

**PARASITOID FAUNA ASSOCIATED WITH INSECT PESTS OF
VEGETABLE CROPS OF KASHMIR HIMALAYA, INDIA:
CHECK LIST AND BIODIVERSITY**

Deen Mohd Bhat*,
Ramesh Chander Bhagat and Ajaz Ahmad Qureshi****

* Corresponding author's address: Department of Zoology, Govt. Degree College Ganderbal, J&K-191201, INDIA. E-mail: bhatdm2014@gmail.com

** Department of Zoology, University of Kashmir, Hazratbal Srinagar, J&K-190006, Present address: G.P.O, Residency Road, Srinagar, Jammu & Kashmir 190001, INDIA. E-mail: bhagatrc@yahoo.com

*** Islamic University of Science and Technology, Awantipora, Jammu & Kashmir, INDIA; 2 P.O.BOX No.1250. E-mail: draijazphd@gmail.com

[Bhat, D. M., Bhagat, R. C. & Qureshi, A. A. 2017. Parasitoid fauna associated with insect pests of vegetable crops of Kashmir Himalaya, India: Check list and biodiversity. Munis Entomology & Zoology, 12 (1): 168-174]

ABSTRACT: Parasitoids are natural enemies of insect pests and form one of the potential biological control measures. This paper presents an up-to-date systematic checklist of parasitoids species reported to be parasitizing various insect pests in vegetable ecosystems of Kashmir. The paper deals with 54 sp. of parasitoids falling under one family of insect order Diptera and eight families of order Hymenoptera distributed over 43 insect genera recorded from the 16 host-insect pest species on 16 species of vegetable crops in diverse areas and localities of Kashmir valley. These enlisted parasitoids include 5 tachinids, 3 aphelinids, 6 aphidiids, 11 braconids, 2 chalcidids, 12-eulophids, 11-ichneuonids, 3-pteromalids and 1 trichogrammatid. Besides, geographical local distribution of enlisted parasitoids, the paper also incorporates parasitoid-Host insect pest and Host-vegetable crop catalogue-cum-checklist.

KEY WORDS: Pest, parasitoid, vegetable, braconids, ichneuonids, eulophids, chalcidids, Kashmir

The vegetables form essential components of human diet in Kashmir as they are rich source of proteins, carbohydrates, minerals, vitamins, besides providing the necessary roughages. The Valley of Kashmir is ideally suited for cultivation of deciduous fruit and broad-leaved juicy vegetables but it is equally favorable for the insect pests. The vegetable crops in this region are damaged by a number of insect pests of different insect orders. At least 20 insect pest species have been reported infesting various vegetable crops from different areas and localities of Kashmir (Rishi, 1967; Punjabi et al., 1970; Malik et al., 1972; Zaka-ur-rab et al., 1981; Bhagat, 1986; Anonymous, 1997; Dar et al., 2002; Kumar et al., 2006; Bhat, 2008; Bhat et al., 2011).

The insect pest populations associated with vegetable crops of this region are suppressed in the field condition by various natural enemies including parasitoids, predators and pathogens. A number of parasitoid species have been reported on various types insect pests attacking vegetable crops in this region (Simmonds & Rao, 1960; Stary & Ghosh, 1975, 1978; Bhagat, 1986; Bhagat & Ahmad, 1991; Bhagat, 2008; Bhat & Bhagat, 2008; Bhat & Bhagat, 2009, 2009a,b,c; Bhat & Bhagat, 2010; Bhat et al., 2009 & 2009a; Bhat et al., 2010, 2010a,b; Bhat et al., 2011, 2013). However, the said reports are scattered in different journals and there is a lack of systematic and consolidated information of parasitoid fauna which suppress vegetable crop pests from Kashmir Valley.

Therefore, the present work was undertaken to present an up to date checklist/ diversity of such parasitoids which could act as a ready reference for their future studies. Moreover, the present work could be useful source of information for exploring the possibility of utilizing these parasitoids for biological control after standardization of their rearing technique in Kashmir region. Pathogens and predators are not considered here. The paper also provides a more up-dated Parasitoid-insect Host pest and Host-vegetable crop catalogue-cum-checklist from J&K.

