Int.J.Curr.Microbiol.App.Sci (2017) *6*(9): 2495-2505

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 9 (2017) pp. 2495-2505**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.609.307

A Survey on Occurrence and Diversity of Insect Pests of Cauliflower in Dindigul and Theni Districts of Tamil Nadu, India

Arun Debbarma[1*], J. Jayaraj[1], P. Chandramani[2], N. Senthil[3], M. Ananthan[4] and K. Prabakaran[5]

[1]Department of Entomology, AC & RI, Madurai, Tamil Nadu, India
[2]Department of Entomology, AC & RI, Kudumiyanmalai, Tamil Nadu, India
[3]Department of Biotechnology, AC & RI, Madurai, Tamil Nadu, India
[4]Department of Horticulture, Horticultural Research Station, Thadiyankudisai, Tamil Nadu, India
[5]Department of Agricultural Economics, AC & RI, Madurai, Tamil Nadu, India
**Corresponding author*

Keywords

Survey, Cauliflower, Pests, Natural enemies.

Article Info

Accepted:
26 August 2017
Available Online:
10 September 2017

A B S T R A C T

Roving surveys were taken from September 2015 to 2017 covering Theni and Dindigul districts of Tamil Nadu, India aiming to document the occurrence of major insect pests and their natural enemies in cauliflower crop at different elevations. The insect pest diversity of cauliflower was from Lepidoptera (29.63 per cent), Homoptera (14.81 per cent), Orthoptera (14.81 per cent), Hemiptera (7.81 per cent), Coleoptera (7.41 per cent), Diptera (7.41 per cent), Hymenoptera (3.70 per cent), Thysanoptera (3.70 per cent), Dermaptera (3.70 per cent), Dictyoptera (3.70 per cent) and Acarina (3.70 per cent) respectively. The natural enemies diversity were from Hymenoptera (41.67 per cent), Coleoptera (20.83 per cent), Hemiptera (12. 50 per cent), Diptera (8.33 per cent), Neuroptera (4.17 per cent), Odonata (4.17 per cent) and Araneae (8.33 per cent). The most damaged plant parts were curds followed by leaves and stem.

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* Linn.) is one of the most important cruciferous vegetables in India and worldwide however the production is low because this crop suffers from both the biotic and abiotic stresses. In India, cauliflower crop occupies an area of 433.9 ha with a production of 8573.3 MT (National Horticulture Board, 2015) and this is one of the most ravaged cruciferous vegetables by insect pests. Earlier in India, 37 insects' pests were recorded in cabbage, Lal, (1975), and Bhatia and Verma, (1993). Raja *et al.*, (2014) recorded 11 insect pests in Tamil Nadu in crucifers and Raju and Sivaprakasagam, (1989) reported Diamondback moth, *Plutella xylostella* (Linnaeus), Mustard aphid, *Lipaphis erysimi* (Kaltenbach), cabbage semilooper, *Trichoplusiani* (Hubner), and cutworms, *Agrotis ipsylon* (Hubner), as widespread pests on crucifers. Worldwide surveys indicate the major pests that ravaged the *Brassicaceae*

family were *viz*., diamondback moth, *Plutella xylostella* (Linnaeus), cabbage leaf webber, *Crocidolomia binotalis* (Zeller), Gram pod borer, *Helicoverpa armigera* (Hubner), tobacco caterpillar, *Spodoptura litura* (Fabricius), cabbage semilooper, *Trichoplusiani* (Hubner), cabbage Head borer, *Hellulaundalis* (Fabricius), cabbage butterfly, *Pierisbrassicae* (Linnaeus), cutworms, *Agrotis ipsylon* (Hubner), cabbage aphid, *Brevicoryne brassicae* (Linnaeus), mustard aphid, *Lipaphis erysimi* (Kaltenbach), green peach aphid, *Myzuspersicae* (Sulzer), Flea beetle, *Phyllotretacruciferae* (Goeze), painted bug, *Bagrada cruciferarum* (Kirkaldy), mustard sawfly, *Athalialugens proxima* (Klug) (Bonneimaison, 1965, Lu, 1983, Cheng *et al.*, 1987, Anita and Suchi, 2012, Singh and Pal, 2014, Deeplata and Rao, 2012, Ratnasri, 2012, Palande *et al.*, 2004.

Materials and Methods

Roving Surveys were carried out in different cauliflower growing areas of Dindigul (10.365581ºN and 77.970657º E) and Theni (10.008834ºN and 77.4923747ºE) districts during 2015-2017 to investigate the occurrence and diversity of major insect pests and their natural enemies. The surveywas conducted in Komalipatty, Kannanur, Kodaikanal, Kallymandayam, Amblikkai, Thangachiyamapatty, Virupachi, Oddanchatrum, Odaipatty, Lakyankottaiof Dindigul district and also survey was conducted in Kottur, Veerapandi, Kumbum, Andipatty, Chinnamanur, Merkayankottai and Ayyamapatty of Theni district. The surveys were carried out in three elevations *viz*., 150m MSL, 500m MSL and above 1500m MSL. Farmers' fields having at least 0.5 acre area was selected and the field was divided into five plots (P_1, P_2, P_3, P_4 and P_5) and in each plot 10 plants were selected at random for counting the pests population and observations were taken in zigzag rows (Raja *et al.*, 2014). Sampling population densities of various stages viz., eggs, larvae/nymph, pupae and adult of the pest were observed once in 15 days by following the method of Muhammad Haseeb *et al.*, (2001). These pests and natural enemies were identified based on the taxonomic keys. The individual species was recorded in accordance with family. The following formula were used to find out the individual species per cent, overall order per cent and plant parts damaged per cent.

