



## The butterfly pests (Lepidoptera: Pieridae) of brassicaceae crops and their biological control in J&K- A review

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### Abstract

The paper presents a brief review and checklist of the butterfly pests of family Pieridae (Lepidoptera) and their biological control agents (natural enemies) like parasitoids, predators and pathogens on various brassicaceae crops from Jammu and Kashmir. A consolidated account of as many as 5 butterfly pest species is documented in this paper. Based on the literature survey, the present paper encapsulates the detailed information about the host- plant range, nature and extent of damage and period of activity of said butterfly pest species in J&K. The paper also presents an account of 12 biological control agents (natural enemies) of these butterfly pests reported from this region.

**Keywords:** brassicaceae, butterfly, pests, natural enemies

### 1. Introduction

Among the various temperate vegetables produced in Jammu and Kashmir, the Cole (brassicaceae) vegetable crops are the important ones that add higher revenue to the state (Shanker *et al.*, 2016) [20]. The cabbage butterflies, *Pieris brassicae*, *P. canidia* and *P. rapae* have been found to be the common pests of brassicaceae crops like cabbage and cauliflower (Bhatia & Verma, 1993[30]; Bhutani & Jotwani, 1984[11]; Firake *et al.*, 2012 [31], Sharma & Rao, 2012 [22] and Debbarma, 2017) [14]. The present study, based on the literature survey, revealed that as many as 6 species of butterfly pests belonging to family Pieridae of Insect Order Lepidoptera have been reported earlier on brassicaceae crops in the state of J&K. The prominent studies in this regard has been conducted by Rishi (1967) [20], Pandey *et al.* (2006) [19], Bhat (2008) [10], hat *et al.* (2011) [3], Bhat (2018) [7] and Bhat & Ahhanger (2018) [8]. As many as 12 natural enemies (parasites, predators and pathogens) of said butterfly pests have been also reported from the State of J&K (Bhat *et al.*, 2010 [4], 2013 [5], 2017 [6]; Bhat, 2018 [7], Shankar, *et al.*, 2016 [21]; Kour *et al.*, 2018) [16].

### 2. Materials and methods

The present study compiled and consolidated the scattered information about various butterfly Insect pests (family Pieridae) and their biological agents/ natural enemies on brassicaceae crops of the state of J&K, as recorded previously in published literature in this record. Based on the literature Survey, all such published research papers, were examined and the information obtained was documented. The data base and checklist was generated encapsulating necessary information about these butterfly pests, with regard to their host plant ranges, nature and extent of damage, period of activity, biological control agents and authors reporting. In order to generate said information, besides previously published research papers, other vital e-resources and abstracting services, particularly,

CABI, NISCAIR, AGRICOLA, Biological abstracts, Inflib net etc. were also consulted.

### 3. Results & Discussion

The consolidated account and checklist of butterfly insect pests of family Pieridae (Order Lepidoptera) in J&K is presented below. In the present checklist as many as 5 species of butterfly pests have been reported on nearly 9 varieties of brassicaceae plant crops across the region of J&K. Moreover, a record of nearly 12 species of natural enemies of said butterfly pests is encapsulated as under:

#### 3. 1. Checklist of Lepidopterous pests (Insecta: Lepidoptera) of brassicaceae crops of J&K:

##### 3. 1.1. Family: Pieridae

##### 3. 1.1.1. *Pieris brassicae* (Linnaeus) [1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 17, 19, 20, 21]

**Host Plants:** *Brassica campestris*, *Brassica oleracea* var. *acephala*, *B. o.* var. *botrytis*, *B. o.* var. *capitata*, *B. o.* var. *gongyloides*, *B. napus*, *Brassica rapa*, *Raphanus sativus*

**Nature and extent of damage:** younger larvae scrap the leaf surface while as older ones riddle the leaves with large irregularly shaped holes. When the infestation is high, leaves are completely skeltonized, causing the death of the plant.

**Pest Status:** Major pest

**Period of activity:** April to October

##### Biological Control (Natural enemies)

- Parasitoids (Hymenoptera):** Ichneumonidae: *Hyposoter ebininus* [4, 6, 7], *Pimpla* sp. [4, 6]; Braconidae: *Cotesia glomerata* [4, 6, 7]; Chalcididae: *Brachymeria* sp. [4, 6]; Pteromalidae: *Pteromalus puparum* [4, 6, 7]
- Parasitoids (Diptera):** Tachinidae: *Compsilura concinnata* [5, 6, 7], *Exorista larvarum* [5, 6, 7], *Phryxe vulgaris* [7, 21]
- Predators (Hymenoptera):** Vespidae: *Polistes rothynei* [4], *Polistes stigma* [4]; Formicidae: *Myrmica* sp

[4].

