Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol 5 [4] August 2017: 01-08
Online ISSN 2321-1040
CODEN: RJCEA2 [USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Distribution and seasonal activity of anthocorid bugs (Hemiptera: Anthocoridae) in sub-temperate zone of Himachal Pradesh (India)

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ABSTRACT
Periodical field surveys carried out to record the distribution of anthocorid bugs on different flora infested with soft-bodied insect and mite pests. Present study revealed that both the prey and predators were associated with different plants hosts; their activity was noticed on various plants including vegetable crops, fruit crops, ornamentals and forest-wild flora. During field survey anthocorid bugs belonging to three genera and five species were identified which were:Anthocorisconfusus Reuter, Anthocoris dividens Bu and Zheng, belonging to Anthocorini tribe, Orius bifilarus Ghauriand Orius niger Wolff (tribe oriini) and Lippomanus brevicornis Yamada. Orius bifilarus was the predominant species on annual crops and was associated with 16 host plants, whereas O. niger was associated with 7 host plants. Both the species of Anthocoris, i.e. A. confusus and A. dividens were found to be associated primarily with one host plants, viz. Prunus persica and Bauhinia vahlii, respectively. Anthocorid bugs commenced their field activity in March, which continued throughout the year up to November on one or other crop or flora depending upon abundance of the prey for their multiplication. The peak period of activity, irrespective of species of the anthocorids, occurred in May (59 bugs/30 minutes) and October (82 bugs/30 minutes) in 2009, April (137) and June (141) in 2010, and April - May (121-118) in 2011.
Key words: *Anthocoris confuses; Anthocoris dividens; Orius bifilarus; Orius niger; Lippomanus brevicornis; Species; Field Survey.*

Received 20.05.2016 Accepted 02.08.2016

INTRODUCTION

The Anthocorid bugs, commonly known as minute pirate bugs or flower bugs, belong to the insect order Hemiptera and family Anthocoridae. Anthocorids possess many of the characteristics of an ideal biocontrol agent, such as high searching efficiency and feeding rate, short duration of development, density dependent response to the pest population and synchronization of predator and prey population [4,16]. They are associated largely with annual and perennial crops, forests, greenhouse crops, ornamental plants, and stored products. *Anthocoris* and *Orius* are the commonly occurring genera. Anthocorid bugs of genus *Orius* Wolff is predominating and more than 70 described species distributed in the Oriental, Ethiopian, Palaearctic, and Neotropical regions, but is relatively poorly represented in the Nearctic region [16]. Anthocoris Fallen, 1814 is the second largest genus in the family Anthocoridae, comprising more than 70 species worldwide [14,25,8,7,19]. The majority of species occur in the Holarctic Region, but the genus is most speciose in Asia, as about 40 species have been reported from China [7]. In India, *A. annulipes* and *A. indicus* Poppius was described, both from Sikkim, northeastern territory of the country. Subsequently, *A. nilgiriensis* Muraleedharan, 1977 from Tamil Nadu, southern India [23]. Species of the genus *Anthocoris* are commonly found on broad-leaved plants, particularly on trees, where they appear to feed on aphids, psyllids, thrips, mites, and other small arthropods [18]. Several species of *Anthocoris* are known as important biological control agents in temperate fruit orchards, where they feed extensively on pest psyllids and aphids [1,15,18]. Many species of *Anthocoris* feed on aphids living in plant galls [30]. In the western Palearctic Region, *A. nemoralis* [11] and *A. nemorum* [22] have been well studied as major predators on pear and apple [21].

Orius appear to be particularly important in the natural control of mites and soft bodied insect pests in a variety of agricultural and horticultural crops [2]. Several species of *Orius* have been found in orchards

including *O. insidiosus* (Say), *O. vicinus* (Ribaut), *O. majusculus* (Reuter), *O. niger*(Wolff) and *O. minutus* (L.) [17,20,33], where they feed on small insects. *Orius* spp. occur in greenhouses and in variety of row crops, where they feed on thrips, mites, aphids, and eggs of pest Lepidoptera and Coleoptera. These predators may be particularly important natural enemies of flower thrips [32]. Several studies show that *O. albidipennis* (Reuter), *O. majusculus* (Reuter) and *O. laevigatus* (Fieber) can maintain populations of *Frankliniella occidentalis* (Pergande) and *Thrips tabaci* Lindeman (Thysanoptera: Thripiae), below economic thresholds [26,10]. The aim of this study was to find the distribution and seasonal activity of anthocorid bugs on different flora infested with soft-bodied insects (aphids, psyllids, thrips, etc.) and mites.