MATERIAL AND METHODS

The reported host data of every parasitoid species on commonly found vegetables in Kashmir was collected by examining the published and unpublished record/ literature and was presented in tabulated form. The parasitoid-Host insect pest and Host-vegetable plant catalogue-cum-checklist of these parasitoids from J&K was compiled and presented, followed by the reference citing that association. Wherever given in the literature, the local distribution of every enlisted parasitoid was also compiled and presented in the catalogue. The parasitoid species listed here include those emerged from field-collected hosts reported in the literature and from some unpublished data of my own Ph. D. thesis.

RESULTS AND DISCUSSION

The parasitoids associated with insect pests of vegetable crops in Kashmir (India) is presently represented by 53 species belonging to 8 insect families (Aphelinidae, Aphidiidae, Braconidae, Chalcididae, Eulophidae, Ichneuomonidae, Pteromalidae and Trichogrammatidae) of order Hymenoptera and 1 family (Tachinidae) of order Diptera. These parasitoids are distributed under 43 insect genera. The detailed parasitoid-Host pest and Host-vegetable catalogue-cum-checklist of these parasitoids, along with their distribution as reported in the studied, is provided in Table 1.

The families of parasitoids covered in the present paper comprised Aphelinidae with 5 species in 4 genera, Aphidiidae with 6 species in 4 genera, Braconidae with 11 species in 8 genera, chalcididae with 2 species in 1 genus, Eulophidae with 12 species in 10 genera, Ichneuomonidae with 11 species in 9 genera, Pteromalidae with 3 species in 3 genera and Trichogrammatidae with 1 species in 1 genus. The parasitoids listed herein include *Aphelinus* sp., *Encarsia* sp., *Eretmocerus* sp. in family Aphelinidae; *Aphidius* sp., *Aphidius salicis* Haliday, *Aphidius matricariae* Haliday, *Diaeretiella rapae* (M'Int), *Toxares deltiger* (Haliday) and *Trioxys (Binodoxys)* sp. in family Aphidiidae; *Apanteles* sp., *Bracon hebetor* Say, *Cotesia glomerata* Linn. *C. plutellae* (Kurdj.), *C. ruficrus* (Haliday), *Cotesia* sp., *Dacnusa* sp., *Dinocampus coccinellae* (Schränk), *Microplitis* sp., *Opius* sp. and *Zelex chlorophthalma* Nees in family Braconidae; *Brachymeria femorata* Panz., *Brachymeria* sp. in family Chalcididae; *Asecodes* sp., *Chrysonotomyia* sp., *Chrysocharis horticola* Mani, *Closterocerus indica* (Khan et al.), *Diglyphus horticola* Khan, *Diglyphus* sp., *Euderus agromyzae*, *Euplectrus ceylonensis* Howard, *E. euplexae* Rohwer, *Hemiptarsenus varicornis* (Girault), *Pediobius indicus* Khan, *Quadrastichus* sp. in family Eulophidae; *Campoletis chlorideae* Uchida, *Campoletis* sp., *Charops bicolor* (Szepligeti), *Diadegma fenestrata* (Holmgren) (= *Diadegma fenestralis*), *Erioborus* sp., *Horogones* sp., *Hyposoter ebeninus* (Grav.), *Itoplectis* sp., *Itoplectis* nr.

himalayensis, *Pimpla* sp., *Scambus* sp. in family Ichneuomonidae; *Herbertia indica* (Burks), *Pteromalus puparum*, *Tetrastichus sokolowskii* Kurd. in family Pteromalidae; *Compsilura concinnata* (Meigen), *Drino* sp., *Exorista larvarum* (Linnaeus), *Exorista* sp., *Voria ruralis* Fallen in family Tachinidae and *Trichogramma* sp. in family Trichogrammatidae.

