India. Anantapur Dt.
Trypetidae	Fruit fly <i>Bactrocera</i> sp. (on Alangium fruits) <i>Carpomyia vesuviana</i> (attacking Zizyphus fruits) <i>Dacus</i> (<i>Chaetodacus</i>) <i>cucurbitae</i> <i>Dacus longistylus</i> (attacking seed capsules of Calotropis)	<i>Opus fletcheri</i> <i>Siv.</i> <i>Austroopius</i> sp.	do. do. do. do.	Coimbatore. Throughout India. S. India.

<i>Dacus (Cioctolactus) incisus</i> (infesting fruits of the tree of <i>Careya arborea</i>)	<i>Opinus incisus</i> , <i>Silo</i> .	do.	Coorg.
<i>Dacus (Chaetodacus) incisus</i> . do. On a fly boring into Zizyphus fruits	<i>Opinus (Biosteres) persulcatus</i> , <i>Silv.</i> <i>Opinus (Biosteres) compansans</i> , <i>Silo</i> . <i>Opinus (Biosteres) carponyiae</i> , <i>Silo</i> .	do. do. do. do.	do. do. do. Coimbatore.
On fruit flies	<i>Asobara orientalis</i> , <i>Vier.</i>	do.	
On fruit fly maggots (col- lected and taken to Aus- tralia by Compere in 1907).	<i>Syntomosphyrum indicum</i> , <i>Silo</i> .	Super. Chalcidoidea	S. India.
<i>Aspidomyia sesami</i> (Gingelly gall-fly)	<i>Eurytoma dentifectus</i> , <i>Gah.</i>	Eurytomidae.	Coimbatore.
Cholam gall-fly	<i>Tetrastichus coimbatorensis</i> , <i>Roh.</i>	Eulophidae.	do.
Galls on <i>Macraea arueria-</i> probably on gall-flies	<i>Tetrastichus isaaci</i> , <i>Roh.</i>	do.	do.
From cumbu grains pro- bably on gall-flies	<i>Tetrastichus okawus</i> , <i>Roh.</i>	do.	do.
From grass galls-probably on gall-flies.	<i>Neanastatus trochantericus</i> , <i>Gah.</i>	Encyrtidae.	do.
do	<i>Xestonodidea foersteri</i> , <i>Gah.</i>	Platygastridae	do.
<i>Faclydiplosis oryzae</i> -Paddy gall flies,	<i>Folygnotus sp.</i>	do.	Tanjore.
<i>Syrphus</i> (on water melon)	<i>Bassus orientalis</i> , <i>Cam.</i>	Ichneumonidae.	Coimbatore
<i>Aphis</i> on tobacco	<i>Aphidius colemani</i> , <i>Vier.</i>	Braconidae.	Bangalore.
<i>Aphis maidis</i> (on ragi)	<i>Aphidencyrus sp.</i>	Encyrtidae	do.
<i>Eurybrachys</i> (on eggs)	<i>Leurocerus n. sp.</i>	do.	do.
<i>Pantaboya</i> (Cholam shoot fulgorid)	<i>Paramyrus optabilis</i> , <i>Perk.</i>		Coimbatore.

Cecidomyiidae

Syrphidae

HEMIPTERA

Aphidae

Fulgoridae

Host family.	Host insect.	Parasitic insect.	Parasite family.	Distribution.
HEMIPTERA (Contd.) Coccidae	<i>Ceroplastodes cajanii</i>	<i>Aphycus fuscicornis</i> , Gah.	Encyrtidae.	Coimbatore.
	do.	<i>Anicetus ceylonensis</i> , How.	do.	do.
	do.	<i>Chiloncurus</i> sp.		S. India.
	do.	<i>Metaphycus</i> n. sp.		do.
	<i>Lecanium nigrum</i>	<i>Eucomys lecaniorum</i> , Mayr.	Aphelinidae	Coimbatore.
	do.	<i>Aneristus ceroplastae</i> , How.		do.
	do.	= <i>Cocophagus orientalis</i> , How.	Miscogasteridae	
	do.	<i>Scutellista cyanea</i> , Mot.	Encyrtidae	do.
	do.	<i>Encyrtus lecaniorum</i> , Mayr.		do.
	do.	= <i>Eucomys lecaniorum</i> , Mayr.	do.	S. India.
	do.	<i>Anicetus ceylonensis</i> , How.		
	do.	A new genus and species of Encyrtus.		
	do.	<i>Microterys kotinskyi</i> , Fell.		
	do.	<i>Encyrtus barbatus</i> , Timb.		do.
	do.	<i>Megalomium</i> sp.		
	<i>Puteinaria maxima</i>	<i>Marietta leopoldina</i> , Mot.	Braconidae.	Coimbatore.
	do.	<i>Anicetus ceylonensis</i> , How.	Aphelinidae.	do.
	do.	<i>Aphycus flavus</i>	Encyrtidae	do.
	do.	<i>Aphycus</i> n. sp.	do.	do.
	do.	<i>Perissopterus</i> n. sp.		S. India.
<i>Puteinaria psidii</i>	<i>Microterys kotinskyi</i> , Fullaway.			
do.	<i>Adelencyrtus chionaspidis</i> .		Coimbatore.	
do.	<i>Aphelinus mytilaspidis</i> .	Aphelinidae	do.	
do.	<i>Encyrtus flavus</i> .	Encyrtidae	do.	
do.	<i>Cocophagus</i> sp.	Aphelinidae	do.	
<i>Puteinaria</i> sp.	<i>Metaphycus</i> n. sp.		do.	
<i>Pseudococcus citri</i>	<i>Tetraneum indicus</i> .		do.	
<i>Lecanium haemisphaerium</i>	<i>Comys rufescens</i> .		do.	

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