MATERIALS AND METHODS

Periodic observations at weekly interval were carried out for recording the population of anthocorid bugs in the University Campus, Nauni in Solan district of Himachal Pradesh (sub-temperate zone) during the period from March to December for two years (2009-2010) and from March 2011 to August 2011. For collection of these bugs different vegetable crops {*Cucumis sativus* (L.) , *Phaseolus vulgaris* (L.) and *Solanum tuberosum* (L.)}, field crop (*Zea mays* L.), fruit crops {*Malus domestica* Borkh. and *Prunus persica* (L.) Batsch}, ornamentals (*Callistemon lanceolatus* (Sm.), *Cosmos sulphureus* Cav., *Dahlia X hybrida* Cav., *Clarkia amoena* (Lehm.) A.Nels. & J.F.Macbr, *Hibiscus rosa-sinensis* L., *Polianthes tubrosa* L., *Rosa* spp.) and wild flora {*Albizia lebbeck* (L.) Benth, *Bauhinia vahlii* Wight & Arnott and *Eucalyptus hybrid*} infested with soft bodied insects (aphids, psyllids, thrips, etc.) and mites were surveyed. In order to follow a standard methodology for each crop, mainly the flowers and apical growing buds were monitored and anthocorids (adults and nymphs) were collected by beating the flowers and apical buds onto a plastic bag. Sampling continued for 30 minutes, but when no specimen could be obtained it was prolonged to 1 hour. Vegetable crops, field crops and ornamental plants are small in height and maximum 6-6.5 feet was searched for specimens but in case of fruit crops and wild flora, specimens were collected up to the height of 10-12 feet The collected specimens were brought to the laboratory and counted as males, females and nymphs. Adult anthocorids were first identified to genus level on the morphological features of the body, wings, antenna, pronotum, pseudarolia, collar, etc. by using key [23]and then to species level by observing male and female genitalia. Slides for identification of male and females genitalia were prepared according to the methodology [27,19]. Identification was done by using the details given by different authors for different species [12,7,19,35].

RESULT AND DISCUSSION

Anthocorid bugs belonging to three genera and five species were identified from Solan area, which were *Anthocorisconfusus* and *A. dividens* Bu and Zheng, [7] 2001, belonging to the tribe Anthocorini, *Orius bifilarus* [12] and *O. niger* belonging to the tribe Oriini and *Lippomanus brevicornis* [35] belonging to the tribe Almeidini, the last one got attracted to white paper sheet spread over debris in the cucumber field. These were collected from 16 plant species (herbs, shrubs and trees). The maximum population of *Orius* was noticed on annual crops, whereas *Anthocoris* was observed on trees. *Orius bifilarus* was the predominant species in sub temperate area on annual crops and was associated with all 16 host plants from which anthocorids were collected during the period of study whereas *O. niger* was associated with 7 host plants (Table 1a). Both the species of *Anthocoris*,i.e. *Anthocoris confusus* and *A. dividens* were found to be associated primarily with one host plants, *viz*. peach (*Prunus persica*) and bauhinia (*Bauhinia vahlii*), respectively (Table 1b). Study of Tommasini [30], revealed the association of *Orius* species mainly with annual crops. They collected *Orius* from 19 vegetable crops, 10 ornamental crops and from 5 wild plants in Italy. In the present study, *Orius* spp. were collected from 16 plant species (herbs, shrubs and trees). In Pakistan, *O. bifilarus* was collectedfrom 11 plant species infested mainly with thrips and mites [12] and from cotton in India infested with *Aphis gossypii* (Glover). *O. insidiosus* collectedindividuals more commonly from flowers [9]. They also collected specimens of *Orius* from trees. *Orius niger* as well as *A. confusus* feeding on grass aphids infesting grains and bird cherry were collected from the forest-steppe zone of Western Siberia [5].