The host insect pests of above mentioned parasitoids are represented by *Pieris brassicae* Linnaeus, *P. rapae* (Linnaeus), *Pontia daplidice* Linnaeus in family Pieridae (Lepidoptera), *Plutella xylostella* (Linnaeus) in family Plutellidae (Lepidoptera), *Thysanoplusia orichalcea* Fabricius, *Trichoplusia ni* (Huebner), *Helicoverpa* (=Heliethis) *armigera* (Hubner) and *Spodoptera* sp. in family Noctuidae (Lepidoptera), *Chromatomyia* (=Phytomyza) *horticola* (Goureau), *Liriomyza trifolii* (Burgess) in family Agoromyzidae (Diptera), *Bemisia tabaci* (Gennadius) in family Aleyrodidae (Homoptera), *Aphis gossypii* Glover, *Aphis fabae* (Scopoli), *Acyrtosiphon pisum* (Harris), *Brevicoryne brassicae* Linnaeus and *Lipaphis erysimi* (Kaltenbach) in family Aphidiidae (Homoptera). A total of 19 species of vegetable host crop plants of these insect pests are represented by 8 plant families including Alliaceae (*Alium cepa*), Apiaceae (*Daucus carota*), Brassicaceae (*Brassica campestris*, *Brassica oleracea* var. *acephala*, *B. o.* var. *botrytis*, *B. o.* var. *capitata*, *B. o.* var. *gongyloides*, *B. rapa*, *B. napus*), Cucurbitaceae (*Cucurbita maxima*, *C. melo*, *C. moschata*, *Lygenaria siceraria*, *Luffa cylindrica*), Fabaceae (*Pisum sativum*, *Trigonella foenum-graecum*), Leguminaceae (*Phaseolus vulgaris*), Malvaceae (*Malva sylvestris*), Polygonaceae (*Rumex nepalensis*) and Solanaceae (*Lycopersicon esculentum*, *Solanum melongena* and *S. tuberosum*). *Brassica oleracea* is represented by four varieties.

Now a day's, many of the species of parasitoids are being utilized for suppression /control of insect pest populations by adopting various methods of applied biological control in various parts of the world. Many of these parasitoids listed here were reported to be abundant and were obviously important in suppressing pest populations. The present work gives an opportunity to further extend the present study to explore the possibility of utilizing the reported parasitoids for biological control after standardization of their rearing technique in Kashmir region. The list of parasitoids provided herein is obviously incomplete and represents only some of the more common species. Additional field surveys and detailed studies to understand the role of these and other species will be important in implementing effective integrated pest management programs in this region.

LITERATURE CITED

- Anonymous.** 1997. Studies on collection and identification of vegetable pests and their natural enemies. Annual report of All India coordinated research project on Bio-control(ICAR), Bangalore, India.
- Bhagat, R. C. & Ahmad, M. N.** 1991. Aphidiid parasitoids (Hymenoptera) of Aphids (Homoptera) of Jammu-new records, host range and biological notes. *Journal of Aphidology*, 5: 90-96.
- Bhagat, R. C.** 1986. On aphid pests and their aphidiid parasitoids of Agricultural importance in Kashmir Valley, India. *Ind. Agriculturist*, 30 (3): 229-235.
- Bhagat, R. C.** 2008. Biodiversity of parasite-fauna of Jammu, Kashmir and Ladakh. Publishing Co. New Delhi: 232 pp.
- Bhat, D. M.** 2008. Studies on insect parasites and predators of some insect pests of vegetable crops of Kashmir Valley. Ph.D thesis, submitted in P.G. Department of Zoology, University of Kashmir, Srinagar, J&K (India).
- Bhat, D. M. & Bhagat, R. C.** 2008. Studies on parasitoids of cabbage diamondback moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) in Kashmir Valley. *Journal of Entomological Research*, 32 (4): 303-308.
- Bhat, D. M. & Bhagat, R. C.** 2009. Occurrence of natural enemies of the brinjal white fly, *Bemisia tabaci* (Genn.) (Homoptera: Aleyrodidae) in Kashmir Valley (India). *Indian Journal of Applied and Pure Biology*, 24 (2): 271-272.
- Bhat, D. M. & Bhagat, R. C.** 2009a. Natural parasitism of *Pieris rapae* (L.) and *Pontia daplidice* (L.) (Lepidoptera: Pieridae) on cruciferous crops in Kashmir Valley (India). *American-Eurasian Journal of Agriculture and Environmental Science*, 5 (4): 590-591.
- Bhat, D. M. & Bhagat, R. C.** 2009b. Natural Parasitism of Leaf Miner, *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) on Vegetable Crops in Kashmir (India). *World Journal of Agricultural Sciences*, 5 (S): 888-891.
- Bhat, D. M. & Bhagat, R. C.** 2009c. Record of *Zele chlorophthalma* Nees (Hymenoptera: Braconidae), a parasite of *Spodoptera* sp. (Lepidoptera: Noctuidae) from Kashmir. *Indian Journal of Entomology*, 71 (3): 262-263.