$$\text{Individuals Species Per cent} = \frac{\text{No. of indidual species}}{\text{Sum of total species}} \text{ X } 100$$

$$\text{Overall order per cent} = \frac{\text{Total no. of species in respective order}}{\text{Total species recorded in overall order}} \text{ X } 100$$

$$\text{Plant parts damaged diversity per cent} = \frac{Pest feeding on respective\ plant\ parts}{Total No. of Species feeding on whole plant} X\ 100$$

Results and Discussion

The survey indicated that in Theni as well as in Dindigul districts, the Diamondback moth, *Plutellaxylostella* (Linnaeus) was most prevalent pest on cauliflower (Table 1). The others pests recorded during the survey were *viz*., tobacco caterpillar, *Spodopturalitura* (Fabricius), cabbage leaf webber, *Crocidolomia binotalis* (Zeller), cabbage semilooper, *Trichoplusiani* (Hubner), cabbage Head borer, *Hellulaundalis* (Fabricius), Gram pod borer, *Helicoverpa armigera* (Hubner), cutworms, *Agrotisipsylon* (Hubner), Bihar hairy caterpillar, *Spilosomaobliqua* (Walker), painted bug, *Bagradacruciferarum* (Kirkaldy), Sugarcane pyrilla, *Pyrilla perpusilla* (Walker), Mustard Aphid, *Lipaphiserysimi* (Kaltenbach), Green peach Aphid, *Myzus persicae* (Sulzer), Cabbage Aphid, *Brevicorynebrassicae* (Linnaeus), whitefly, *Bemisia tabaci* (Gennadius), cabbage flea beetle, *Phyllotreta cruciferae* (Goeze), ash weevil, *Myllocerus*spp, earwigs, *Forficula auricularia* (Linnaeus), cabbage

root borer, *Delia radicum* (Linnaeus), leaf miner, *Chromatomyia horticola* (Goureau), shorthorned grasshopper, *Oxya*spp, grasshopper, *Atractomorpha crenulata* (Fabricius), cricket, *Gryllus campestris* (Linnaeus), katydid, *Pterophilla camellifolia* (Fabricius), thrips, *Thrips tabaci* (Lindeman), American cockroach, *Periplaneta americana* (Linnaeus), mustard sawfly, *Athalialugens proxima* (Klug) and mites (Table 1 and Fig. 1). Variance of these pests from season to season and region to region is comparable with the findings of Sachan and Srivastava, (1972), Sachan and Gangwar (1990) and Chaudhuri *et al*., (2001), Sarfaraz*et al*., (2005).

The predator noticed and recorded during the survey were coccinellids *viz*., *Chilomenessexmaculatus* (Fabricius), *Coccinella septumpunctata* (Fabricius), *Brumoides suturalis* (Fabricius)and *Scymnus* sp., syrphids such as *Episyrphus balteatus* (Fabricius) and *Ischiodons cutellaris* (Fabricius), predatory bug such as big eye bug, *Geocoris spp*, pirate bug, *Orius insidiodus* (Say) and Damsel bug, *Nabisroseipennis* (Reuter). The others predators recorded during the survey were green lacewing, *Chrysoper lazastrowi* (Sillemi), ants such as big headed ants, *Pheidole* sp. (Fabricius), *Solenopsi sinvicta* (Boren) and, carpenter ants, *Componatus compressus* (Fabricius), the spider such as the jumping spider and wolf spider (Table 2 and Fig. 2). Predators recorded during the survey in cruciferous crop were comparable with the findings of several authors (Firake*et al*., 2012, Jalali *et al*., 2003, Agarwal *et al*., 2007, Sood, 2004). The ground skimmer, *Diplacodes trivialis* (Rambur) was noticed and recorded feeding on adult diamondback moth, *Plutella xylostella* (Linnaeus) during the survey periods in both Theni and Dindigul districts as efficient predators.

The parasitoids noticed during the survey were *viz*., *Cotesia plutellae* Kurdjumov, *Diadegmasemiclausum* Kurdjumov, *Oomyzus sokolowski* (Kurdjumov), *Diadromus* spp, *Trichogramma* spp, *Diaretiellarapae* M'Intosh, *Aphidius spp.*, and *Encarsia Formosa* (Gahan) (table 2 and Fig. 2). These parasitoids recorded in present survey conducted in Theni and Dindigul Districts in crucifers crops were in conformity with the finding of Chandramohan, (1994) and Ushachauhan *et al*., (1997).

