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STUDIES ON THE POPULATION DENSITY AND FLIGHT ACTIVITY OF THE PENTATOMID BUGS, *DOLYCORIS INDICUS* STAL AND *EURYDEMA PULCHRUM* WESTWOOD ATTACKING AGRICULTURAL CROPS IN KASHMIR VALLEY

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A B S T R A C T

The population density of pentatomid bugs was worked out in major vegetable growing belts of Kashmir valley during the cropping season of 2013-14. For the study of population densities field observations of two common species of Pentatomid bugs were carried out. The species namely *Eurydema pulchrum* and *Dolycoris indicus* were found in highest numbers from two selected districts of Kashmir Viz., Srinagar and Budgam. The number of individuals of specified species collected in different seasons, months and weeks at a site in district Srinagar (Batapora) indicate that the highest population density of the species was in the summer season while it was very low in spring and autumn season. Flight activity of the pentatomid pests varies with species, seasons and the site. The maximum flight activity was observed in early summer and in late summer. The flight activity continued until November depending upon the temperature nonetheless during this month, flights were usually of very low incidence. The flight activity of plant bugs stopped altogether during winter months in Kashmir valley. Based on these studies, the agricultural crops could be saved from bug attack by timely intervention and application of suitable management tactics to reduce their populations below economic injury level.

Keywords: Population density, Flight activity, Seasonal variations, Pentatomid pests.

INTRODUCTION

Perusal of the literature reveals that scantly research has been done on the different aspects of the population dynamics of the stink bugs. Stavroki (1979) studied the distribution and abundance of pentatomid bug, injurious to cereals in France. Todd (1981) observed the effects of the stink bugs on soyabean and reported four species, *Nezara viridula*, *Acrosternum hilare*, *Euschistus servus* and *Piezodorus guildini* as a wide spread pests in America. Fortes and Grazia (2000) provided distribution maps of about twenty species of genus Rio of family Pentatomidae of south and Central America. Ahmad & Akhter (2015) studied the taxonomy and biology of two pentatomid pests, *Dolycoris indicus* and *Eurydema pulchrum* attacking agricultural crops in Kashmir notwithstanding, in India no detailed work on population dynamics of pentatomid bugs has been done so far. Altogether neglected study on population dynamics on Pentatomid bugs encouraged the authors to undertake the present work comprehensively. Therefore, the present paper deals with the detailed investigations on population densities and flight patterns of the two pentatomid pests attacking agricultural crops in Kashmir so as to monitor overall population fluctuations of sting bugs in Kashmir and conversely the timely intervention for their management.

MATERIAL AND METHODS

The pentatomid bugs were collected from two districts of Kashmir valley during the years 2013-14. The specimens were collected from different agricultural sites. To study population dynamics, field observations on two species of pentatomid bugs were made from January 2013 to December 2014.

Collection and Sampling: The collection and sampling of the specimens was done by the following methods:

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- **Hand picking method:** As the name indicates hand collection techniques are nothing more than simple collection of the stink bugs by hand directly from the host plants. This technique was employed especially when the insects were resting, feeding or were in copulation state. However in certain cases additional equipments like forceps were used for picking up the bugs from the host plant.
- **Net sweeping:** The bugs were captured by sweeping net from the agricultural crops. The entomological net used for the collection purpose of Stink bugs were of 12 inches in diameter with a handle length of $1^{1/2}$ feet. The net sweeping method for the study of population dynamics was found successful, since the adults of the pentatomid bugs were easily caught due to their abundance in open vegetation. The insects were collected weekly for an hour from the selected areas. The specimens were preserved in separate vials containing 70% alcohol. The number of individuals of each species collected during different weeks and months of the year were recorded. The collection was always made in the afternoon. Meteorological records were obtained from the Meteorological Department, Srinagar, Kashmir, India. Sampling at different sites was carried out to study the population density and flight activity of pentatomid bugs by following Grootaert *et al*. (2010) and Wang (2011).

RESULTS AND DISCUSSION

The number of individuals of *Eurydema pulchrum* collected in different seasons, months and weeks at a site in district Srinagar (Table-1; Fig. 1) indicates that the highest population density of this species was in the summer season. Very low population density of this species was observed in the spring and autumn season. Further the highest number of individuals of *Eurydema pulchrum* was noticed in the month of July which accounts to about 40% of the total catch during 2013-14. The field observations indicate that during the early summer, these individuals were not visible in the field. But on the onset of summer season, *Eurydema pulchrum* showed a steady rate of increase in population with relatively sharp increase in temperature. Again in autumn season, the infested host plants showed decline in the number of this species. Likewise *Dolycoris indicus* though less in number as compared to *Eurydema pulchrum* was noticed to exist in high population in summer season especially in the month of July. The number of individuals of the species, *Dolycoris indicus* collected in different months of different years at a site in district Budgam is indicated in Table. 2; Fig. 2. The field observations of this species reveal that very low number of individuals of this species was noticed in the month of May during the year 2013 and in the month of October, 2014. Highest density of this species was noticed in the summer season which accounts to about 78% of the total catch in year 2014.