- Bhat, D. M. & Bhagat, R. C.** 2010. Record of some hymenopteran parasitoids of leaf miner on vegetables in Kashmir Valley. *Annals of Plant Protection Sciences*, 18 (1): 237-238.
- Bhat, D. M., Bhagat, R. C. & Azim, M. N.** 2009. Record of Natural enemies of *Helicoverpa armigera* from Kashmir valley. *Annals of Plant Protection Sciences*, 17 (1): 229-230.
- Bhat, D. M., Bhagat, R. C. & Qureshi, A.** 2009a. Records of some hymenopterous parasitoids of serpentine leaf miner, *Liriomyza trifolii* in vegetable ecosystems in Kashmir. *Indian Journal of Plant Protection*, 37 (1&2): 188-189.
- Bhat, D. M., Bhagat, R. C. & Qureshi, A.** 2010. Newly recorded hymenopteran parasitoids of semilooper, *Thysanoptera orichalcea* F. on some vegetable crops in Kashmir Valley (India). *Journal of Entomological Research*, 34 (1): 53-54.
- Bhat, D. M., Bhagat, R. C., Qureshi, A. & Gulzar, A.** 2010a. Report of natural parasitism of *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) by *Dinocampus coccinellae* (Schränk) (Hymenoptera: Braconidae: Euphorinae) from Kashmir valley (India). *Annals of Entomology*, 28 (2): 112.
- Bhat, D. M., Bhagat, R. C. & Qureshi, A.** 2010b. Some Natural-enemies of *Pieris brassicae* on cruciferous crops in Kashmir Valley. *Annals of Plant Protection Sciences*, 18 (2): 516-518.
- Bhat, D. M., Bhagat, R. C. & Qureshi, A.** 2011. A survey of insect pests damaging vegetable crops in Kashmir valley (India), with some new records. *Journal of Entomological Research*, 35 (1): 85-91.
- Bhat, D. M., Bhagat, R. C. & Qureshi, A.** 2011a. Natural parasitisation of *Spodoptera litura* F. (Lepidoptera: Noctuidae) by *Zele cholorophthalma* Nees (Hymenoptera: Braconidae) in vegetable ecosystems of Kashmir Valley, India. *Halteres*, 3: 88-90.
- Bhat, D. M., Qureshi, A. & Bhagat, R. C.** 2013. Natural Parasitisation of *Pieris brassicae* (Lepidoptera: Pieridae) by Tachinid flies (Diptera) on some vegetable crops in Kashmir. *Indian J. Applied & Pure Bio.*, 28 (1): 31-34.
- Bhat, M. A.** 2008. A report of insect-pests associated with cole crops in Kashmir. *Applied Biological Research*, 10: 66-67.
- Dar, G. H., Bhagat, R. C. & Khan, M. A.** 2002. Biodiversity of Kashmir Himalaya. Valley Book House, Srinagar, Kashmir (J&K): 399 pp.
- Kumar, P. A., Namgyal, D., Mehdi, M., Mir, M. S. & Sheikh, B. A.** 2006. A case study: Major insect pest associated with different vegetable crops in cold arid region Ladakh, of Jammu and Kashmir. *Journal of Entomological Research*, 30 (2):169-174.
- Malik, R. A., Punjabi, A. A. & Bhat, A. A.** 1972. Survey study of insect and non-insect pests of Kashmir. *Horticulturist*, 3: 29-44.
- Punjabi, A. A., Bhat, A. A. & Masoodi, M. A.** 1970. Insect pests of crops vegetables, fruits and stored grain products prevailing in Kashmir. *Inform. Bull. Agr. Dep. J&K Govt. Kashmir (J&K)*, pp.16.
- Rishi, N. D.** 1967. Studies on insect pests of Kashmir Part III, Vegetables, major pests with their life -history and control measures. *Kmr. Sci.*, 4: 62-78.
- Simmonds, F. J. & Rao, V. P.** 1960. Record of *Plutella maculipennis* Cont. and some of its parasites in Kashmir India. *Canad. Ent.*, 92 (4): 274.
- Stary, P. & Ghosh, A. K.** 1975. Aphid parasites (Hymenoptera: Aphidiidae) from Meghalaya, India. *Oriental Insects*, 9: 343-349.
- Stary, P. & Ghosh, A. K.** 1978. Further records of aphid parasitoids (Hymenoptera: Aphidiidae) from Meghalaya, India. *Oriental Insects*, 12: 77-80.
- Zaka-ur-Rab.** 1981. Studies on Agromyzidae (Diptera) of Kashmir, India, some interesting palaeartic species. *Bulletin of Entomologica Agaria, (Filippo Silvestri)*, 38: 133-137.

Table 1. Parasitoids of insect pests of vegetable crops recorded from Kashmir, India.