**d. Granulosis virus** [16]**3.1.1.2. *Pieris brassicae kashmirensis* Rishi** [2, 8, 20]**Host Plants:** *Brassicas* spp., *Brassica juncea***Nature and extent of damage:** younger larvae scrap the leaf surface while as older ones riddle the leaves with large irregularly shaped holes. When the infestation is high, leaves are completely skeltonized, causing the death of the plant.**Period of activity:** April to October**Pest Status:** Major**Natural enemies:** Not known**3.1.1.3. *Pieris canidia* (Sparm)** [2, 8, 10, 23, 24, 25]**Host Plants:** *B. o. var. botrytis*, *B. o. var. capitata*, *B. o. var. gongyloides*, *R. sativus***Nature and extent of damage:** Defoliation and skeltonisation**Period of activity:** April to September**Pest Status:** Minor to moderate**Natural enemies:** Not known**3.1.1.4. *Pieris rapae* (Linnaeus) (P82)** [2, 3, 6, 10, 7, 8, 9, 13, 18, 19, 21, 26]**Host Plants:** *B. o. var. acephala*, *B. o. var. capitata*, *B. o. var. gongyloides*, *B. napus*, *B. rapa***Nature and extent of damage:** The larvae feed next to veins or the midrib on the underside of the leaves and chew out irregular holes in the leaves.**Period of activity:** April to November**Pest Status:** Moderate**Biological Control (Natural enemies)****a. Parasitoids (Hymenoptera):** Ichneumonidae: *Hyposoter ebininus* [4, 6, 7]; Braconidae: *Cotesia glomerata* [4, 6, 7]; Chalcididae: *Brachymeria femorata* [4, 6].**b. Parasitoids (Diptera):** Tachinida, *Phryxe vulgaris* [21]**3.1.1.5. *Pontia daplidice* (Linnaeus) (P83)** [2, 3, 6, 7, 8, 9, 24, 13, 25, 26, 27, 28]**Host Plants:** *B. o. var. acephala*, *B. o. var. botrytis*, *B. o. var. gongyloides*, *B. napus*, *B. rapa*, *R. sativus***Nature and extent of damage:** The larvae bite holes into the leaves. Large larvae are more damaging to young plan**Period of activity:** May to October**Pest Status:** Minor to moderate**Natural enemies: Parasitoid (Hymenoptera):** Ichneumonidae: *Hyposoter ebininus* [4, 6, 7]**3.1.1.6. *Pontia glouconome* (Klug.)** [8, 10]**Host Plants:** *B. o. var. botrytis*, *B. o. var. capitata***Nature and extent of damage:** Defoliation and skeltonisation**Period of activity:** April to September**Pest Status:** Minor to moderate**Natural enemies:** Not known**3.2. Brassicacea host plants of butterfly pests (Pieridae) in J&K**

As recorded in afore mentioned checklist, it was observed that based on the literature survey the butterfly pests of family pieridae attack about nine variets of brassicacea plans in J&K, viz, Kale (*Brassica oleracea* var. *acephala*),

Cabbage (*B. o. var. capitata*), cauliflower (*B. o. var. botrytis*), Knolkhol (*B. o. var. gongyloides*), oil seeds (*Brassica juncea*, *B. compestris*, *B. napus*), turnip (*B. rapa*), Raddish (*Raphanus sativus*).

**Key to numerical in the long brackets [ ], cited in the above checklist:** Bhat, 2002 [1]; Bhagat, 2017 [2]; Bhat *et al.*, 2011 [3]; Bhat *et al.*, 2010 [4]; Bhat *et al.*, 2013 [5]; Bhat *et al.*, 2017 [6]; Bhat, 2018 [7]; Bhat & Ahanger, 2018 [8]; Bhat & Bhagat, 2009 [9]; Bhat, 2008 [10]; Bhutani & Jotwani, 1984 [11]; Chandra, 2009 [12]; Dar *et al.*, 2002 [13]; Debbarama *et al.*, 2017 [14]; Hussain *et al.*, 2018 [15]; Kour *et al.*, 2018 [16]; Mathew, 2005 [17]; Pandae & Dawedi, 2005 [18]; Pandey *et al.*, 2006 [19]; Rishi, 1967 [20]; Shankar *et al.*, 2016 [21]; Sharma & Rao, 2012 [22]; Bala *et al.*, 2014 [23]; Bhingam, 1907 [24]; Qureshi *et al.*, 2013 [25]; Vashney, 1993 [26]; Mani, 1962 [27]; Wynter Blyth, 1957 [28]; Bhat, 2008 [29]; Bhatia & Verma, 1993 [30]; Firake *et al.*, 2012 [31].

