

Original Research Article

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A Study on Entomo-Fauna as Recorded from Cauliflower Crop in an Agro-Ecosystem near Bikaner, Rajasthan, India

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ABSTRACT

Keywords

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Cauliflower, *Brassica oleracea* var. *botrytis* L. belonging to family Brassicaceae (Cruciferae) is a very popular winter vegetable Rabi crop cultivated especially in North India. The crop is also cultivated in the State of Rajasthan during winter. Ecologically, insects play many different roles as pests, predators and parasites, pollinators, decomposers and scavengers and so forth. Looking into this, the present study was conducted to document the entomo-fauna associated with this crop in the region. An indigenously designed cage net was employed for collection. In all, 71 insects belonging to 6 orders and 32 families were collected from the crop, of which based on density 6 were dominant, 53 frequent and 12 were rare forms. The maximum density as well as diversity was found in the month of November, while, minimum in the month of April 2013.

Introduction

Cauliflower, *Brassica oleracea* var. *botrytis* L. belonging to family Brassicaceae (Cruciferae) is a very popular winter vegetable Rabi crop cultivated especially in North India. Typically, only the head (the white curd) of aborted floral meristem is eaten, while the stalk and surrounding thick, green leaves are used in vegetable broth or discarded. Cauliflower is low in fat, but high in dietary fibre, folate, water, and vitamin C, possessing a high nutritional density. Cauliflower contains several phytochemicals, usually occurring in the cabbage family that may be beneficial to human health. A high intake of cauliflower has been associated with reduced risk of aggressive prostate cancer.

The crop is also cultivated in the State of Rajasthan during winter. The state of Rajasthan, the land with vivid topographical features and geographically, is located between 23°3'-30°12' N and 69°30'-78°17' E. Bikaner district lies in North-Western part of Rajasthan located between 27°11' and 29°03' North latitudes and 71°52' and 74°12' East longitudes. The district has a dry climate with large variation in temperature and has scanty rainfall. The summer months are extremely hot with the day temperature sometimes going up to 49.9°C, May being the hottest month. During winter the minimum temperature sometimes drops up to 0°C, January being the coldest month. Ecologically, insects play many different

roles as pests, predators and parasites, pollinators, decomposers and scavengers and so forth. Looking into this, the present study was conducted to document the insects associated with this crop in the region.

Materials and Methods

The agro-ecosystems in the form of crop fields studied lie about 10 to 15 km away from the city, covering an area of 6 hectares each. These are irrigated by sewage water. In all six crop fields were covered during the present survey from September 2012 to April 2013 and September 2013 to April 2014 when the crop of cauliflower was cultivated.

An indigenously designed cage (net) of 1m×1m×1m of nylon mesh was used for the purpose as also used by Saigal (2002). The cage covered the 1m³ volume while holding the crop inside. The fauna trapped within the cage was mechanically picked up. Using cage the insects were collected between 7A.M to 11A.M. Sampling was done fortnightly. The insects collected by the above method were transferred to killing bottles and the killed insects were preserved. Large winged insects were put to dry preservation by pinning them in insect boxes, while, smaller insects were preserved in 70% alcohol. The fauna were sorted out group-wise and identifications were made following pertinent literature. Help from the section of Entomology, Department of Agriculture, Bikaner and Desert Regional Station of the Zoological Survey of India, Jodhpur was also taken for identification and for confirmation.

Results and Discussion

The cauliflower was cultivated in the agro-ecosystem during September to April. The entomofauna collected from this crop has been presented in Table 1. In all, 71 insects

belonging to 6 orders and 32 families were collected from the crop, of which based on density 6 were dominant, 53 frequent and 12 were rare forms. The maximum density as well as diversity was found in the month of November, while, minimum in the month of April 2013.

