

JES-Life Sciences

## Biodiversity, Distribution and Host Range of the Genus *Ephedrus* Haliday (Hymenoptera: Aphidiidae) in Manipur, N.E. India

P.M. Singh\*, P. Devjani, Kh. Devikarani and T.K. Singh

Department of Life Sciences, Manipur University, Canchipur- 795003, Manipur.

\*Department of Zoology, Presidency College, Motbung, Manipur

### Article Info

#### Article History

Received : 05-05-2011

Revised : 11-06-2011

Accepted : 12-06-2011

#### \*Corresponding Author

Tel : +91-3852435837

Fax :

Email:

tsingh06@yahoo.co.in

### Abstract

The aphidiid wasps are small ichneumonoid hymenopterous insects which are strictly specific solitary endophagous parasitoids of the aphids. They are amongst the most important group of parasitic insects that can be utilized as bio-control agent of aphids. So far 60 genera of aphidiid parasitoids have been described from all over the world. Out of these the genus *Ephedrus* Haliday is a common one. An extensive study of this genus along with their aphid hosts in different localities of Manipur during 2007- 2008 revealed the occurrence of 13 species belonging to the genus viz. *Ephedrus brevis*, *E. cerasicola*, *E. dioscorae*, *E. lacertosus*, *E. minor*, *E. nacheri*, *E. niger*, *E. orientalis*, *E. persicae*, *E. plagiator*, *E. srinagarensis*, *Ephedrus* sp.a and *Ephedrus* sp.b. The parasitoids revealed variations in terms of their altitudinal distribution (from 785m.to 1920 m. MSL). Most of the parasitoid species exhibited host specificity however *E. plagiator* showed extreme polyphagy parasitizing 4 aphid host species infesting different host plants.

©ScholarJournals, SSR

**Key Words:** Biodiversity, aphidiid parasitoids, *Ephedrus*, aphids.

### Introduction

The geographic distribution of parasitoids depends on the plant communities and associated aphids, as well as on their faunal history (Stary, 1970). Both altitudinal and latitudinal differences in parasitoid diversity play an important role in the biological control, especially of important pests. Parasitoids possess the potential to be effectively employed in Integrated Pest Management Programmes (IPM) of the aphid pest owing to their parasitic nature, narrow host range, high reproductive potential resulting to easy mass multiplication and seasonal synchrony with their aphid hosts (Singh & Agarwala, 1992; Singh, 2001).

A perusal of literature revealed that aphid parasitoids of Manipur were earlier studied by Stary & Raychaudhuri (1977), Singh & Singh (1986a, b, c, 1987, 1988). Out of the 60 genera of Aphidiid parasitoids that have been described from all over the world, about 12 genera have been recorded from Manipur (Singh, 1987). Among these, the genus *Ephedrus* Haliday is a common one. Present study deals with the diversity of *Ephedrus* spp., their seasonal incidence, host association and vertical distribution.

### Methods

An extensive study of the occurrence of Aphidiid parasitoids was carried out in different localities of Manipur during 2007-2008. The study area was divided into 4 altitudinal strata viz., i) 150-600 m above mean sea level, ii) 601-1200m MSL, iii) 1201-1800 m MSL and iv) more than 1800m MSL in order to understand the vertical distribution of the parasitoid species. For obtaining the adult parasitoids, aphid colonies infesting different host plants were collected from the field and

brought to the laboratory. The aphids thus collected were reared and kept under observation for the emergence of adult parasitoids as described by Stary (1970) and Stary and Ghosh (1983). Emerged parasitoids and their respective host aphids were preserved in 70% ethyl alcohol. Specimens were boiled in 10% KOH solution, further heated in chloral phenol and mounted in gum chloral. Slides were then studied under microscope for observation and identification.

### Results

#### *Diversity and Incidence:*

Abundance and host alternation, which are associated with the distribution of aphid species often affect parasitoid species richness positively, which suggests that aphids with a wide distribution might be exposed to different parasitoid complexes (Stary, 1970; Stadler, 2002). The study revealed the occurrence of 13 species of parasitoids parasitizing 8 species of aphid belonging to 6 genera under the sub-family Aphidinae. The host range of different parasitoid species indicated that majority of them were host-specific i.e., 7 species parasitizing single host-species, 1 species was oligophagous and 5 species were polyphagous. The parasitoids were collected from aphid host infesting on 16 plant species belonging to 10 families viz., Apiaceae, Asteraceae, Brassicaceae, Fabaceae, Lamiaceae, Malvaceae, Poaceae, Rosaceae, Solanaceae, Verbanaceae.

The seasonal incidence of the parasitoid revealed that they were active from the month of October to March. Maximum activity was during January (Table 1). This coincided with the population of the aphid in the field. Thus the

abundance of this parasitoid decreased during the pre-winter period and attained peak during mid-winter and again decreased during post-winter and pre-spring periods. Out of

the 13 species of parasitoids, *Ephedrus plagiator* Nees was found to have maximum number of aphid host, followed by *E. srinagarensis* Stary and Bhagat.