Parasitoid taxa	Host-pest range/ Order: Family	Host-plant range	Districts	Selected references
Order: Diptera				
Family: Tachinidae				
<i>Compsilura concinnata</i>	<i>Pieris brassicae</i> (Lep.: Pie.)	<i>Brassica oleracea</i> var. <i>campestris</i> , <i>B. o.</i> var. <i>gongylodes</i> , <i>B. o.</i> var. <i>capitata</i> , <i>B. o.</i> var. <i>acephala</i> , <i>Raphanus sativus</i> .	2,5,7	Bhat et al., 2013
<i>Drino</i> sp.	<i>Trichoplusia ni</i> (Lep.: Noc.)	<i>Pisum sativum</i>	7	*Bhat unpublished data
<i>Exorista larvarum</i>	<i>P. brassicae</i> (Lep.: Pie.)	<i>Brassica oleracea</i> var. <i>campestris</i> , <i>B. o.</i> var. <i>gongylodes</i> , <i>B. o.</i> var. <i>capitata</i> , <i>B. o.</i> var. <i>acephala</i> , <i>R. sativus</i> .	2,5,7	Bhat et al., 2013
<i>Exorista</i> sp.	<i>Helicoverpa armigera</i> (Lep.: Noc.)	<i>B. o.</i> var. <i>capitata</i>	2,7	Bhat et al., 2009
		<i>B. o.</i> var. <i>botrytis</i>	2,7	
<i>Voria ruralis</i>	<i>Plutella xylostella</i> (Lep.: Plu.)	<i>B. o.</i> var. <i>capitata</i>	7	Simmonds & Rao, 1960
		<i>B. o.</i> var. <i>capitata</i>	7	*Bhat unpublished data
	<i>Trichoplusia ni</i> (Lep.: Noc.)	<i>B. o.</i> var. <i>gongylodes</i>	2,7	
		<i>P. sativum</i>	5	
Order: Hymenoptera				
Family: Aphelinidae				
<i>Aphelinus</i> sp.	Unidentified aphid (Hom.: Aph.)	<i>Cucurbita moschata</i>	2	*Bhat unpublished data
		<i>Rumex nepalensis</i>	5	
<i>Encarsia</i> sp.	<i>Bemisia tabaci</i> (Hom.: Ale.)	<i>Solanum melongena</i>	--	Bhat & Bhagat, 2009
<i>Eretmocerus</i> sp.	<i>B. tabaci</i> (Hom.: Ale.)	<i>S. melongena</i>	--	
Family: Aphidiidae				
<i>Aphidius matricariae</i>	<i>A. fabae</i> Scopoli (Hom.: Aph.)	<i>R. nepalensis</i>	--	Bhagat & Ahmad, 1991