**3.3. Table 1. Based on literature survey, No. of host plants and biological control agents of Pierid butterflies on brassica crops in J&K**

S. No.	Butterfly species (Pieridae)	No. of host plants	No. of Natural enemies reported		
			Parasitoids	Predator	Pathogen
1	<i>Pieris brassicae</i>	8	8	3	1
2	<i>Pieris brassicae kashmirensis</i>	2	-	-	-
3	<i>Pieris canidia</i>	4	-	-	-
4	<i>Pieris rapae</i>	5	4	-	-
5	<i>Pontia daplidice</i>	6	1	-	-
6	<i>Pontia glouconome</i>	2	-	-	-

**3.4. Some pictures representing nature of damage caused by butterfly pests on brassica crops in J&K (Courtesy: Bhat) [29]**

Pic 1



Pic 2



Pic 3



Pic 4



Pic 5



Pic 6



Pic 7



Pic 8



Pic 9



Pic 10



Pic 11



Pic 12



Pic 13

**Keys to pictures (Courtesy: Bhat) [29]**

1. Pic. 1-4. *Pieris brassicae* larvae devouring brassica plants in J&K
2. Pic. 5-6. *Pieris rapae* larvae feeding on brassica plants in J&K
3. Pic. 7-8. *Pontia daplidice* larvae feeding on brassica plants in J&K
4. Pic. 9. Parasitoid *Brachymeria* sp. (Chalcididae) recovered from *Pieris* in J&K
5. Pic. 10-11. Parasitoid *Hyposoter ebininus* (Ichneumonidae) recovered from *Pieris* and *Pontia* in J&K
6. Pic. 12. Parasitoid *Cotesia glomerata* (Braconidae) recovered from *Pieris* in J&K
7. Pic. 13. Predatory wasp *Polistes* (Hymenoptera) devouring *Pieris* larvae in the field in J&K

**3.5. Some pictures of natural enemies (Parasitoids and predators) of pierid butterfly pests in J&K (Courtesy: Bhat) [29]**