The survey was carried out in 150, 500 and 1500 m MSL of Dindigul district and 150 m MSL of Theni District. The insect pests as well as natural enemies population diversity varies according to the elevations. The most prevalent pests order were from Lepidoptera, Homoptera, Orthoptera, Hemiptera, Coleoptera, Diptera, Hymenoptera, Thysanoptera, Dermaptera, Dictyoptera and Acarina respectively (Table 3). The natural enemies diversity order were from Hymenoptera (41.67 per cent), Coleoptera (20.83 per cent), Hemiptera (12. 50 per cent), Diptera (8.33 per cent), Neuroptera (4.17 per cent), Odonata (4.17 per cent) and Araneae (8.33 per cent) (Table 4).

The most preferred and susceptible cauliflower plant part damaged were curds (27.59 per cent) followed by leaves by sucking (24.14 per cent), leaves by defoliation (13.79 per cent), leaves by marginal feeding (10.34 per cent), whereas leaves by webbing, leaves by zigzag mines, roots and stem, leaf mining or circular hole and leaves by circular minute holes share same per cent of damaged such as 3.45 per cent respectively (table 5). The order Lepidoptera were most consistent in ravaging this crop followed by Homoptera, Hemiptera, Orthoptera, Coleoptera, Diptera, Dermaptera, Hymenoptera, Thysanoptera, Dictyoptera and Acarina. The variation of feeding was noticed among different species of the insect pests on cauliflower and these pests infestation also varies with different crop growth stages.

Fig.1 Map of survey areas *viz*., Theni and Dindigul Districts of Tamil Nadu, India

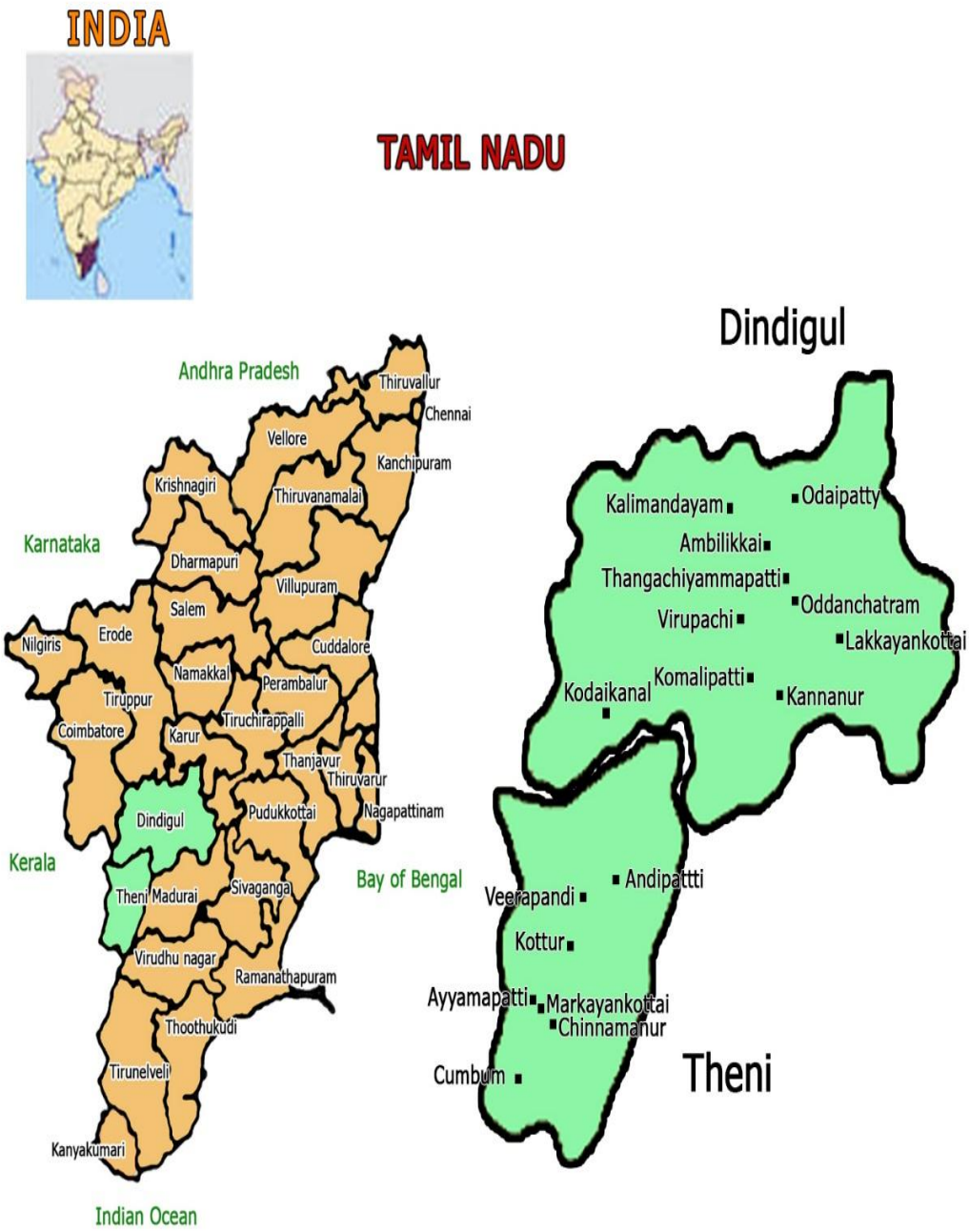

Fig. No. 1. Distribution pattern of major insect pests in cauliflower crop in Theni and Dindigul Districts of Tamil Nadu, 2015-17