Anthocorid bugs commenced their field activity in March, which continued throughout the year up to November on one or other crop or flora depending upon abundance of the prey for their multiplication. The peak period of activity, irrespective of species of the anthocorids, occurred in May (59 bugs/30 minutes) and October (82 bugs/30 minutes) in 2009, April (137) and June (141) in 2010, and April - May (121-118) in 2011 till continuance of observations (Figure 1). During winter months (December to February) no specimen could be collected in both the years (2009 and 2010) of study. Thus each year, there were two peaks of activity which depended upon prevalence of activity of the pest, as predators

tend to increase their populations depending upon suitability of biotic and abiotic factors, primarily on availability of the quality food material.

Amongst the five species collected from the study area, *Orius bifilarus* was the predominant throughout the year (Figure 2). *Orius* nymphs and adults were collected by beating flowers or terminal buds [30]. Same technique was used to capture the *Orius* species and these bugs were mostly collected from annual crops. During 2009 and 2010, the capture of *O. bifilarus* was 71.3 and 73.8 per cent, respectively. However, in 2011, *A. confusus* and *O. bifilarus* were predominant among anthocorids collected up to August with respective capture of 49.4 and 38.6 per cent. There were two peak activity periods of *O. bifilarus* during first two years. These were noticed during April (26bugs/30min) and October (82bug/30min) in 2009, and same pattern was observed during April and September-October 2010 (66 and 55-56 bugs/30 minutes, respectively), while up to August of 2011 the peak period of activity was during June (46 bugs/30 min) (Figure 3). *O. niger* was the second species of *Orius* noticed in the surveyed area. However, it was sparingly collected during the study period; their count was 3-6 bugs/30 minutes in March, May, August and November, 2009 and a maximum catch of 15bugs/30minutes was obtained in September. During 2010 it was observed in March, June, August and September (1-5 bugs/30min), while up to mid of 2011 its activity was observed only in March and May (1 and 5 bugs/30min) (Figure 4). Adults of *Orius bifilarus* were noticed for the first time among the flowers of *Prunus persica* feeding on thrips, mainly in second week of March in 2009 and 2011 and in third week of March in 2010, whereas adults of *O. niger* were noticed for the first time in the second week of March during three years of study among the flowers of *Prunus persica.*

Table 1a. Prevalence and association of *Orius* spp. with different host plants in Solan area (Himachal Pradesh)