<i>Aphidius matricariae</i>	<i>A. fabae</i> Scopoli (Hom.: Aph.)	<i>R. nepalensis</i>	--	Bhagat & Ahmad, 1991	
	<i>Brevicoryne brassicae</i> (Hom.: Aph.)	<i>Brassica</i> sp.	--	Stary & Ghosh, 1975	
	<i>Lipaphis erysimi</i> (Hom.: Aph.)	<i>Brassica napus</i>	--	Stary & Ghosh, 1978	
<i>Aphidius salicis</i>	<i>Semiaphis heraclei</i> (Hom.: Aph.)	<i>Daucus carrota</i>	--	Bhagat, 1986	
<i>Aphidius</i> sp.	Unidentified aphid (Hom.: Aph.)	<i>Malva sylvestris</i>	4, 5	*Bhat unpublished data	
		<i>R. nepalensis</i>	5		
<i>Diaeretiella rapae</i>	<i>L. erysimi</i> (Hom.: Aph.)	<i>B. campestris</i>	--	Bhagat, 1986 & Bhagat & Ahmad, 1991	
		<i>B. Brassicae</i> (Hom.: Aph.)	<i>B. o. var. acephala</i>	--	*Bhat unpublished data
		<i>B. o. var. acephala</i>	1,3,6		
		<i>B. o. var. botrytis</i>	7		
		<i>B. o. var. gongylodes</i>	2,4,7		
		<i>B. o. var. capitata</i>	2,7		
		<i>Aphis cracivora</i> (Hom.: Aph.)	<i>Solanum tuberosum</i>	--	Bhagat & Ahmad, 1991
<i>B. brassicae</i> (Hom.: Aph.)	<i>B. o. var. acephala</i>	--	Bhagat, 1986		
<i>Toxares deltiger</i>	Unidentified aphid (Hom.: Aph.)	<i>Brassicaceae</i> plant	--	Rao et al., 1970	
		<i>Brassica</i> sp.	--	Stary & Ghosh, 1975	
<i>Trioxys (Binodoxys)</i> sp.	Unidentified aphid (Hom.: Aph.)	<i>Lycopersicon esculentum</i>	2,4,6	*Bhat unpublished data	
		<i>C. moschata</i>	2,4,5,6,7		
		<i>Rumex</i> sp.	2,5		
<i>Family: Braconidae</i>	<i>P. xylostella</i> (Lep.: Plu.)	<i>Trigonella foenum-graecum</i>	7		
		<i>B. o. var. gongylodes</i> , <i>B. o. var. capitata</i> , <i>B. o. var. acephala</i> , <i>B. o. var. botrytis</i>	2,4,5,6,7	Bhat & Bhagat, 2008	
<i>Bracon hebetor</i>	<i>H. armigera</i>	<i>L. esculentum</i>	2, 3	*Bhat unpublished data	
<i>Cotesia glomerata</i>	<i>P. rapae</i> (Lep.: Pie.)	<i>B. o. var. capitata</i>	4,5	Bhat & Bhagat, 2009a	
		<i>B. rapa</i>	2		
	<i>B. Brassica</i> (Lep.: Pie.)	<i>B. o. var. capitata</i>	2,4,7	Bhat et al., 2010b	
		<i>B. o. var. botrytis</i>	2,3		
<i>C. plutellae</i>	<i>P. xylostella</i> (Lep.: Plu.)	<i>B. o. var. gongylodes</i> , <i>B. o. var. capitata</i> , <i>B. o. var. acephala</i> , <i>B. o. var. botrytis</i> , <i>B. rapa</i>	2,3,4,5,6	Bhat & Bhagat, 2008	
<i>Cotesia ruficrus</i>	<i>T. orichalcea</i> (Lep.: Noc.)	<i>B. o. var. capitata</i>	2	Bhat et al., 2010	
		<i>T. foenum-graecum</i>	5		
<i>Cotesia</i> sp.	<i>H. armigera</i> (Lep.: Noc.)	<i>B. o. var. capitata</i>	2	Bhat et al. 2009	
<i>Dinocampus coccinellae</i>	<i>*Coccinella septempunctata</i> (Col.: Coc.)	X	--	Bhat et al., 2010a	
<i>Opius</i> Sp.	<i>Chromatomyia horticola</i> (Dip.: Agr.)	<i>B. campestris</i>		Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010	
	<i>Liriomyza trifolii</i> (Dip.: Agr.)	<i>Lagenaria siceraria</i>	2,7	Bhat et al., 2009a	
		<i>Luffa cylindrica</i>	2,7		
		<i>C. maxima</i>	4		
<i>Dacnusa</i> sp.	<i>C. horticola</i> (Dip.: Agr.)	<i>B. campestris</i> ,	1,2,3,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010	
		<i>P. sativum</i>			
	<i>L. trifolii</i> (Dip.: Agr.)	<i>L. siceraria</i>	2,5,7	Bhat et al., 2009	
		<i>L. cylindrica</i>	2,7		
<i>Microplitis</i> sp.	<i>H. armigera</i> (Lep.: Noc.)	<i>C. maxima</i>	4		
		<i>L. esculentum</i>	2,4,5,6,7	Bhat et al., 2009	
<i>Zelex chlorophala</i>	<i>Spodoptera</i> sp. (Lep.: Noc.)	<i>S. tuberosum</i>			
		<i>B. o. var. capitata</i>	--	Bhat & Bhagat, 2009	
		<i>B. o. var. gongylodes</i>	--		
	<i>S. litura</i> (Lep.: Noc.)	<i>B. o. var. acephala</i>	--	Bhat et al., 2011a	
		<i>B. o. var. gongylodes</i> ,			
		<i>B. o. var. acephala</i>			
Family: Chalcididae					
<i>Brachymeria femorata</i>	<i>Pieris rapae</i> (Lep. Pie.)	<i>L. esculentum</i>	2,7	Bhat & Bhagat, 2009a	
		<i>B. o. var. capitata</i>	4		
<i>Brachymeria</i> sp.	<i>Pieris brassicae</i> (Lep. Pie.)	<i>B. o. var. gongylodes</i>			
		<i>B. o. var. capitata</i>	2,4,7	Bhat et al., 2010b	
		<i>B. o. var. gongylodes</i>	2,5,7		