Of the seventeen lepidopteran species documented, based on density, thirteen were frequent (*D. chrysippus*, *L. boeticus*, *Zizina* sp., *E. hecabe*, *A. aurota*, *C. pomona*, *C. vestalis*, *C. indica*, *H. recurvalis*, *Tephрина* sp., *U. pulchella*, *S. exigua* and *A. ipsilon*) and four (*H. ornata*, *L. orbonalis*, *Hymenia* sp. and *A. styx*) were rare forms. Among, twelve coleopteran species documented, eight were frequent (*Cicindella* sp., *A. bengalensis*, *O. catta*, *O. bonasus*, *P. nasutus*, *A. ferruginea*, *C. septempunctata* and *M. sexmaculatus*), four were (unidentified species A & B, *H. truncatulus* and *Myloccerus* sp.) rare species. *X. fenestrata*, *A. cerana* and *A. mellifera* were documented as three dominant hymenopteran species, while, *Enicospilus* sp., *Campsomeris* sp., *Scoliasoror* sp., *D. affinis*, *Formica* sp., *Pepsis* sp., *P. carolina*, *Halictus* sp., *X. violacea*, *A. dorsata*, *A. florea*, unidentified species A, B and C were fourteen frequent forms.

Of the total eleven hemipteran species, eight (*D. cingulatus*, *Clavigrella* sp., *N. viridula*, *A. janus*, *A. spinidens*, *Piezodorus* sp., *Oncocephalus* sp. and unidentified species B) were frequent, three (*B. hilaris*, *Alcaeus* sp. and unidentified species C) were rare forms. *Chrotogonus* sp., *S. gregaria*, *Ochrilidia* sp., *O. chinensis*, *Pyrgomorpha* sp., *Atractomorpha* sp. and unidentified species A, were the seven frequently noted, while, only one species *Acrida* sp. was a rare form among the eight orthopteran insects. Among six dipteran insect species, three were dominant which included *C. quinquefasciatus*, *S. peregrina* and *M.*

domestica and three were frequent forms (*Stichopogon* sp., syrphid fly and *D. cucurbitae*).

The present work gets support from the earlier work by various authors. Cruciferous vegetables viz. cabbage, cauliflower and knol-knol grown in and around Shillong have been found to be attacked by different insect pests which include cabbage butterfly *Pieris brassicae*, cabbage aphid *Brevicoryne brassicae*, mustard aphid *Lipaphis erysimi*, cutworms *Agrotis ipsilon* and *A. flammata*,

cabbage loopers *Plusia orichalcea* and *Trichoplusia* sp. and diamond back moth *Plutella xylostella* by Sachan & Gangwar (1990). *Brassica oleracea* var. *capitata* L. is extensively grown both in hills and valleys of Manipur and is damaged by a variety of insect pests of which cabbage butterfly *Pieris brassicae* L. was observed as a problem pest by Shri Ram & Pathak (1992). Mitra & Banerjee (2007) reported cauliflower to be pollinated by flies.

Table.1 Entomofaunal Diversity and Density (Number/Trap*) on Cauliflower During the Period of Study