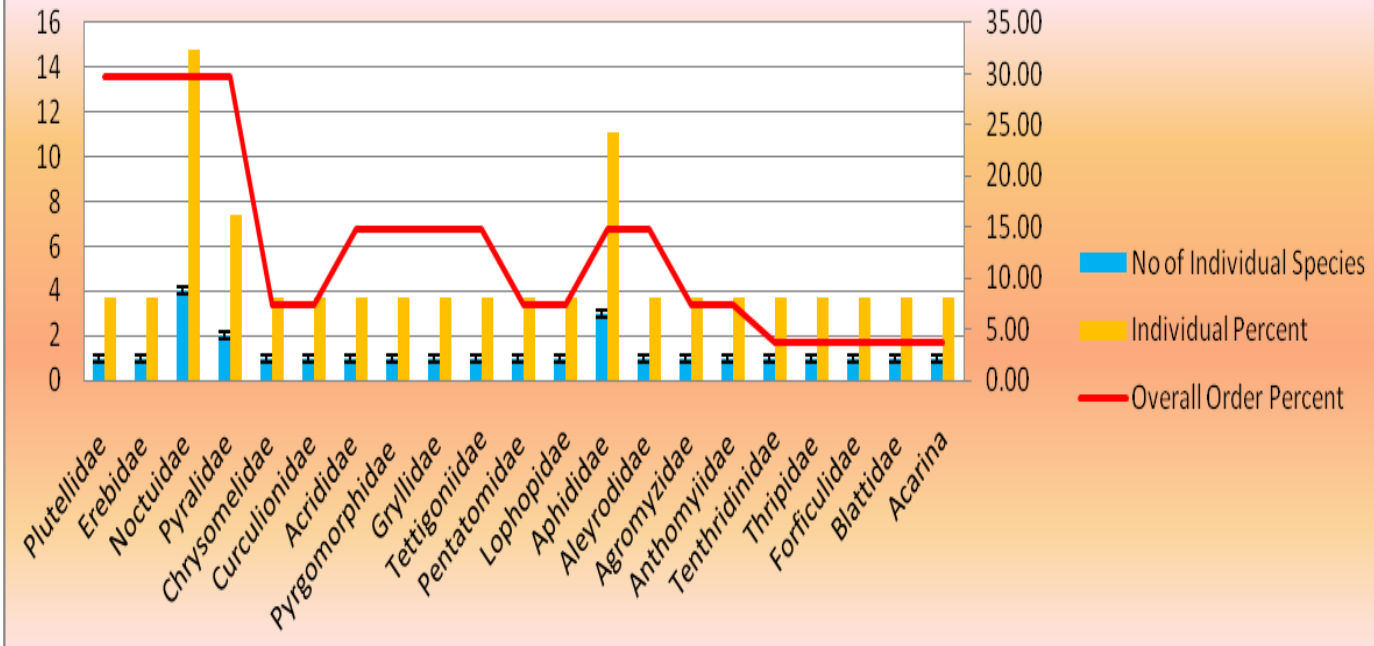

Fig.No. 2. Distribution pattern of natural enemies in cauliflower ecosystem in Theni and Dindigul District of Tamil Nadu, 2015-17