Month	Week	*Orius bifilarus*		
		2009	**2010**	**2011**
March	II	Pr(F): 3♀,1♂	-	Pr(F): 2♀
	III	Pr(F): 3♀,1♂,IN; Ca(F): 1♀	Pr(F): 2♀	Pr(F): 3♀,1♂
	IV	Pr(F): 1♀; Eu(F): 1♀	Pr(F): 1♂	Pr(F): 1♀,2♂,6N
April	I	Pr(F): 3♂,1N; Eu(F): 3♀,1♂	-	Pr(F): 4♀,3♂
	II	Ca(F): 2♀,1♂; Eu(F): 3♀,2♂	Pr(F): 1♀,1♂; Al(L): 6N	Pr(F,L): 2♀,2♂,4N
	III	Pr (F,L): 1♀,1♂,1N; Ca (F): 2♂; So(A,F): 3♀,2♂	Al(L): 2N; Ma(L,F): 6♀,3♂,35N	Pr(F,L): 1♀,3♂,1N; Al (L,F): 2♀,1N
	IV	Pr(L): 1♂,1N; So(A,F): 1♂	Al(L,F): 4♀,1♂,7N	Pr(F,L): 1♂,1N
May	I	Pr(L): 1N; So(A,F): 1♂	Al(L,F): 3♀,3♂,4N	Pr(L): 3♀, 2♂
	II	Pr(L): 1♀,1♂,1N; Ro(F): 1♀	Al(L,F): 1♀,2♂,2N	Pr(L): 1♀, 2♂,4N
	III	Pr(L): 2♂	Al(L,F): 2♀,1♂,1N	Pr(L): 1♀,3♂,1N; Ba(F): 2♀
	IV	Ph(A,F): 3♀,2♂	-	Pr(L): 3♀,1♂; Ba(F): 2♀,1♂
June	I	-	Al(L,F): 2♀; Ba(F): 3♀; Cu(A,F):1♀,1N	Cu(A,F): 2♀,1N
	II	Ph (F): 1♀,1♂	Ba(F): 2♀,1♂; Cu(A,F): 9♀,1♂,5N	Cu(A,F) : 3♀,2♂,5N; Ma(L): 2♀; Ro(F): 7♀,11♂,3N
	III	-	Cu(L,F): 6♀,3♂	Cu(L,F): 2♀,4♂
	IV	Ph (A,F): 1♀,3N	-	Cu(L,F): 1♀,3♂
July	I	Ph (A,F): 2♀,4♂,1N	Cu(A,F): 2♀,2♂,2N	Cu(A,F): 1♀,3♂,2N
	II	Ph (A,F): 1♂	Cu(A,F): 12♀,7♂,4N	Cu(A,F): 2♀,3♂,1N
	III	Cu(A,F): 2♀,1N	Cu(A,F): 11♀,2♂,2N	-
	IV	Cu(A): 3♀,2♂,2N	-	Cu(A,F): 2♀,3♂
August	I	Cu(A,F): 1♀,2♂	Cu(A,F): 5♀,3♂,1N; Ze(T): 3♀	-
	II	Cu(A,F): 1♀,2♂	Cu(A,F): 4♀,1♂,3N; Ph(A,F): 3♀, 3♂; Ze(T): 2♀, 1♂	Cu(A,F): 2♀
	III	Cu(A,F): 1♀,2♂,2N	Ze(T): 4♀,1♂,3N; Ph(F): 6♀,5♂	Cu(A,F): 1♀,3♂
	IV	Cu(A,F): 3♀,1N	Ph(F): 1♀	-
September	I	Cu(A,F): 1♀,2♂,3N	Cu(A,F): 2♀,3♂; Ph(F,L): 1♂; Co(F): 5♀, 3♂,2N	-
	II	Cu(A,F): 3♀; Ze(T): 3♀,4♂; Go(F): 2♀,1♂, 1N; Da(F): 1♂	Cu(A,F): 1♀; Ze(T): 2♀,1♂; Da(F): 4♀,1♂; Go(F): 2♂; Hi(F): 2♀; Ro(F): 1♂	-
	III	Ze(T): 4♀,2♂,2N; Go(F): 2♀	Da(F): 5♀,3♂; Go(F): 2♀,3♂; Hi(F): 2♀	-
	IV	Cu(A,F): 2♀,1♂	Da(F): 4♂; Go(F): 1♀,2N; Hi(F): 1♀,2♂	-
October	I	Cu(A,F): 3♀,2♂,2N; Ze (T): 3♀,3♂,1N; Go(F): 2♀,1♂; Da(F): 3♀,2♂; Cs(F): 2♀	Cu(A,F): 4♀,3♂,3N; Co(T): 2♀,3♂; Da(F): 1♀, 3♂	-

	II	Ze(T): 4♀,1♂,3N; Go(F): 5♀,4♂,2N; Da(F): 4♀,2♂,1N; Cs(F): 2♀; Po(F): 2♀,1♂; Hi(F): 1♀	Cu(A,F): 3♀,3N; Da(F): 4♀, 2♂,7N; Go(F): 2♂	-
	III	Ze(T): 1♀,1♂; Cs(F): 1♀,2N	Cu(A,F): 2♀,3♂; Da(F): 2♀,5♂	-
	IV	Go(F): 5♀,2♂; Da(F): 2♀,3♂; Cs(F): 3♀, 1♂,1N; Po(F): 2♀; Hi(F): 1♀,1♂	Cu(A,F): 1♀; Da(F): 3♂	-
November	I	Go(F): 1♀,2♂; Da(F): 1♀; Cs(F): 2♀,2♂; Po(F): 1♀,1♂	Da(F): 1♀,3♂	-
	II	Go(F): 3♂; Da(F): 2♂; Cs(F): 1♀,3♂,1N	Da(F): 1♀	-
	III	Cs(F): 1♀,1N	-	-
	IV	Cs(F): 1♀,1♂	-	-
December	I	Cs(F): 1♀	-	-
Orius niger				
March	II	Pr(F): 1♂	Pr(F): 1♀,1♂	Pr(F): 1♂
	III	Pr(F): 1♀,1♂	Pr(F): 2♀	-
May	II	-	-	Cu(A,F): 2♀,1♂
	III	Pr(L): 2♂	-	Cu(A,F): 1♀, 1♂
	IV	Ph(A,F): 1♀,1♂	-	-
June	I	-	Cu(A,F): 2♀,1♂	-
	IV	-	Cu(A,F): 1♀,1♂	-
August	I	Cu(A,F): 1♂	-	-
	II	Cu(A,F): 1♀, 2♂	Ze(T): 2♀,2♂	-
	III	Cu(A,F): 2♀	Ze(T): 1♂	-
September	II	Ze(T): 2♀,1♂; Da(F): 2♂	Da(F): 1♂	-
	III	Da(F): 2♂	-	-
	IV	Da(F): 4♂; Go (F): 1♀,2N; Hi (F): 1♀,2♂	-	-
November	I	Go(F): 2♀,1♂	-	-
	II	Go(F): 1♀,2♂	-	-