From these observations, it can be concluded that maximum number of individuals of these species are found in the month of June and July. This indicates that pentatomid insects show a steady rate of increase in population with a relatively sharp increase in temperature. Flight activity of *Eurydema pulchrum* was greatest in the month of June and July. The flight activity of this species was noticed in the fields of cruciferous crops in the Budgam and Srinagar districts of Kashmir in the month of May during the year 2013 and in the month of April during the year 2014. The flight activity of two species at two different sites was observed four times per two hours. The flight activity of *Eurydema pulchrum* continued until September and stopped altogether in October. Flight activity of *Dolycoris indicus* was greatest in the month of July. The flight activity of the species continued up to October and stopped completely in the month of November in the valley. Temperature was found to be the primary factor governing the flight activity of all most all the pentatomid pest species. Because insects are ectothermic, temperature is probably the single most important environmental factor influencing insect behaviour, distribution, development, survival and reproduction. As a result growing degree-days are commonly used to estimate insect development, often relative to a biofix point i.e. a biological milestone, such as when insect comes out of population in spring. Degree days can help with pest control.

Yamamura and Kiritani (1998) approximated the development rate r as:

$$r = \begin{cases} \frac{T - To}{K} & T \geq To \\ 0 & T \leq To \end{cases}$$

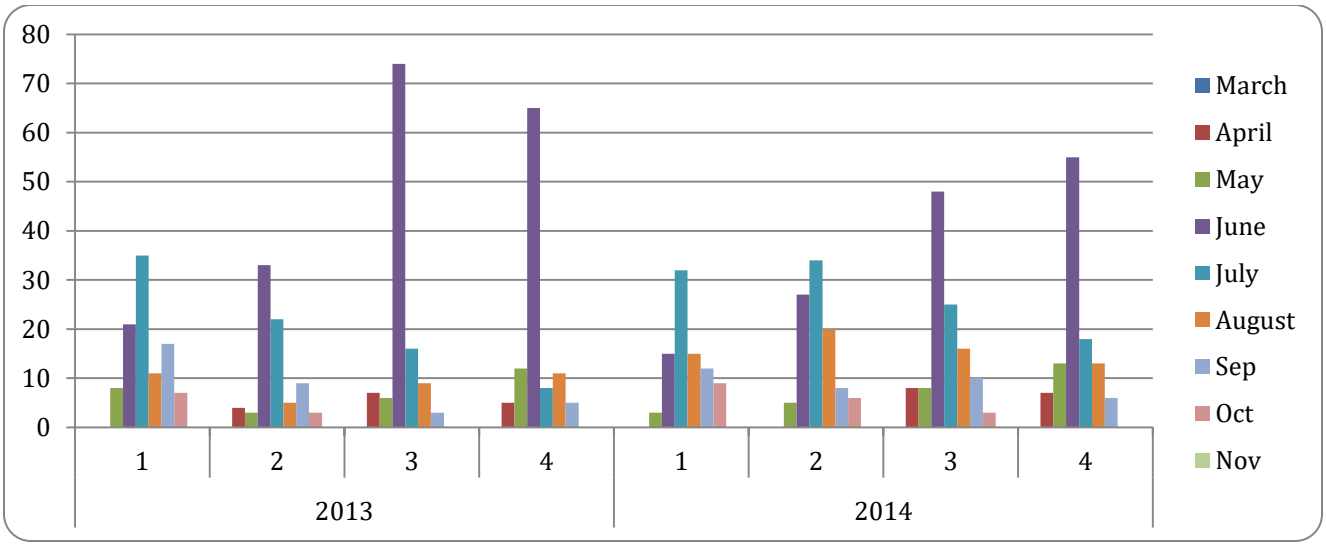

Figure 1. Bar chart showing total number of individuals of *Eurydema pulchrum* during the years, 2013 & 2014.