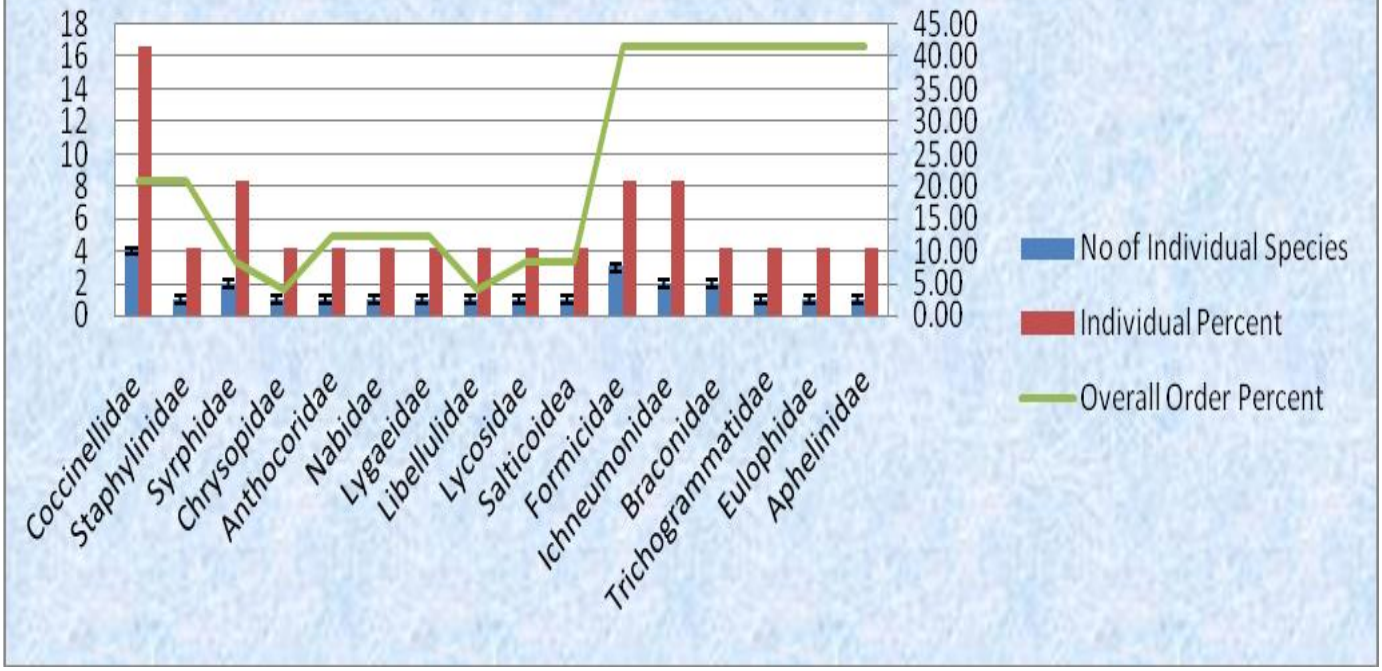

Table.1 Pests of cauliflower recorded during survey conducted at Theni and Dindigul districts, Tamil Nadu, 2015-2017

Sl. No.	Common name	Scientific name	Order	Family	Destructive stage
Biting and Chewing Insect pests:					
1.	Diamondback moth	*Plutellaxylostella*(L.)	Lepidoptera	Plutellidae	Caterpillar
2.	Tobacco caterpillar	*Spodopturalitura*(F.)	Lepidoptera	Noctuidae	Caterpillar
3.	Cutworm	*Agrotisipsylon*(Hub.)	Lepidoptera	Noctuidae	Caterpillar
4.	Cabbagesemilooper	*Trichoplusiani* (F.)	Lepidoptera	Noctuidae	Caterpillar
5.	Gram caterpillar	*Helicoverpaarmigera*(Hub.)	Lepidoptera	Noctuidae	Caterpillar
6.	Cabbage leaf webber	*Crocidolomiabinotalis*(Zell.)	Lepidoptera	Pyralidae	Caterpillar
7.	Head borer	*Helullaundalis*(F.)	Lepidoptera	Pyralidae	Caterpillar
8.	Bihar hairy caterpillar	*Spilosomaobliqua*(Wlk.)	Lepidoptera	Erebidae	Caterpillar
9.	Flea beetle	*Phyllotreatacruciferae*(Go.)	Coleoptera	Chrysomelidae	Adult
10.	Weevil	*Myllocerus*spp	Coleoptera	Curculionidae	Adult
11.	Shorthorned grasshoper	*Oxyaspp*	Orthoptera	Acrididae	Nymph and adult
12.	Grasshopper	*Atractomorphacrenulata* (F.)	Orthoptera	Pyrgomorphidae	Nymph and adult
13.	Katydids	*Pterophillacamellifolia*(F.)	Orthoptera	Tettigoniidae	Nymph and adult
14.	Cricket	*Grylluscampestris*(L.)	Orthoptera	Gryllidae	Nymph and adult
15.	Earwigs	*Forbiculaauricularia* (L.)	Dermaptera	Forficulidae	Adult
16.	Cabbage root borer	*Delia radicum*(L.)	Diptera	Anthomyiidae	Maggot
17.	Mustard sawfly	*Athalialugensproxima*(Kl.)	Hymenoptera	Tenthredinidae	Larva
18.	Cockroach	*Periplanetaamericana*(L.)	Dictyoptera	Blattidae	Adult
Sucking insect pest:					
19.	Painted bug	*Bagradacruciferarum* (Kirk.)	Hemiptera	Pentatomidae	Nymph and adult
20.	White fly	*Bemisiatabaci* (Genna.)	Homoptera	Aleyrodidae	Nymph and adult
21.	Aphid	*Myzuspersicae*(Sulzer)	Homoptera	Aphididae	Nymph and adult
22.	Aphids	*Brevicorynebrassicae*(L.)	Homoptera	Aphididae	Nymph and adult
23.	Mustard aphid	*Lipaphiserysimi*(Kalt.)	Homoptera	Aphididae	Nymph and adult
24.	Pyrilla	*Pyrillaperpusilla* (Wlk.)	Hemiptera	Lophopidae	Nymph and adult
25.	Mites	Unknown	Acarina	Unknown	Nymph and adult
26.	Thrips	*Thripstabaci* (Lindeman)	Thysanoptera	Thripidae	Nymph and adult
27.	Leaf miner	*Chromatomyiahorticola*(G.)	Diptera	Agromyzidae	Maggot

Table.2 Natural enemies of cauliflower recorded during survey conducted at Theni and Dindigul districts, Tamil Nadu, 2015-2017

