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Faunistic survey of chalcid parasitoids (Chalcidoidea: Hymenoptera) in Cuddalore District of Tamil Nadu

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Abstract
Extensive survey for collection of chalcid parasitoids was made in Cuddalore district of Tamil Nadu. In the present study, three collection methods (Host rearing, yellow pan trap and net sweeping) were used to collect the chalcid parasitoids from different ecosystems in Tamil Nadu. A total of 358 parasitoids were collected from Cuddalore district. Among the collections, the most abundant superfamily Chalcidoidea was collected using different methods. In each super families, yellow pan trap recorded more yielded (174 of parasitoids), than Host rearing (150 of parasitoids) and Sweep net (34 of parasitoid). Encyrtidae and Chalcididae recorded 40 and 30 numbers of parasitoids individually utilizing yellow pan trap. The lowest numbers of parasitoids observed were from the super families Torymidae, Trichogrammatidae and Pteromalidae (2, 2 and 3 respectively).

Keywords: Faunistic Survey, chalcid parasitoids, cuddalore

Introduction
In recent years, numbers of insect pests species have become resistant to an increasing number of insecticides. The increasing public awareness on dangers of pesticide use demands for safer products or pest control strategies. In this context, use of natural enemies to manage agricultural pests appears to be an option (Noyes & Hayat, 1994) [11]. Of the natural enemies used in insect pest management, the parasitic hymenopterans have been the most successful bio-control agents (Noyes, 1985 & Greathead, 1986) [12, 3]. The Chalcidoidea is one of the most species rich super family in the order Hymenoptera family Encyrtidae (Hymenoptera: Chalcidoidea) is one of the largest of the chalcidoid families. This family currently includes nearly 4,000 described species in 497 genera globally, 610 species in 142 genera update from India (Noyes, 2018) [10]. The superfamily Chalcidoidea (Hymenoptera) is a hyper-diverse group of insects currently including some 22,000 described species worldwide and almost all species are parasitoids of insects, with many attacking economically significant pests such as whiteflies, aphids and scale insects (Noyes, 2009). The families Aphelinidae and Encyrtidae are the most successful groups of Chalcidoidea used in the biological control of pest scale insects (Guerrieri & Noyes, 2000) [4].

Materials and methods
Extensive survey for collection of chalcid parasitoids was made in Cuddalore district of Tamil Nadu. In the present study, three collection methods (Host rearing, yellow pan trap and net sweeping) were used to collect the chalcid parasitoids from different ecosystems in Tamil Nadu. Once an effective natural enemy has been identified, the first step in a mass-rearing programme is a trial to rear it on a natural host (the pest organism) in a economical way. Members of the family Encyrtidae (Hymenoptera: Chalcidoidea) are important parasitoids of mealybugs, scales, psyllids, aphids and white flies (Hayat, 2006) [5]. Most natural enemies are recorded in this way. Parasitoids of the hymenopterous family Encyrtidae are one of the most important groups of natural enemies of soft scale insects and have been used extensively in biological control.
The traps were placed in a suitable habitat, such as grassland, forest and crop cultivated field, after the traps were filled with saturated salt solution for preservation and a few drops of detergent to break the surface tension of the water and makes the insects sink. At least 50 traps (Noyes, 1982) were placed in a locality for effective sampling. The specimens are preserved in 95% ethanol and placed in a freezer. The trapped specimens were segregated under microscope and encyrtids alone were transferred to 70 per cent alcohol and stored at -20°C. Sweeping can be an effective method of capturing encyrtids. A Sweep net is a funnel-shaped net attached to a long-handled frame that is swept back and forth through grass or other vegetation. The net handle (aluminium) was about 1.0 m long with circular head. A net bag

was made up of strong and durable white terelene with a very fine mesh that retains even the minute parasitoids inside the net but allowing easy passage of air and was narrowing to the rounded bottom. After the sweep, the insects were transferred into polythene bags or light box, then separated the encyrtids using an aspirator into 70 per cent ethyl alcohol and observe under microscope.