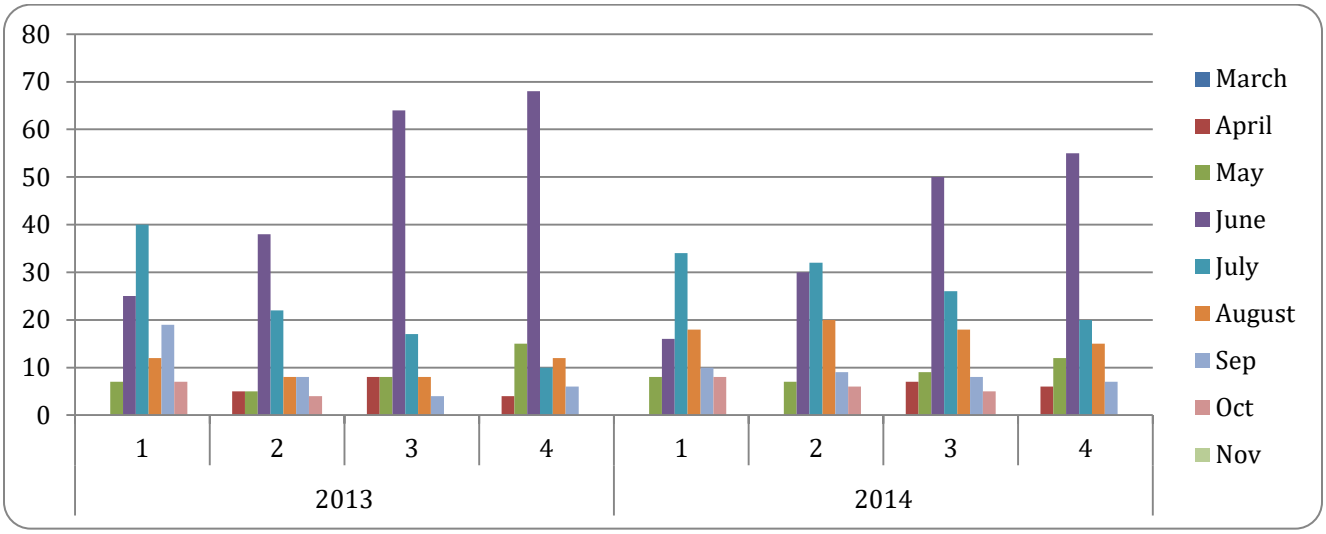

Figure 2. Bar chart showing total number of individuals of *Dolycoris indicus* during the years, 2013 & 2014.

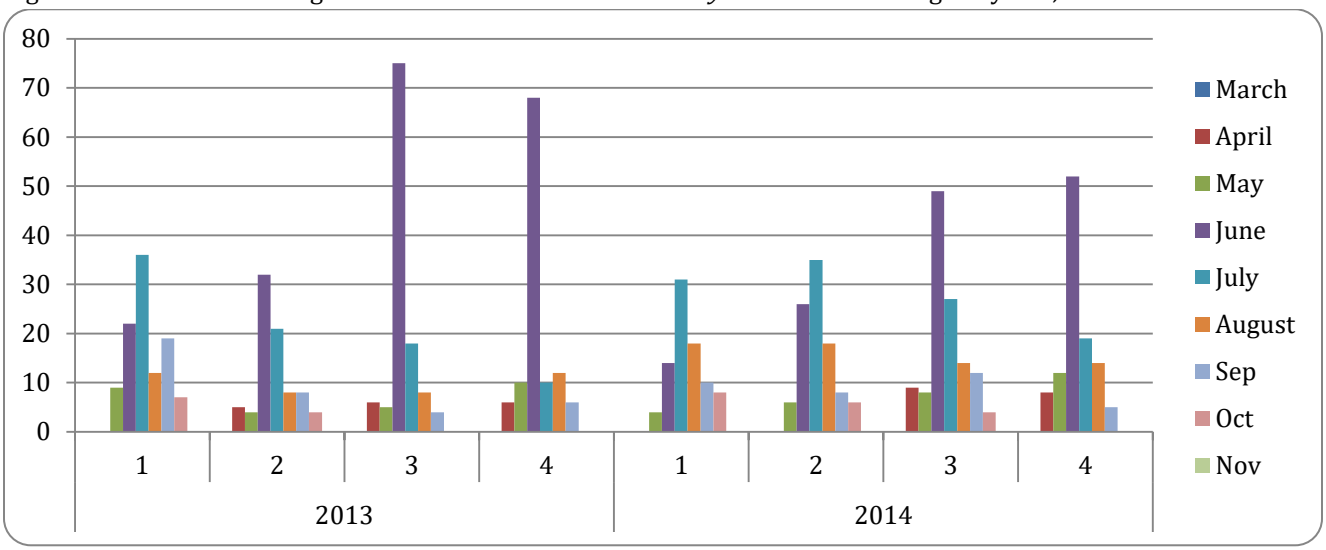

Figure 3. Bar chart showing total number of individuals of *Eurydema pulchrum* during the years, 2013 & 2014.