Table 1: List of Parsitoids.

Sl. No.	Parasitoid	Host	Host-Plant	Period of activity
1.	<i>Ephedrus brevis</i> Stelfox	<i>Myzus persicae</i>	<i>Duranta plumeiri</i>	Mar
2.	<i>E. cerasicola</i> Stary	<i>Aphis citricola</i>	<i>Bidens pilosa</i>	Dec
		<i>Aphis gossypii</i>	<i>Solanum melongena</i>	Feb
3.	<i>E. dioscorae</i> Bhagat	<i>Acyrtosiphon pisum</i>	<i>Pisum sativum</i>	Feb
4.	<i>E. lacertosus</i> Haliday	<i>Brachysiphoniella montana</i> (v.d. Goot)	<i>Panicum paludosum</i>	Mar
5.	<i>E. minor</i> Stelfox	<i>Uroleucon sonchi</i>	<i>Sonchus oleraceae</i>	Dec
			<i>Blumia aromatica</i>	Jan
		<i>Lipaphis erysimi</i>	<i>Brassica nigra</i>	Jan
6.	<i>E. nacheri</i> Quilis	<i>Aphis gossypii</i>	<i>Tagetes fastula</i>	Dec
		<i>Uroleucon sonchi</i>	<i>Sonchus oleraceae</i>	Feb
7.	<i>E. niger</i> Gautier, Bonnamour, Gaumonts	<i>Uroleucon sonchi</i>	<i>Blumia heiracifolia</i>	Dec
8.	<i>E. orientalis</i> Stary and Schlinger	<i>U. sonchi</i>	<i>B. heiracifolia</i>	Dec
9.	<i>E. persicae</i> Froggatt	<i>Aphis gossypii</i>	<i>Solanum</i> sp.	Oct
10.	<i>E. plagiator</i> Nees	<i>Lipaphis erysimi</i>	<i>Brassica oleraceae</i>	Feb-Mar
		<i>A. pisum</i>	<i>P. sativum</i>	Mar
		<i>A. craccivora</i>	<i>Solanum</i> sp.	Mar
			<i>Dolichos lablab</i>	Jan
		<i>A.gossypii</i>	<i>Duranta plumeiri</i>	Dec
			<i>Hibiscus rosasinensis</i>	Dec
			<i>Solanum nigra</i>	Dec
11.	<i>E. srinagarensis</i> Stary and Bhagat	<i>Brachysiphoniella montana</i>	<i>Panicum paludosum</i>	Mar
		<i>A.gossypii</i>	<i>Rosa centifolia</i>	Dec
			<i>Solanum melongena</i>	Jan
		<i>Myzus persicae</i>	<i>Solanum nigra</i>	Jan
12.	<i>Ephedrus</i> sp. A	<i>U. sonchi</i>	<i>B. heiracifolia</i>	Jan
13.	<i>Ephedrus</i> sp. B	<i>M. persicae</i>	<i>Solanum</i> sp.	Jan
			<i>Coriander</i> sp.	Jan
		<i>U. sonchi</i>	<i>B. heiracifolia</i>	Jan
		<i>A.gossypii</i>	<i>Ocimum</i> sp.	Jan

Table 2: Vertical distribution of aphid parasitoid.

Sl.No.	Parasitoid	Type	A	B	C	D
1.	<i>Ephedrus brevis</i> Stelfox	S	-	+	-	-
2.	<i>E. cerasicola</i> Stary	O	-	-	+	-
3.	<i>E. dioscorae</i> Bhagat	S	-	-	+	-
4.	<i>E. lacertosus</i> Haliday	S	-	-	+	-
5.	<i>E. minor</i> Stelfox	P	-	+	-	+
6.	<i>E. nacheri</i> Quilis	P	-	-	+	+
7.	<i>E. niger</i> Gautier, Bonnamour, Gaumonts	S	-	+	-	-
8.	<i>E. orientalis</i> Stary and Schlinger	S	-	+	-	-
9.	<i>E. persicae</i> Froggatt	S	-	+	-	-
10.	<i>E. plagiator</i> Nees	P	-	+	+	+
11.	<i>E. srinagarensis</i> Stary and Bhagat	P	-	+	+	+
12.	<i>Ephedrus</i> sp. A	S	-	+	-	-
13.	<i>Ephedrus</i> sp. B	P	-	-	+	-

Abbreviations: A= 150-600m msl, B= 601-1200m msl, C= 1201-1800m msl, D≥ 1801m msl; O=Oligophagous, P=Polyphagous, S= Species specific, += presence of parasitoids, - = absence of parasitoids.

#### Vertical Distribution of Parasitoids:

The state of Manipur which shows altitudinal variations of more than 2550m MSL was divided into four altitudinal strata (Table 2). It was observed that altitude ranging from 601-1200m msl harboured maximum number of species as well as aphid-host. This might be due to availability of their respective plant and the aphid host but in the hilly region, the species abundance decreased. Aphid parasitoids and their host were not found in the stratum A (150-600m msl).