Table 1b. Prevalence and association of *Anthocoris* spp. with different host plants in Solan area (Himachal Pradesh)

Month	**Week**	***Anthocoris confusus***		
		2009	**2010**	**2011**
March	III	-	Pr(L): 2♀,1N	-
	IV	Pr(L): 1♀	Pr(L): 2♀,9♂,5N	Pr (L): 2♀
April	I	Pr(L): 1♂	Pr(L): 4♀,12♂,8N	Pr(L): 4♀, 2♂
	II	Pr(L): 1♀,2♂	Pr(L): 7♀,5♂,10N	Pr(L): 10♀, 9♂,6N
	III	Pr(L): 2♂,3N; So(A,F): 1♂	Pr(L): 7♀,3♂,6N	Pr(L): 16♀,10♂, 11N
	IV	Pr(L): 2♀,1N	Pr(L): 3♀,3♂,2N	Pr(L): 12♀, 7♂,9N
May	I	Pr(L): 2♀,4N	Pr(L): 1♀,3N	Pr(L): 10♀, 8♂,6N
	II	Pr(L): 3♀,2♂,10N	Pr(L): 2♀,1♂	Pr(L): 6♀, 7♂,1N
	III	Pr(L): 2♀,5♂,7N	Pr(L): 1♀	Pr(L): 6♀, 5♂,3N
	IV	Pr(L): 3♂,4N	Pr(L): 1♀	Pr(L): 7♀, 3♂,2N
June	I	-	-	Pr(L): 4♀, 2♂
	II	Pr(L): 2♂	-	Pr(L): 2♀, 1♂
	III	-	-	Pr(L): 2♀
Anthocoris dividens				
May	III	-	-	Ba(F): 1♀
	IV	-	-	Ba(F,L): 2♀,1♂
June	I	-	Ba(F): 1♂	Ba(F): 2♀,1♂
	II	-	-	Ba(F): 2♂; Pr (L): 1♀
	III	-	-	Ba(F): 1♀,1♂
	IV	-	Ba(L): 2♀	-

Table 1c. Prevalence and association of *Lippomanas* brevicornis with different host plants in Solan area (Himachal Pradesh)

Month	**Week**	***Lippomanas***		
		2009	**2010**	**2011**
May	IV	-	-	Cu(F): 1♀,14♂

Abbreviations for different host plants used in tables (1a,1b, and 1c): A - Apical bud, Al - *Albizia lebbec*k,Ba - *Bauhinia vahlii*,Ca - *Callistemon lanceolatus,* Cs - *Cosmos sulphureus*,Cu - *Cucumis sativus*, Da - *Dahliax hybrida*, Eu - *Eucalyptushybrid*,F - Flower,Go (Godetia) – *Clarkia amoena*, Hi -*Hibiscus rosa -sinensis*,L - Leaves,Ma - *Malus domestica*,N – Nymph, Ph - *Phaseolus vulgaris*,Po - *Polianthes tubrosa*,Pr - *Prunus persica*, Ro - *Rosa*,So - *Solanum tuberosum*,T - Tassel,Ze - *Zea mays*,