Predators:					
S. No.	**Common name**	**Scientific name**	**Family**	**Order**	**Prey**
1.	Ground skimmer	*Diplacodestrivialis*(Ram.)	Libulellidae,	Odonata	Diamondback moth
2.	Syrphids	*Episyrphusbalteatus*(F.)	Syrphidae	Diptera	Aphids and whitefly
3.	Syrphids	*Ischiodonscutellaris*(F.)	Syrphidae	Diptera	Aphids and whitefly
4.	Coccinelids	*Menochilussexmaculatus*(F.)	Coccinellidae	Coleoptera	Aphids and whitefly
5.	Coccinelids	*Brumoidessuturalis*(F.)	Coccinellidae	Coleoptera	Aphids and whitefly
6.	Coccinelids	*Coccinellatransversalis*(F.)	Coccinellidae	Coleoptera	Aphids and whitefly
7.	Coccinelids	*Scymnus*spp	Coccinellidae	Coleoptera	Aphids and whitefly
8.	Rove beetle	*Paederussp*(F.)	Staphylinidae	Coleoptera	Multiple
9.	Green lace wings	*Chrysoperlazastrowi*(Sill.)	Chrysopidae	Neuroptera	Aphids and whitefly
10.	Pirates bugs	*Oriusinsidiodus* (Say)	Anthocoridae	Heteroptera	Aphids and whitefly
11.	Big eye bug	*Geocoris*spp (Say)	Lygaeidae	Heteroptera	Aphids and whitefly
12.	Damsel bug	*Nabis*spp (Reuter)	Nabidae	Heteroptera	Small insect
13.	Ants	*Pheidole*ssp (Westwood)	Formicidae	Hymenoptera	Diamondback moth
14.	Carpenter Ants	*Componotus*spp (Latreille)	Formicidae	Hymenoptera	Diamondback moth
15.	Fire ant	*Dorylusorientalis*(Westw.)	Formicidae	Hymenoptera	Diamondback moth and Cotesia
16.	Jumping spider	Unknown	Salticidae	Araneae	Multiple
17.	Wolf Spider	Unknown	Lycosidae	Araneae	Multiple

Parasitoids:					
S. No.	**Common name**	**Scientific name**	**Family**	**Order**	**Parasitic stage**
18.	Braconid wasp	*Cotesiaplutellae*(Kurdj.)	Braconidae	Hymenoptera	Larval
19.	Ichneumon wasp	*Diadegmasemiclausum*(Kurdj.)	Ichneumonidae	Hymenoptera	Larval
20.	Ichneumon wasp	*Diadromus*spp(Gravenhorst)	Ichneumonidae	Hymenoptera	Larval -pupal
21.	Eulophid wasp	*Oomyzussokolowski* (Kurdj.)	Eulophidae	Hymenoptera	Larval -pupal
22.	Trichogramma	*Trichogramma*spp	Trichogrammatidae	Hymenoptera	Egg
23.	Parasitoid wasp	*Encarsiaformosa*(Gahan)	Aphelinidae	Hymenoptera	Nymph-adult
24.	Parasitoid wasp	*Diareatiella*spp (M'Intosh)	Braconidae	Hymenoptera	Nymphs-Adult

Table.3 Distribution pattern of major insect pests of cauliflower ecosystems in Theni and Dindigul Districts of Tamil Nadu, India, 2015-17

S. No	Order	Family	No. of species	Districts	Elevations (above MSL)
1.	Lepidoptera	Plutellidae	01	Dindigul and Theni	150, 500 and 1500m
2.	Lepidoptera	Erebidae	01	Theni	150m
3.	Lepidoptera	Noctuidae	04	Dindigul and Theni	150, 500 and 1500m
4.	Lepidoptera	Pyralidae	02	Dindigul and Theni	150, 500 and 1500m
5.	Coleoptera	Chrysomelidae	01	Dindigul and Theni	150 and 500m
6.	Coleoptera	Curculionidae	01	Dindigul	150 and 500m
7.	Orthoptera	Acrididae	01	Dindigul and Theni	150 and 500m
8.	Orthoptera	Pyrgomorphidae	01	Dindigul	150 and 500m
9.	Orthoptera	Gryllidae	01	Dindigul	150 and 500m
10.	Orthoptera	Tettigoniidae	01	Theni and Dindigul	150 and 500m
11.	Heteroptera	Pentatomidae	01	Dindigul and Theni	150, 500 and 1500m
12.	Hemiptera	Lophopidae	01	Dindigul	150 and 500m
13.	Homoptera	Aphididae	03	Dindigul and Theni	150, 500 and 1500m
14.	Homoptera	Aleyrodidae	01	Dindigul and Theni	150, 500 and 1500m
15.	Diptera	Agromyzidae	01	Dindigul and Theni	150, 500 and 1500m
16.	Diptera	Anthomyiidae	01	Theni	150 m
17.	Hymenoptera	Tenthredinidae	01	Theni	150 m
18.	Thysanoptera	Thripidae	01	Dindigul	150 and 500m
19.	Dermaptera	Forficulidae	01	Dindigul	150 and 500m
20.	Dictyoptera	Blattidae	01	Dindigul and Theni	150 and 500m
21.	Acarina	Unknown	01	Theni	150 m