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Status
Order: Lepidoptera																		
Family: Danaidae																		
<i>Danaus chrysippus</i> Linn.	-	-	-	-	-	-	-	-	-	2	3	3	-	-	-	-	-	F
Family: Lycaenidae																		
<i>Lampides boeticus</i> Linn.	-	-	-	-	-	-	-	-	-	-	2	2	1	-	-	-	-	F
<i>Zizina</i> sp.	-	-	-	-	-	-	-	-	-	-	2	2	-	1	-	-	-	F
Family: Pieridae																		
<i>Eurema hecabe</i> Linn.	1	1	1	1	-	-	-	-	1	1	4	4	2	1	-	1	-	F
<i>Anaphaeis aurota</i> Fab.	1	-	-	-	-	-	-	-	1	1	5	4	1	-	-	-	-	F
<i>Catopsila pomona</i> Cramer	-	1	1	-	-	-	-	-	1	1	4	4	-	-	-	-	-	F
<i>Colotis vestalis</i> Butler	-	-	1	1	-	-	-	-	-	-	2	1	-	-	-	-	-	F
Family: Hesperidae																		
<i>Hesperilla ornata</i> Leach.	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	R
Family: Crambidae																		
<i>Leucinodes orbonalis</i> Guenee	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	R
<i>Cryptographis indica</i> Saunders	-	-	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	F
<i>Hymenia recurvalis</i> Fab.	-	-	-	-	-	-	-	-	-	-	2	1	-	1	-	-	-	F
<i>Hymenia</i> sp.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	R
Family: Geometridae																		
<i>Tephрина</i> sp.	-	-	-	-	-	-	-	-	-	1	2	1	1	-	-	-	-	F
Family: Sphingidae																		
<i>Acherontia styx</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	R
Family: Arctidae																		
<i>Utethesia pulchella</i> Linn.	-	-	-	-	-	-	-	-	-	-	3	2	2	1	1	1	-	F
Family: Noctuidae																		
<i>Spodoptera exigua</i> Hubner	-	-	-	-	-	-	-	-	-	2	2	2	2	-	-	-	-	F
<i>Agrotis ipsilon</i> Hufnagel	1	1	-	-	-	-	-	-	-	-	3	2	1	-	-	-	-	F
Order: Coleoptera																		
Family: Cicindelidae																		
<i>Cicindella</i> sp.	3	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	F

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ma r	Ap r	May	Status
Family: Carabidae																		
Unidentified sp. A	-	-	-	1	-	-	-	-	-	-	1	1	-	-	1	1	-	R
Family: Scarabaeidae																		
<i>Anomala bengalensis</i> Blanch.	1	1	1	1	-	-	-	-	-	-	2	1	1	-	-	-	-	F
<i>Onthophagus catta</i> Fab.	2	2	1	1	-	-	-	-	-	-	2	3	-	-	-	-	-	F
<i>Onthophagus bonasus</i> Fab.	-	-	1	1	-	-	-	-	2	1	-	-	1	-	-	-	-	F
<i>Peltonotus nasutus</i> Arrow	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-	-	-	F
<i>Apogonia ferruginea</i> Fab.	-	-	-	2	-	-	-	-	-	-	2	1	3	-	-	-	-	F
Unidentified sp. B	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	R
Family: Coccinellidae																		
<i>Coccinella septempunctata</i> Lin.	-	-	-	4	-	-	-	-	-	-	2	2	-	1	1	1	-	F
<i>Menochilus sexmaculatus</i> Fab.	-	-	2	1	-	-	-	-	-	2	-	-	-	-	2	-	-	F
Family: Curculionidae																		
<i>Hypolixus truncatulus</i> Fab.	-	-	-	-	-	-	-	-	-	1	1	-	-	-	2	-	-	R
<i>Myllocerus</i> sp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R
Order: Hymenoptera																		
Family: Ichneumonidae																		
<i>Enicospilus</i> sp.	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-	F
Family: Scolidae																		
<i>Campsomeris</i> sp.	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	F
<i>Scoliasoror</i> sp.	-	-	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-	F
Family: Formicidae																		
<i>Dolichoderus affinis</i> Emery	-	-	-	-	-	-	-	-	-	-	4	2	2	-	-	-	-	F
<i>Formica</i> sp.	-	-	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	F
Family: Pompilidae																		
<i>Pepsis</i> sp.	-	-	-	-	-	-	-	-	-	-	5	2	-	-	-	-	-	F
Family: Vespidae																		
<i>Polistes carolina</i>	-	-	-	-	-	-	-	-	-	1	3	1	-	-	-	-	-	F
Family: Halictidae																		
<i>Halictus</i> sp.	-	-	-	-	-	-	-	-	-	2	3	1	2	-	-	-	-	F
Family: Apidae																		
<i>Xylocopa fenestrata</i> Fab.	-	-	-	-	-	-	-	-	-	4	4	2	4	-	-	-	-	D
<i>Xylocopa violacea</i> Linn.	-	-	-	-	-	-	-	-	-	1	2	1	1	-	-	-	-	F
<i>Apis cerana</i> Fab.	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	D
<i>Apis mellifera</i> Linn.	-	-	-	-	-	-	-	-	-	-	5	5	4	2	-	-	-	D
<i>Apis dorsata</i> Fab.	-	-	-	-	-	-	-	-	-	4	3	5	-	-	-	-	-	F
<i>Apis florea</i> Fab.	-	-	-	-	-	-	-	-	-	-	5	5	-	-	-	-	-	F
Unidentified sp. A	-	-	-	-	-	-	-	-	-	2	2	2	2	-	-	-	-	F
Unidentified sp. B	-	-	-	-	-	-	-	-	-	1	2	2	2	-	-	-	-	F
Unidentified sp. C	-	-	-	-	-	-	-	-	-	-	4	2	1	-	-	-	-	F
Order: Hemiptera																		
Family: Pyrrhocoridae																		
<i>Dysdercus cingulatus</i> Fab.	1	1	1	1	-	-	-	-	-	-	1	1	1	-	-	-	-	F
Family: Coreidae																		
<i>Clavigrella</i> sp.	3	2	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	F
Family: Pentatomidae																		
<i>Nezara viridula</i> Linn.	2	3	-	-	-	-	-	-	1	1	-	-	-	1	1	-	-	F
<i>Bagrada hilaris</i> Burmeister	2	1	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	R