Family2. Eulophidae						
Asecodes sp.	<i>L. trifolii</i> (Dip.:Agr.)	<i>L. siceraria</i>	5	Bhat et al., 2009a		
		<i>Cucurbita maxima</i>	4.			
<i>Chrysocharis horticola</i>	<i>C. horticola</i> (Dip.: Agr.)	<i>Allium cepa</i> , <i>B. o. Acephala</i> , <i>B. o. gongylodes</i> , <i>P. sativum</i>	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010		
<i>Chrysonotomyia</i> sp.	<i>L. trifolii</i> (Dip.:Agr.)	<i>L. siceraria</i>	2,7	Bhat et al., 2009		
		<i>L. cylindrica</i>	7			
<i>Closterocerus indica</i>	<i>L. trifolii</i> (Dip.:Agr.)	<i>L. siceraria</i>	2,5	Bhat et al., 2009a		
		<i>L. cylindrica</i>	2			
		<i>C. maxima</i>	4			
		<i>L. esculentum</i>	2			
		<i>C. melo</i>	4			
		<i>C. sativus</i>	1			
		<i>S. tuberosum</i>	7			
<i>Diglyphus horticola</i>	<i>C. horticola</i> (Dip.: Agr.)	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>B. o. gongylodes</i> , <i>B. rapa</i> , <i>M. sylvestris</i> , <i>P. sativum</i>	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010		
<i>Diglyphus</i> Sp.	<i>C. horticola</i> (Dip.: Agr.)	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>B. o. gongylodes</i> , <i>B. rapa</i> , <i>M. sylvestris</i> , <i>P. sativum</i>	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010		
		<i>L. trifolii</i> (Dip.: Agr.)	<i>L. siceraria</i> ,		2,5,7	Bhat et al., 2009a
			<i>L. cylindrica</i>		2,7	
			<i>C. maxima</i>		4	
			<i>L. esculentum</i>		2	
			<i>C. melo</i>	4		
			<i>C. sativus</i>	1,4		
			<i>S. tuberosum</i>	7		
<i>Euplectrus ceylonensis</i>	<i>T. orichalcea</i> (Lep.: Noc.)	<i>B. o. var. gongylodes</i>	2	Bhat et al., 2010		
<i>E. euplexae</i>	<i>H. armigera</i> (Lep.: Noc.)	<i>B. o. var. capitata</i>	7	Bhat et al., 2009		
<i>Pediobius indicus</i>	<i>C. horticola</i> (Dip.: Agr.)	<i>A. cepa</i> , <i>P. sativum</i> , <i>B. o. acephala</i>	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010		
<i>Hemiptarsenus varicornis</i>	<i>L. trifolii</i> (Dip.: Agr.)	<i>L. siceraria</i>	2,4,7	Bhat et al., 2009a		
		<i>L. cylindrica</i>	2,7			
<i>Euderus agromyzae</i>	<i>C. horticola</i> (Dip.: Agr.)	<i>A. cepa</i> , <i>B. campestris</i> , <i>B. o. acephala</i> , <i>P. sativum</i>	2,4,5,6,7	Bhat & Bhagat, 2009b and Bhat & Bhagat, 2010		
<i>Quadrastichus</i> sp.		<i>L. siceraria</i>	2,5	Bhat et al., 2009a		
		<i>L. cylindrica</i>	2			
Family: Ichneumonidae						
<i>Campoletis chloridae</i>	<i>T. orichalcea</i> (Lep.: Noc.)	<i>B. rapa</i>	1,3,5	Bhat et al., 2010		
		<i>A. cepa</i> ,	2			
		<i>P. sativum</i>	7			
	<i>H. armigera</i> (Lep.: Noc.)		<i>S. tuberosum</i>	1,2,3	Bhat et al., 2009	
<i>L. esculentum</i>			7	Bhat et al., 2009		
soybean			4,5,6	Bhat et al., 2009		
<i>Campoletis</i> sp.	<i>Trichoplusia ni</i> (Lep.: Noc.)	<i>B. o. var. capitata</i>	2,6,7	'Bhat unpublished data		
		<i>B. o. var. gongylodes</i>	4			
<i>Charops bicolor</i>	<i>H. armigera</i> (Lep.: Noc.)	<i>L. esculentum</i>	2,7	Bhat et al., 2009		
<i>Diadegma fenestrata</i> (Holmgren) (=Diadegma fenestrata)	<i>H. armigera</i> (Lep.: Noc.)	<i>L. esculentum</i>	2,7	Bhat et al., 2009		
		<i>P. xylostella</i> (Lep.: Plu.)	<i>B. campestris</i> , <i>B. o. var. acephala</i> , <i>B. o. var. capitata</i> , <i>B. o. var. gongylodes</i> , <i>R. sativus</i> , <i>B. rapa</i>	1,2,3,4,5,6,7	Bhat & Bhagat, 2008	
<i>Erioborus</i> sp.	<i>H. armigera</i> (Lep.: Noc.)	<i>L. esculentum</i>	2,7	Bhat et al., 2009		
<i>Horogenes</i> sp.	<i>Plutella maculipennis</i> (=xylostella) (Lep.: Plu.)	<i>B. o. var. capitata</i>	7	Simmonds & Rao, 1960		