Table.4 Distribution pattern of natural enemies of cauliflower ecosystems in Theni and Dindigul Districts of Tamil Nadu, India, 2015-17

S. No	Order	Family	No. of species	Districts	Elevations (above MSL)
1.	Coleoptera	Coccinellidae	04	Dindigul and Theni	150 m and 500 m
2.	Coleoptera	Staphylinidae	01	Dindigul and Theni	150 m and 500 m
	Diptera	Syrphidae	02	Dindigul and Theni	150 m and 500 m
3.	Neuroptera	Chrysopidae	01	Theni and Dindigul	150 m and 500 m
4.	Hemiptera	Anthocoridae	01	TheniandDindigul	150 m and 500 m
5.	Hemiptera	Nabidae	01	Theni and Dindigul	150 m and 500 m
6.	Hemiptera	Lygaeidae	01	Theni and Dindigul	150 m and 500 m
7.	Odonata	Libellulidae	01	Dindigul and Theni	150 and 500m
8.	Araneae	Lycosidae	01	Dindigul and Theni	150 m and 500 m
9.	Araneae	Salticidae	01	Dindigul and Theni	150 m and 500 m
10.	Hymenoptera	Formicidae	03	Dindigul and Theni	150 and 500m
11.	Hymenoptera	Ichneumonidae	02	Dindigul and Theni	150 m and 500 m
12.	Hymenoptera	Braconidae	02	Dindigul and Theni	150 m and 500 m
13.	Hymenoptera	Trichogrammatidae	01	Dindigul and Theni	150 and 500m
14.	Hymenoptera	Eulophidae	01	Dindigul and Theni	150 and 500m
15.	Hymenoptera	Aphelinidae	01	Dindigul and Theni	150 and 500m

Table.5 Distributions pattern of major insect pests of cauliflower ecosystem based on plant part Damaged in Theni and Dindigul districts, Tamil Nadu during, 2015-17

S. No.	Plant parts damaged and nature of damaged	No. of species	Species	Diversity per cent
1.	Curds bites and feeds on curd	08	*Plutellaxylostella*(L.),*Hellulaundalis*(F.), *Spodopturalitura*(F.),*Helicoverpaarmigera*(H), *Lipaphiserysimi (Kalt.),Forbiculaauricularia*(L.),*Periplanetaamericana*(L.), *Myzuspersicae*(Sul.)	27.59
2.	Stem and Cutting at base	01	*Agrotisipsylon*(Hubner)	3.45
3.	Leaves and Defoliates	04	*Spodopturalitura*(F.), *Crocidolomiabinotalis*(Z.),*Athalialugensproxima*(Klug), *Myllocerusspp, Trichoplusiani*(Fabricius),	13.79
4.	Leaves, silvering, curling and yellowing of leaves	07	*Thripstabaci*(Lind.),*Bagradacruciferarum*(Kirk.),*Brevicorynebrassicae*(L.),*Myzuspersicae*(Sulzer), *Lipaphiserysimi*(Kalt.),*Pyrillaperpusilla* (Wlk.), Mites	24.14
5.	Leaves, Webbing and papery appearance	01	*Crocidolomiabinotalis* (Zeller)	3.45
6.	Leaves zigzag leaf mines	01	*Phytomyzahorticola* (Goureau)	3.45
7.	Roots and stem, rottening	01	*Delia radicum*(Linnaeus)	3.45
8.	Stem and curd by boring	01	*Hellulaundalis* (Fabricius)	3.45
9.	Leaf mining or circular hole	01	*Plutellaxylostella*(Linnaeus)	3.45
10.	Leaves circular minute holes	01	*Phyllotretacruciferae* (Goeze)	3.45
11.	Leaves, marginal feeding	03	Grasshopper, katydids, cricket	10. 34
Total		29		100

In conclusion, the most widely distributed and prevalent orders of insects infesting cauliflower crop in Theni and Dindigul District noticed during the survey were Lepidoptera, Hemiptera, Orthoptera, Coleoptera, Diptera, Dermaptera, Dictyoptera, Thysanoptera, Hymenoptera and Acarina. The most successful natural enemies noticed during above mentioned districts were under the insect orders of Hymenoptera, Coleoptera, Diptera, Odonata, Neuroptera, Hemiptera and Araneae.

Acknowledgement

The first author is thankful to ICAR, India for providing the Senior Research Fellowship during the experiment. The authors are thankful to the farmers of Theni and Dindigul Districts for sparing their fields and manpower and to execute the survey during the year 2015-2017.

References

Agarwal, V. M., Rastogi, N., Raju, S. V. S. 2007. Impact of predatory ants on two lepidopteran insect pests in Indian cauliflower agroecosystems. *J. Appl. Entomol.*, 131: 493-500.

Anil, S., 2004. Studies on seasonal population fluctuations of aphid pests of cabbage and their predators.*Pest Management in Horticultural Ecosystems*, 10(1): 41-48.

Anita, Singh and Suchi, Gandhi. 2012. Agricultural insect pest: Occurrence and infestation level of agricultural fields of Vadodara, Gujarat. *International Journal of Scientific Research and Publications*, 2(4): 1- 5.