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Status
<i>Alcaeus</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	R
<i>Aspongopus janus</i> Fab.	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F
<i>Andrallus spinidens</i> Fab.	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	F
<i>Piezodorus</i> sp.	2	-	2	2	-	-	-	-	2	2	-	-	-	-	-	-	-	F
<i>Oncocephalus</i> sp.	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	F
Unidentified sp. B	-	-	2	3	-	-	-	-	2	2	-	-	-	-	-	-	-	F
Unidentified sp. C	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	R
Order:																		
Orthoptera																		
Family:Acrididae																		
<i>Chrotogonus</i> sp.	1	1	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	F
<i>Schistocerca gregaria</i> Forskal	2	1	1	1	-	-	-	-	-	-	1	1	1	-	-	-	-	F
<i>Ochridia</i> sp.	-	1	1	1	-	-	-	-	1	1	1	-	-	-	-	-	-	F
<i>Oxya chinensis</i> Thunberg	-	-	1	1	-	-	-	-	1	1	1	1	1	1	1	-	-	F
<i>Acrida</i> sp. Linn.	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R
Family:																		
Pyrgomorphidae																		
<i>Pyrgomorpha</i> sp.	2	-	2	2	-	-	-	-	2	1	-	-	-	-	-	-	-	F
<i>Atractomorpha</i> sp.	-	-	-	-	-	-	-	-	1	1	-	-	2	2	2	-	-	F
Unidentified sp. A	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	1	-	F
Order:Diptera																		
Family:Culicidae																		
<i>Culex quinquefasciatus</i> Say	6	4	5	3	-	-	-	-	3	2	4	3	2	3	4	5	-	D
Family:Asilidae																		
<i>Stichopogon</i> sp.	1	-	1	1	-	-	-	-	2	2	-	-	-	1	2	3	-	F
Family:																		
Syrphidae																		
Syrphid fly	1	1	1	-	-	-	-	-	1	-	1	1	-	-	-	-	-	F
Family:																		
Tephritidae																		
<i>Dacus cucurbitae</i>	2	1	1	-	-	-	-	-	-	-	-	-	1	2	1	2	-	F
Family:																		
Sarcophagidae																		
<i>Sarcophaga peregrina</i>	2	1	1	1	-	-	-	-	2	-	2	-	1	1	-	-	-	D
Family:Muscidae																		
<i>Musca domestica</i> Fab.	2	2	2	2	-	-	-	-	2	2	2	2	1	1	1	1	-	D