Results and Discussion

Chalcidoidea Parasitoid Collected From Cuddalore District

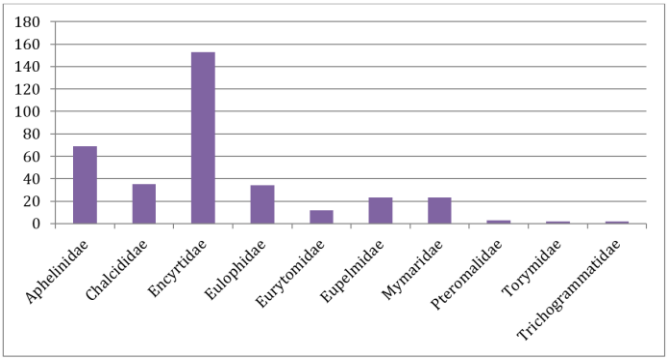
A total of 358 parasitoids were collected from Cuddalore district. Among the collections, the most abundant superfamily Chalcidoidea was collected using different methods. In each super families, yellow pan trap recorded more yielded (174 of parasitoids), than Host rearing (150 of parasitoids) and Sweep net (34 of parasitoid). Encyrtidae and Chalcididae recorded 40 and 30 numbers of parasitoids individually utilizing yellow pan trap. The lowest numbers of parasitoids observed were from the super families Torymidae, Trichogrammatidae and Pteromalidae (2, 2 and 3 respectively).

This group of parasitoids has been little recorded in Net sweep collection method from Cuddalore district, Eulophidae recorded the highest number of 20 parasitoid followed by chalcididae were recorded from 5 numbers of parasitoid.

In the Host rearing method, Encyrtidae recorded highest numbers 110 of parasitoids taken after by Aphelinidae 40 numbers of parasitoid.

Chalcidoid Parasitoid Collected From Cuddalore District

Sl. no	Family	YPT	SN	HR
1.	Aphelinidae	29	0	40
2.	Chalcididae	30	5	0
3.	Encyrtidae	40	3	110
4.	Eulophidae	14	20	0
5.	Eurytomidae	10	2	0
6.	Eupelmidae	19	4	0
7.	Mymaridae	25	0	0
8.	Perilampidae	0	0	0
9.	Pteromalidae	3	0	0
10.	Torymidae	2	0	0
11.	Trichogrammatidae	2	0	0
	Total	174	34	150



Among the families Encrytidae was the dominant one, followed by Aphelinidae in general. However there were few differences among the districts in which some of the families were higher than the other districts and no definite trend could be observed. The results indicated that there exists a slight variation in the parasitoid population with respect to districts. This indicated the availability of host insects like hoppers and favorable conditions for its survival. This is in corroboration with the earlier reports, which showed that the maximum egg parasitisation of 55 per cent for plant hoppers and 72 per cent for leaf hoppers was noted at IRRI (Heinrichs, 1979) [7] while average parasitism was 19 per cent in BPH and 22 per cent in GLH. Watanabe *et al.* (1992) [13] reported that 23-92 per cent of egg mortality in BPH, *Anagrus optabilis* was predominant in young rice plants. Parasitism by *Oligosita* spp. increased with growth of rice plants. Yasumatsu *et al.* (1975) [14] also reported four mymarid parasites *viz.*, *Anagrus optabilis* (Perkins), *Mymar taprobanicum* Ward, *Polynema spand*, *Gonatocerus* sp., which contributed much in the reduction of plant hoppers in Thailand in rice ecosystem.

The family Mymaridae is one of the most distinctive families of Chalcidoidea and includes the smallest known insects. All mymarids are egg parasitoids with two known exceptions (Huber *et al*., 2009) [8]. Several species of leafhoppers and plant hoppers attack rice in different areas of the world, e.g., 19 species in India (Chowdhury *et al*., 2011) [1]. As reported earlier by Dupo and Barrion, 2009 [2], the egg parasitoids attacking delphacid plant hopper pests of rice are predominantly mymarids (Dupo and Barrion, 2009) [2]. Volatile chemicals emitted by plants have a wide range of functions, such as plant-to-plant signals, defence chemicals or pollinator attractants (Heil and Karban, 2010) [6], and so a volatile blend can have different meanings for different organisms. For insects, these volatiles may indicate a suitable food source, an oviposition site, the presence of herbivorous prey or hosts, or they may be used by pollinators to locate flowering plants (Dicke, 2011). Parasitoid wasp species that attack insect herbivores rely on herbivore or oviposition-induced plant volatiles (HIPVs/OIPVs) to locate host infested plants, and even identify the most suitable host developmental stages. These are the possible reasons for the difference in parasitoid population from study area.

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