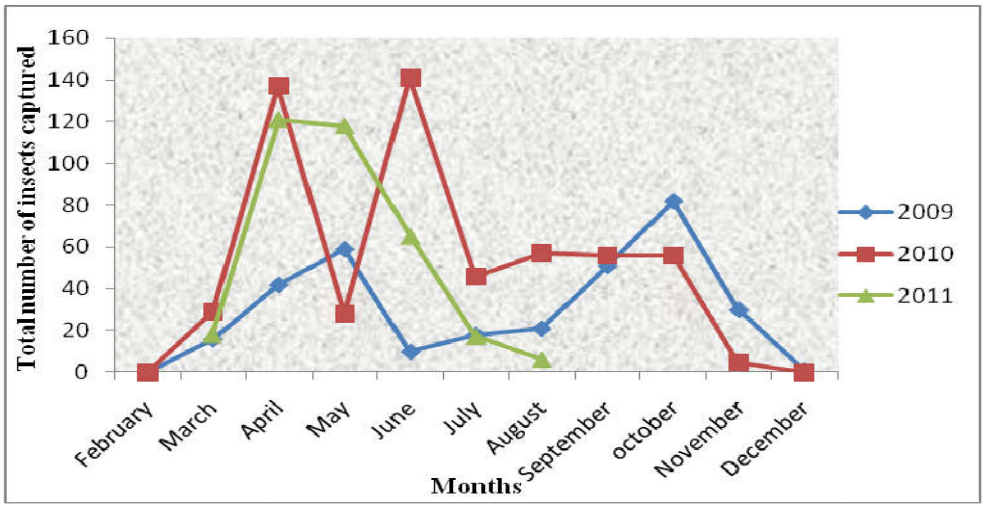

Fig.1. Activity of Anthocorids during three progressive years (2009-2011)

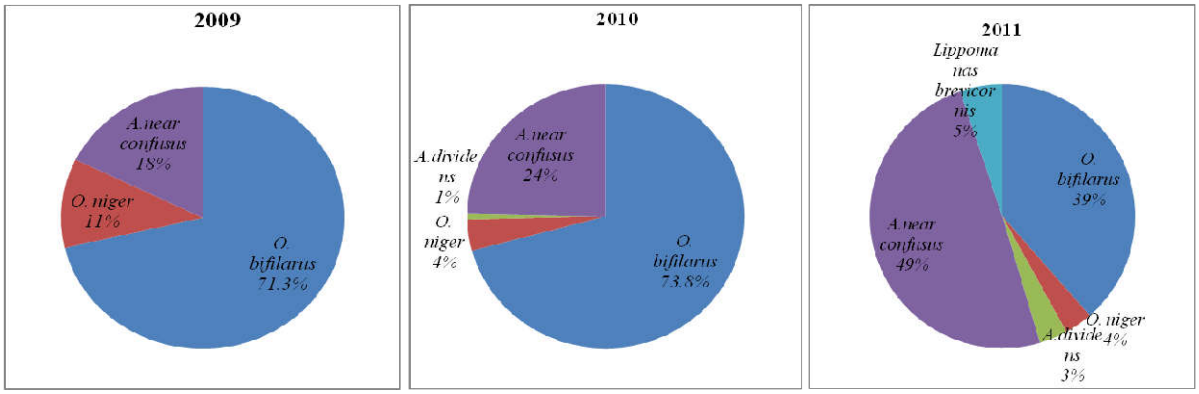

Fig.2. Percentage capture of five anthocorids during 2009 to 2011

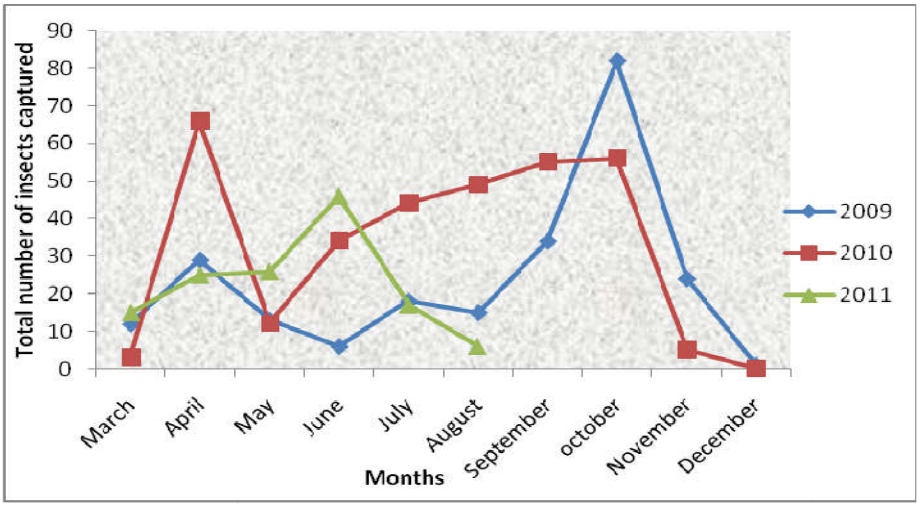

Fig. 3. Activity of *O. bifilarus* during the period of study (March 2009 - August 2011)