* Average of all the six crop fields

D-Dominant,
D>100

F-Frequent,
100 >D>25

R-Rare
R≤25

Chryso dieixis sp. has been noted to attack plants belonging to cabbage family (Swain, 1971; Holloways, 1964). *Spodoptera litura* has been reported to cause damage to cabbage (Hick, 1980; Hill, 1975). *Pieris brassicae* is one of the most destructive

pests of cole crops and has been reported to cause damage in entire Himalayan ranges as well as in foot hills by Rataul (1966). *Heliothis armigera* damages a wide range of crops including cabbage and *Agrotis ipsilon* has been reported to damage cabbage (Hill,

1975; Hick 1980). In plains of Rajasthan, cabbage aphid incidence has been reported from November to March there after declining due to heat by Sachan & Srivastava (1972). Honeybees as effective pollinators of cauliflower were also reported by Kakar (1981). Zaz & Kuchwaha (1983) made a relative quantitative survey of the tobacco caterpillar, *Spodoptera litura* on cauliflower and cabbage crops during both kharif and rabi seasons. The authors recorded the pest from last week of June till last week of December on cauliflower, which shifted subsequently to cabbage wherein the incidence commenced from end of December or first week of January and lasted till the end of March. The pest activity on cauliflower crop got accelerated about middle of August and again in November. On cabbage its peak activity was recorded during March. Free (1993) reported flies and bees to visit cauliflower. Kumar & Nigam (1991) have noted cauliflower to be attacked by many insects viz., *Lipaphis erysimi*, *Myzus persicae*, *Brevicoryne brassicae*, *Euborellia annulipes*, *Tricentrus bicolor*, *Patanga succinata*, *Bemisia tabaci*, *Caliothrips indicus*, *Frankliniella sulphurea*, *Thrips*, *Plutella maculipennis*, *Hellula undalis*, *Diacrisia obliqua*, *Crociodolomia binotalis*, *Agrotis ipsilon*, *Agrotis segetum*, *Plusia chalcites*, *Plusia eriosoma*, *P. orichalcea*, *P. signata*, *Trichoplusia*, *Spodoptera litura*, *Phytomyza atricornis*, *Athalia proxima*, *Chaetochnema basalis*, *Phyllatreata cruciferae* and *Apion* spp. and therefore support the present findings.

Cauliflower crop has been observed to be attacked by various pests which included, *Patanga succincta*, *Tricentrus bicolor*, *Lipaphis erysimi*, *Myzus persicae*, *Bagrada cruciferarum*, *Caliothrips idicus*, *Thrips tabaci*, *Plutella xylostella*, *Crociodolomia binotalis*, *Hellula undalis*, *Diacrisia obliqua*, *Amathes c-nigrum*, *Agrotis ipsilon*,

A. segetum, *Spodoptera litura*, *Trichoplusia*, *Phytomyza atricornis*, *Athalia lugens proxima* and *Dorylus orientalis* as suggested by Nayar *et al.* (1998) which are also in conformation with the present study. Besides, some other works which support the present findings include those by Sima & Srivastava (2012; 2014), Sima *et al.* (2014) and Bhardwaj *et al.* (2010, 2012 and 2014), wherein the authors have documented various insects on different crops in the desert region.

References

- Bhardwaj, H., Bhati, D., Srivastava, M. 2014. Insect visitors to inflorescence of *coriandrum sativum* as observed in an agro-ecosystem near Bikaner, Rajasthan (India). *Asian Acad. Res. J. Multidisciplinary*, 1(27): 396–408.
- Bhardwaj, Harshwardhan, Parul Thaker, Meera, Srivastava. 2010. Hymenopteran visitors of *Tagetes erecta* as observed in an agro-ecosystem near Bikaner, Rajasthan. *Curr. Biotica*, 4(1): 94–102.
- Bhardwaj, Harshwardhan, Srivastava, Meera. 2012. A study on insect visitors of certain cucurbit vegetable crops in an agro-ecosystem near Bikaner, Rajasthan, India. *J. Acad.*, 2(3): 99–126.
- Bhardwaj, Harshwardhan, Thaker, Parul, Srivastava, Meera. 2012. Hymenopteran floral visitors as recorded from an agro-ecosystem near Bikaner, Rajasthan. *Global J. Sci. Front. Res. Agric. Bio.*, 12(3): 19–34.
- Free, J.B. 1993. Insect pollination of crops (2rd ed.) Academic press, Harcourt Brace Jovanovich Publ., London. 684 p.
- Hick, S. 1980. Insect and Nematode Pests of Crops. Rural Development Hand book No. 17 DPI.