<i>Hyposoter ebeninus</i>	<i>P. rapae</i> (Lep. : Pie.)	<i>B.o. var. capitata</i>	2,7	Bhat & Bhagat, 2009a
		<i>B. o. var. gongylodes</i>	1,5,7	Bhat & Bhagat, 2009a
		<i>B. o. var. acephala</i>	3,6,7	Bhat & Bhagat, 2009a
	<i>Pontia deplidice</i> (Lep. : Pie.)	<i>B. o. var. gongylodes</i>	3,5	Bhat & Bhagat, 2009a
		<i>B. o. var. acephala</i>	4	
	<i>Pieris brassicae</i> (Lep. : Pie.)	<i>B. campestris</i>	1,2,3	Bhat et al., 2010b
		<i>B. o. var. capitata</i>	2,7	
		<i>B. o. var. gongylodes</i>	1,2,3,4,5	
		<i>B. o. var. botrytis</i>	1,2,3,5,6,7	
<i>B. o. var. acephala</i>		2,7		
	<i>B. rapa</i>	2,3,4,5,6,7		
<i>Itoplectis</i> sp.	<i>Plutella maculipennis</i> (= <i>xylostella</i>) (Lep. : Plu.)	<i>B. o. var. capitata</i>	7	Simmonds & Rao, 1960
<i>Itoplectis</i> nr. <i>himalayensis</i>	<i>P. xylostella</i>	<i>B. o. var. capitata</i> , <i>B. o. var. gongylodes</i> , <i>B. campestris</i>	2,4,5,7	Bhat & Bhagat, 2008
<i>Pimpla</i> sp.	<i>P. brassicae</i> (Lep.: Pie)	<i>B. o. var. gongylodes</i>	5,7	Bhat et al., 2010b
<i>Scambus</i> sp.	<i>Thysanoplusia orichalcea</i> (Lep.: Noc.)	<i>Phaseolus vulgaris</i>	2,5	Bhat et al., 2010
		<i>R. nepalensis</i>	5	
Family: Pteromalidae				
<i>Herbertia indica</i>	<i>L. trifolii</i> (Dip.: Agr.)	<i>L. siceraria</i>		Bhat et al., 2009a
		<i>L. cylindrica</i>	2	Bhat et al., 2009a
<i>Pteromalus puparum</i>	<i>P. brassicae</i> (Lep.: Pie)	<i>B. o. var. capitata</i>	2,7	Bhat et al., 2010b
<i>Tetrastichus sokolowskii</i>	<i>P. xylostella</i>	<i>B. capitata</i> , <i>B. o. var. botrytis</i>	2,7	Bhat & Bhagat, 2008
Family: Trichogrammatidae				
<i>Trichogramma</i> sp.	<i>H. armigera</i> (Lep.: Noc.)	<i>S. tuberosum</i> , <i>L. esculentum</i>	2, 3, 4, 6, 7	Bhat et al., 2009

Keys to symbols & abbreviations:- *un-published data of Ph. D. thesis; "Non-pest host of parasitoid; -- = distribution not given; X = host plant not given; 1.=Anantnag, 2.=Budgam, 3.=Bandipora,4=Baramulla, 5= Ganderbal, 6=Pulwama & 7= Srinagar; Lep.= Lepidoptera, Dip.= Diptera, Hom.=Homoptera, Aph.=Aphididae, Agr.= Agromyzidae, Noc.= Noctuidae, Pie.= Pieridae, Plu.= Plutellidae