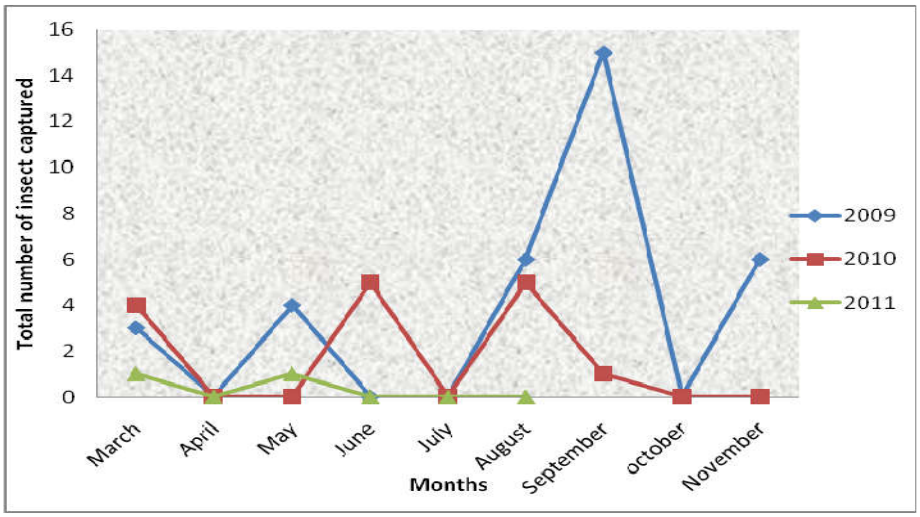

Fig. 4. Activity of *O. niger* during the period of study (March 2009 - August 2011)

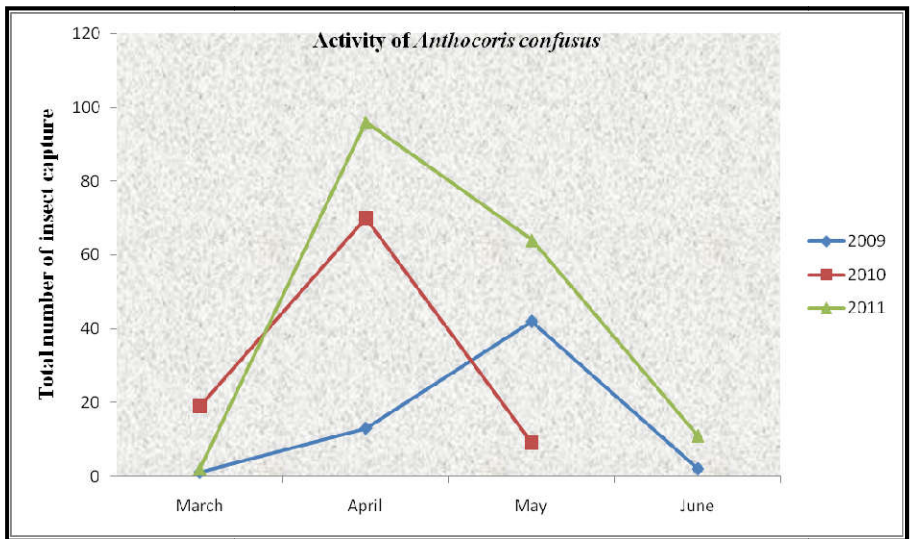

Fig. 5. Activity of *Anthocoris confusus* during three progressive years (2009-2011)