- Hill, D.S. 1975. Agricultural Insect pests of the Tropics & their control. Cambridge University Press, London.
- Holloway, J.K. 1964. Projects in Biological control of weeds. pp. 650 - 670 in Paul De Bach, editor, Biological control of Insects Pests and weeds.
- Kakar, K.L. 1981. Foraging behavior of insect pollination of Cauliflower bloom. *Indian J. Ecol.*, 8: 126–130.
- Kumar, A., Nigam, P.M. 1991. Economic and applied entomology. *Emkay Publications*, New Delhi. pp. 530.
- Mitra, B., Banerjee, D. 2007. Fly pollinators: assessing their value in biodiversity conservation and food security in India. *Rec. Zool. Surv. India*, 107(1): 33–48.
- Nayar, K.K., Ananthkrishnan, T.N., David, B.V. 1998. General and applied entomology. Tata McGraw-Hill Publishing Company Limited, New Delhi. pp. 589.
- Rataul, H.S. 1966. Biology of cabbage butterfly, *Pieris brassicae* L. *Indian J. Hort.*, 16: 256–265.
- Sachan, J.N., Gangwar, S.K. 1990. Seasonal incidence of insect pests of cabbage, cauliflower and Knol-Khol. *Indian J. Ent.*, 52(1): 11–124.
- Sachan, J.N., Srivastava, B.P. 1972. Studies on the seasonal incidence of insect pests of cabbage. *Indian J. Ent.*, 34(2): 123–129.
- Saigal, D. 2002. A study on entomofauna and its ecology in some agroecosystem in the arid around Bikaner (NW Rajasthan). Ph.D Thesis, Maharshi Dayanand Saraswati University, Ajmer. pp. 1–129.
- Shri Ram, Pathak, K.A. 1992. Insecticidal control for cabbage butterfly, *Pieris brassicae* Linn. (Pieridae: Lepidoptera) in Manipur. *Indian J. Ent.*, 54(3): 353–355.
- Sima, Dheeraj Bhati, Meera Srivastava. 2014. Floral visitors of different crops as recorded from an agro-ecosystem near Jhunjhunu, Rajasthan (India). *Int. J. Sci. Res.*, 3(9): 1732–1738.
- Sima, Srivastava, Meera. 2012. Entomofauna associated with Bajra crop as observed in an agro-ecosystem in Rajasthan, India. *Int. J. Theoretical & Appl. Sci.*, 4(2): 109–121.
- Sima, Meera Srivastava. 2014. A comparative study of insect collection made by employing two different methods of collection in an agro-ecosystem near Jhunjhunu, Rajasthan (India). *Int. J. Sci. Res.*, 3(9): 1739–1748.
- Swain, G. 1971. Foreign and commonwealth office, Overseas Development Administration, Overseas Research Publication. *Ag. Zool. in Fiji*. HMSO 18, London, 424 pp.
- Swami, H., Joshi, F.L., Sharma, U.S. 1998. A note on the incidence of major insect pests of cabbage, *Brassica oleracea* var. capita Linn. *Indian J. App. Ent.*, 12: 71–73.
- Zaz, G.M., Kushwaha, K.S. 1983. Quantitative incidence of tobacco caterpillar, *Spodoptera litura* (F.) and related natural enemies in cole crops. *Indian J. Ent.*, 45(2): 201–202.

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