#### Discussion

The result of the present study revealed the occurrence of 13 species of *Ephedrus* parasitoids with distribution varying accordingly with the altitudinal variation. Volkl (1989) also found differences depending on the altitudinal zonation in the composition of the parasitoid complex of *Aphis fabae cirsiacanthoidis* Scopoli in France. Stary et. al. (2004) recorded that the exotic species, *Lysiphlebus testaceipes* (Cresson) is able to occupy higher altitudes on Iberian

Peninsula because of its extensive host range in combination with respective changes due to increasing altitude. In this study, maximum number of *Ephedrus* spp was found to occur in stratum B (601-1200m) followed by stratum C (1201-1800m) while stratum A (150-600m) harboured no parasitoid species. Similar observations were also recorded by Devi *et. al.* (1992-93) and Subhrani *et.al.* (2006) on the genus *Trioxys* Haliday and Aphidiine parasitoids respectively in Manipur, North-East India. Rakhshani *et. al.* (2008) found that *Ephedrus* species on cereal aphids prefer lowland areas in Iran and in his study maximum number of *Ephedrus* sp. individuals were collected from altitude ranging in between 400-600m.

#### Acknowledgements

The authors are grateful to the Head, Department of Life Sciences, Manipur University for providing working facilities.

#### References

- Devi, P.B., Singh, P.M. & Singh, T.K. (1992-93): Parasitoids of the genus *Trioxys* Haliday (Hymenoptera: Aphidiidae) in Manipur, North East India. *J. Aphidol.* 6 & 7 (1 & 2): 35-39.
- Rakhshani, E., Tomanovic, Z., Stary, P. Talebi, A.A., Kavallieratos, N.G., Zamani, A.A. & Stamenkovic, S. (2008): Distribution and diversity of wheat aphid parasitoids (Hymenoptera: Braconidae: Aphidiinae) in Iran. *Eur. J. Entomol.* 105: 863-870.
- Singh, P.M. & Singh, T.K. (1986a): Two new aphid parasitoids (Hymenoptera: Aphidiidae) from Manipur, North East India. *Akitu, N. Ser.* 81: 1-6.
- Singh, P.M. & Singh, T.K. (1986b): Aphid parasitoids (Hymenoptera) from Manipur, North East India. *Akitu, N. Ser.* 78: 1-17.
- Singh, P.M. & Singh, T.K. (1986c): Three new records of aphid parasitoids (Hymenoptera: Aphidiidae) from India. *Newsl. Aphidol. Soc. India* 5: 5.
- Singh, P.M. & Singh, T.K. (1987): Aphid parasites on brinjal plants in Manipur. *Newsl. Aphidol. Soc. India.* 6: 7-9.
- Singh, P.M. (1987): Studies on Aphid Parasitoids (Hymenoptera: Aphidiidae) of Manipur. PhD Thesis, Manipur University.
- Singh, P.M. & Singh, T.K. (1988): A new genus and three new species of Aphidiidae (Hymenoptera) from Manipur, North East India. *Akitu, N. Ser.* 96: 1-8.
- Singh, R. & Agarwala, B. K. (1992): Biology, ecology and control efficiency of the aphid parasitoid *Trioxys indicus*: a review and bibliography. *Biol. Agric. & Hort.* 8: 271-298.
- Singh, R. (2001): Biological control of the aphids by utilising parasitoids. In: *Biocontrol Potential and its Exploitation in Sustainable Agriculture*. Volume 2; Kulwer Academic / Plenum Publishers, USA. Pp 57-73.
- Stadler, B. (2002): Determinants of the size of aphid parasitoid assemblages. *J. Appl. Entomol.* 126 : 258-264.
- Stary, P. (1970): Biology of Aphid Parasites (Hymenoptera: Aphidiidae) with Respect to Integrated Control. Dr. W. Junk, The Hague, 643pp.
- Stary, P and Ghosh, A. K. (1983): Aphid parasitoids (Hymenoptera: Aphidiidae) from India and adjacent countries. *Zoological Survey of India. Tech. Monograph* No. 7, pp 96.
- Stary, P & Raychaudhuri, D. N. (1977): A new species of *Pauesia* (Hymenoptera: Aphidiidae) parasitic on *Lachnus tropicalis* (Homoptera: Aphidiidae) in India. *Orient. Ins.* 11: 233-235.
- Stary, P., Lumbierres, B. & Pons, X. (2004): Opportunistic changes in the host range of *Lysiphlebus testaceipes* (Cresson), an exotic aphid parasitoid expanding in Iberian Peninsula. *J. Pest Sci.* 77: 139-144.
- Subhrani, S., Singh, P.M. & Singh, T.K. (2006): Biodiversity of Aphidiine parasitoids (Hymenoptera: Braconidae) on certain crops in Manipur. *J. Aphidol.* 20 (1): 1-4.
- Volk, W. (1989): The parasitoid complex of *Aphis fabae cirsiacanthoidis* Scopoli (Homoptera: Aphididae) and its changes along a geographical gradient in the Rhone valley. *Acta Oecol.* 10: 167-176.