Earlier in Himachal Pradesh, *Anthocoris minki* Dohrn has been reported feeding on the peach leaf-curl aphid infesting peach and other stone fruits from Shimla [31] and Solan [13], while *A. confusus* on almond trees infested with the peach leaf-curl aphid was reported from Kinnaur district [3]. Some author observed the predator activity during March to August on aphid-infested almond trees with peak period of activity in April-May [3]. However, in Solan, its activity persisted on peach trees only for short period of March to June with a peak period of activity during April in 2010 and 2011, and in May in 2009. Invariably this species was collected from peach tree infested with the peach leaf curl aphid [*Brachycaudus helichrysi* (Kalt.)]. Only one male of this bug was also collected from floral bud of potato field in 2009. With the population build up of the peach leaf curl aphid, the bug population also started to increase to attain peak activity in May 2009 (42 bugs/30min) and such a peak activity was noticed in April 2010 (70 bugs/30min) and 2011 (96 bugs/30min) (Figure 5). Thus, with rising of brood by the overwintering generation of the bug due to rapid increase in aphid population in April-May, bug population was at its peak in April-May. Thereafter, the activity gradually declined towards June, when the aphid population had deserted the peach trees. Not even a single specimen of *A.confusus* could be collected after III week of June and it could not ascertained whether it overwintered thereafter or continued its generation on some other prey infesting other flora. Present observation is contradictory to earlier reports of occurrence of *A. minki* in Solan and Shimla districts of Himachal Pradesh. During the study period not even a single specimen of *A. minki* was collected and all specimens matched with those of *A. confusus*. Horton and Lewis, 2009 stated that *A. confusus* was a common European species which is more of a tree dwelling type. They collected adults and nymphs of *A. confusus* from deciduous trees in Western Washington State from European beech (*Fagus sylvatica*) and linden (*Tilia* sp.) trees infested with the aphid, *Eucallipterus tiliae*. Another species recorded in this area was *A. dividens.* This species is being reported from India for the first time. It was collected mainly from *Bauhinia vahlii* infested with

thrips and aphids. However, one female of this species was collected from the peach foliage along with *A. confusus*. Activity period of this species on *B. vahlii* was May and June. This species was described from China, where it is distributed in Yunnan and Sichuan Province at altitude of 2700m [7]. Recentlya new species, *A. muraleedharani* Yamada, 2010from *Bauhinia purpurea* [34]. While *Anthocoris confusus* wasobserved on trees mainly infested with aphids, *Anthocoris dividens* was active on trees infested with thrips and psyllids. Adults of *A. confusus* were noticed for the first time among curled leaf-whorls filled with *B. helichrysi* aphids on peach trees in the fourth week of March in 2009 and 2011 and in the third week of March in 2010. The first record of appearance of *A. minki* in the second week of March and first week of April [28]. However, activity of *A. confusus* was noticed on almond trees for a long period of six months (March to August) and bugs were in abundance in April-May in Kinnaur district (H.P.)[3]. On the contrary, predator activity lasted only for 3 months in Solan district of Himachal Pradesh. This indicated that the overwintering adults became active in March, when weather conditions was favourable and at that time peach was having thrips and aphids infestation, which provided abundant prey to them. *A. confusus*was too collected, first on 27th March in 1959 and on 22nd March in 1960 from *Salix* spp., *Fagus sylvatica*, *Tilia* X *vulgaris* Hayne, *Quercus robur* L. and *Acer pseudoplatanus.* L [4]. He noticed a single generation of *A. confusus* and peak appearance of adults during July. *A. nemorum*was collected in mid March in 1959 and 1960 [4] but noted that the exact date of spring emergence depended on weather conditions and it was between 23rd March and 16th April Scotland [15].

Besides these two genera, another genus *Lippomanusbrevicornis*was also sampled. This species was collected only once in 2011 from the plant refuge in the field of cucurbits, when 14 males and 1 female got congregated on a white paper sheet placed above the plant debris (Table 1c). This species is also being reported for the first time from India. Some author also described this species from Japan, collected its specimens from light trap. They also collected some individuals from leaf litter layers or clusters of withered leaves on the ground [35].

CONCLUSION

Anthocorid bugs commenced their field activity in March, which continued throughout the year up to November on one or other crop or flora depending upon abundance of the prey for their multiplication. The peak period of activity, irrespective of species of the anthocorids, occurred in May (59 bugs/30 minutes) and October (82 bugs/30 minutes) in 2009, April (137) and June (141) in 2010, and April - May (121-118) in 2011. Therefore, it concluded that anthocorid bug are effective as a bio-control agents against soft bodied insect pest.

ACKNOWLEDGMENT

Authors would like to Vice Chancellor of Dr Y.S. Parmar University of Horticulture and Forestry, Solan (H.P)-India, for providing necessary facilities in Field station and Entomology & Apiculture research Laboratory.

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CITE THIS ARTICLE

Nisha Devi, P.R Gupta and Budhi Ram. Distribution and seasonal activity of anthocorid bugs (Hemiptera: Anthocoridae) in sub-temperate zone of Himachal Pradesh (India). Res. J. Chem. Env. Sci. Vol 5 [4] August 2017. 01-08