Bhatia, R., and Verma, A. K. 1993. Insect pests' complex of cabbage in Himachal Pradesh. *J. Insect Sciences*, 6(2): 297-298.

Bonnemaison, L., 1965. Insect pests of crucifers and their control. *Annual Review of Entomol*, 10: 233-256.

Chandramohan, N., 1994.Seasonal incidence of diamondback moth, *Plutella xylostella* (Linn.) and its parasitoids in Nilgiris. *J. Biol. Cont*., 8: 77–80.

Chaudhuri, N., Ghosh, S. and Senapati, S. K. 2001. Incidence of insect pests of cabbage in relation to prevailing climate conditions of Terai regions. *Indian J. Entomol*., 63(4): 421-428.

Chen, L.L., Kuang, M. Z., Zhen, Z. D., Cao, Y., and Xu, W. W. 1987. A survey of natural enemies of insect pests of vegetable crops in the suburbs of Guangzhou. pp. 393–399 in Fan, H.Z. (*Ed*.) *Integrated control of insect pests and diseases in vegetable crops*. Guangzhou, Guangzhou Science Technology Press (in Chinese).

Deeplata, S., and Rao, D. V. 2012. A field study of pest of cauliflower, cabbage and okra in some areas of Jaipur. *Int. J. Life science Botanical and Pharm. Res*., 1(2): 122-127.

Firake, D. M., Lytan, D., and Behre, G. T. 2012. Biodiversity and seasonal activity of arthropod fauna in Brassicaceus crop ecosystems of Meghalaya, North-east India. *Molecular Entomol*, 3(4): 18-22.

Haseeb, M., Kobori, Y., Amano, H. and Nemoto, H. 2001. Population density of *Plutella xylostella* (Lepidoptera: Plutellidae) and its Parasitoid *Cotesiaplutellae* (Hymenoptera: Braconidae) on two varieties of cabbage in an urban Environment. *Applied Entomology and Zoology*, 36(3): 353-360.

Indian Horticulture Database, 2015.*National Horticulture Board*, Ministry of Agriculture, Govt. of India.www.nhb.gov.in.

Jalali, S. K., Singh, S. P. and Venkatesan, T. 2003. Life table characteristics of *Trichogramma toideabactrae* Nagaraja at different temperatures on eggs of *Plutella xylostella* (Linn.). *Pest*

Management in Horticultural Ecosystems, 9(1): 13-17.

Lal, O.P., 1975. A compendium of insect pest of vegetables in India. *Bull.Entomol. Res*., 56: 16-31.

Lu, Y.X., 1983. A preliminary survey of natural enemies of larvae of *Plutella xylostella*. *Natural Enemies of Insects*, 5: 188–189.

Palande, P. R., Pokharkar, D. S., and Nalawade, P. S. 2004. Seasonal incidence of cabbage pests in relation to weather. *Pest Management in Horticulture Ecosystems*, 10(2): 151-156.

Raja, M., William, S. J. and David, B. V. 2014. Population dynamics of key insect pests of cabbage in Tamil Nadu. *Indian J. Entomol.*, 76(1): 01-07.

Ratnasri, M., 2012. Survey and management of defoliator pests of cabbage. M. Sc, *Theses*, University of Agricultural Sciences, Dharwad, pp-49.

Sachan, J. N., and Gangwar, S. K. 1990. Seasonal incidence of insect pests of cabbage, cauliflower and knolkhol. *Indian J. Entomol*., 52: 111-124.

Sachan, J. N., and Srivastava, B. P. 1972. Studies on seasonal incidence of insect pests of cabbage. *Indian J. Entomol*., 34: 123–129.

Sarfraz, M., Andrew, B. K. and Lioyd, M. D. 2005. Biological control of diamondback moth, *Plutella xylostella*: A review. *Biological Science and Technology*, 15: 763-789.

Singh, R. P., and Pal, S. 2014. Insect pest diversity in cauliflower and its relation to abiotic factors. *Ann. of Plant Protec. Sci*.,22:291-295.

Ushachauhan, Bhalla, O. P. and Sharma, K. C. 1997. Biology and seasonality of the diamondback moth, *Plutella xylostella* (Lepidoptera: Yponomeutidae) and its parasitoids on cabbage and cauliflower. *Pest Management in Horticultural Ecosystems*, 3(1): 7-12.

Wu, J.W., Wang, J. R., Wang, J., Shi, B. D., Wang, W., Wang, B. Z. Dong, Z. H. Wei, D. Z., and Huang, Q. F. 1987. A list of natural enemies of insect pests of vegetable crops in Beijing. *Acta Agricultura Boriali-Sinica*, 2: 75–96.

How to cite this article:

Arun Debbarma, J. Jayaraj, P. Chandramani, N. Senthil, M. Ananthan and Prabakaran, K. 2017. A Survey on Occurrence and Diversity of Insect Pests of Cauliflower in Dindigul and Theni Districts of Tamil Nadu, India. *Int.J.Curr.Microbiol.App.Sci.* 6(9): 2495-2505.
doi: https://doi.org/10.20546/ijcmas.2017.609.307