### 3.6. References

- Bhagat RC, Khan MA. Biodiversity of Kashmir Himalaya. Valley Book House. Srinagar, Kashmir (J&K), 2002, 399.
- Bhagat RC. An Update on the Systematic Checklist and Biodiversity of Caterpillars of Butterfly-Fauna on Food /Host Plant Species of Jammu & Kashmir State (India) - Papilionoidea: Hesperidae, Lycaenidae and Pieridae. International Journal of Current Research in Bioscience and Plant Biology. 2017; 4(7):81-87
- Bhat DM, Bhagat RC, Qureshi AA. A survey of insect pests damaging vegetable crops on Kashmir valley (India), with some new records. Journal of Entomological Research. 2011; 35(1):85-91.
- Bhat DM, Bhagat RC, Qureshi A. Some Natural-enemies of *Pieris brassicae* on cruciferous crops in Kashmir Valley. Annals of Plant Protection Sciences, 2010; 18 (2): 516-518
- Bhat DM, Bhagat RC, Qureshi A. Natural Parasitisation of *Pieris brassicae* (Lepidoptera: Pieridae) by Tachinid flies (Diptera) on some vegetable crops in Kashmir. Indian Journal of Applied & Pure Biology. 2013; 28(1):31-34.
- Bhat DM, Bhagat RC, Qureshi A. Parasitoid fauna associated with insect pests of vegetable crops of Kashmir Himalaya, India: check list and biodiversity. Munis Entomology and Zoology. 2017; 12(1):168-174
- Bhat DM. Incidence and diversity of lepidopterous insect pests and their parasitoids (natural enemies) on cole crops at Danderkhah location in Srinagar District (J&K, India). International Journal of Entomology Research. 2018; 3(2):107-113.
- Bhat DM, Ahanger FA. A systematic checklist and species richness of insect pests associated with vegetable crops in Jammu & Kashmir State (India). Journal of Entomology and Zoology Studies. 2018; 6(2):328-338.
- Bhat DM, Bhagat RC. 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. 2009; 5(4):590-591.
- Bhat MA. A report on insect pests associated with Cole crops in Kashmir. Applied Biological Research. 2008; 10:66-67.
- Butani DK, Jotwani MG. Insects in Vegetables. Periodical Expert Book Agency, Delhi, 1984, 65-66.
- Chandra K, Sidhu AK. Insects of Ladakh. ENVIS Newsletter. 2009; 15(1-2):5-10
- Dar GH, Dar GH, Bhagat RC, Khan MA. Biodiversity of Kashmir Himalaya. Valley Book House. Srinagar, Kashmir (J&K), 2002, 399
- Debbarma A, Jayaraj J, Chandramani P, Senthil N, Ananthan M, Prabakaran K. A Survey on Occurrence and Diversity of Insect Pests of Cauliflower in Dindigul and Theni Districts of Tamil Nadu, India. International Journal of Current Microbiol. Applied Science. 2017; 6(9):2495-2505
- Hussain B, War A, Pfeiffer DG. Mapping foliage damage index and monitoring of *Pieris brassicae* by using GIS-GPS technology in cole crops. Environmental Science, 2018.
- Kour R, Gupta RK, Kour S, Ganai, SA, Sharma S, Ibrahim S. Natural incidence of *Pieris brassicae* Granulosis virus among the population of *Pieris brassicae*. Journal of Pharmacognosy and Phytochemistry, 2018; 7(4):3322-3327.
- Mathew D, Ahmad Z. Carryover of cabbage butterfly, *Pieris brassicae* L through broad leaved pepper grass (*Lepidium latifolium* L.) in cold arid desert of Ladakh. Insect Environment. 2005; 11(1):15
- Pandey AK, Dwivedi SK. Insect Pests and Diseases of Cold Arid Regions, Ladakh. In: Chap.18. Crop Protection: Management Strategies (Ed.: Prasad, D.). Daya Publishing House, New Delhi, 2005, 276-287.
- Pandey AK, Namgyal D, Mehdi M, Mir MS, Shiekh BA. A case study: Major insect pests associated with different vegetable crops in cold and region Ladakh, of Jammu and Kashmir. Journal of Entomological Research. 2006; 30(2):169-174.
- Rishi ND. Studies on insect pests of Kashmir Part III. Vegetables, major pests with their life -history and control measures. Kashmir Science. 1967; A:62-78.
- Shankar U, Kumar D, Singh SK, Gupta S. Pest complex of Cole crops and their management. Technical bulletin No. 1, SKAUST Jammu, 2016, 14.
- Sharma D, Rao DV. A field study of pest of cauliflower cabbage and okra in some areas of Jaipur. International Journal of Life Science Biotechnology and Pharmaceutical Research, 2012, 121-127.
- Bala A, Tara JS, Gupta M. Butterflies of family Pieridae reported from Jammu Region (Jammu and Kashmir). International Journal of Interdisciplinary and Multidisciplinary S Tudies. 2014; 1(7):24-34.
- Bingham CT. The fauna British India, including Ceylon and Burma: Butterflies. Taylor and Francis Ltd., London, 1907, 480.
- Qureshi AA, Bhagat RC, Pathania PC. Rhopalocera diversity (Lepidoptera) of district Kupwara from Jammu and Kashmir State, India. Biol. Forum. 2013; 5(1):100106.
- Varshney RK. Index Rhopalocera Indica. Part III. Genera of butterflies from Indian and neighbouring countries (Lepidoptera: Papilionidae, Pieridae, Danaidae). Oriental Insects. 1993; 27:347-372.
- Mani MS, Singh S. Entomological Survey of Himalaya. Part XXVI. A contribution to our knowledge of geography of the high-altitude insects of the naval Zones from the north-west Himalaya. Part 3. Journal of Bombay Natural History Society. 1962; 59(1):77-99.
- Wynter Blyth MA. Butterflies of Indian Region. The Bombay natural History Society, Bombay, 1957.
- Bhat DM. 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), 2008.
- Bhatia R, Verma AK. Insect pest complex of cabbage in Himachal Pradesh. Journal of Insect Sciences. 1993; 6(2):297-298.
- Firake DM, Lytan D, Behre GT. Biodiversity and seasonal activity of arthropod fauna in Brassicaceae crop ecosystems of Meghalaya, North-east India. Molecular Entomology. 2012; 3(4):18-22.