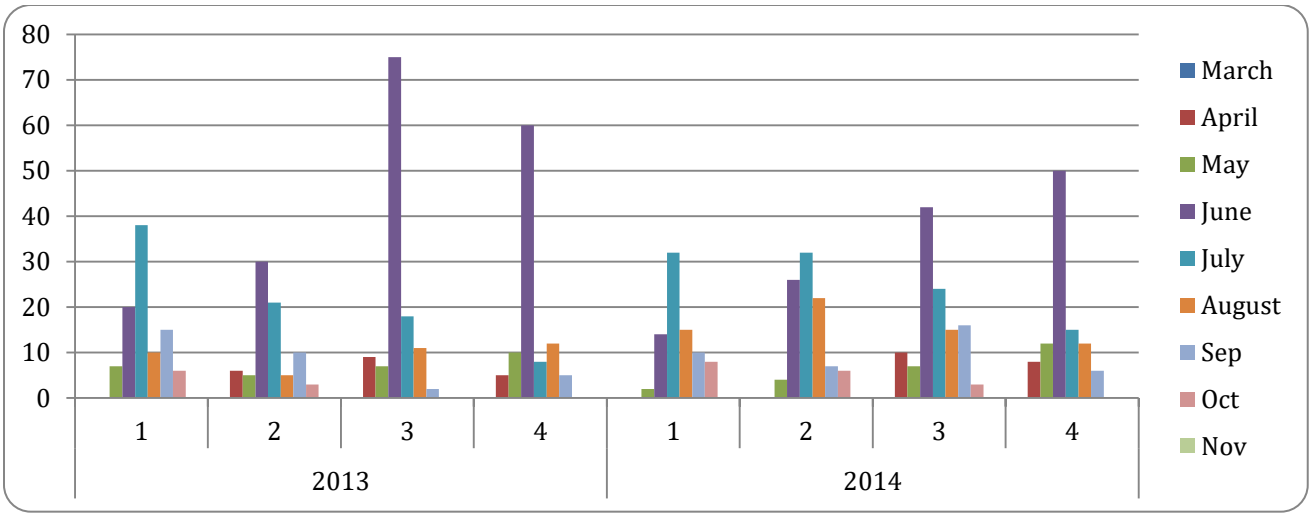

Figure 4. Bar chart showing total number of individuals of *Dolycoris indicus* during the years, 2013 & 2014.

Figure 5. Showing adults of pentatomid bugs, *Dolycoris indicus* and *Eurydema pulchrum*.

Table 1. Number of overall individuals of *Eurydema pulchrum* collected in different seasons/ months/weeks in district Budgam during 2013 & 2014.

Season	Month	Total catch per week							
		2013				2014			
		1	2	3	4	1	2	3	4
Spring	March	-	-	-	-	-	-	-	-
	April	-	4	7	5	-	-	8	7
	May	8	3	6	12	3	5	8	13
Overall		45				44			
		1	2	3	4	1	2	3	4
Summer	June	21	33	74	65	15	27	48	55
	July	35	22	16	08	32	34	25	18
	August	11	05	9	11	15	20	16	13
Overall		320				318			
		1	2	3	4	1	2	3	4
Autumn	Sep	17	9	3	5	12	8	10	6
	Oct	7	3	-	-	9	6	3	-
	Nov	-	-	-	-	-	-	-	-
Overall		44				54			
Total		409				416			

Table 2. Number of overall individuals of *Dolycoris indicus* collected in different seasons/ months/weeks in district Budgam during 2013 & 2014.

Season	Month	Total catch per week							
		2013				2014			
		1	2	3	4	1	2	3	4
Spring	March	-	-	-	-	-	-	-	-
	April	-	5	8	4	-	-	7	6
	May	7	5	8	15	8	7	9	12
Overall		52				49			
		1	2	3	4	1	2	3	4
Summer	June	25	38	64	68	16	30	50	55
	July	40	22	17	10	34	32	26	20
	August	12	8	8	12	18	20	18	15
Overall		324				334			
		1	2	3	4	1	2	3	4
Autumn	Sep	19	8	4	6	10	9	8	7
	Oct	7	4	-	-	8	6	5	-
	Nov	-	-	-	-	-	-	-	-
Overall		48				53			
Total		424				436			

Table 3. Number of overall individuals of *Eurydema pulchrum* collected in different seasons/ months/weeks in district Srinagar (Batapora) during 2013 & 2014.

Season	Month	Total catch per week							
		2013				2014			
		1	2	3	4	1	2	3	4
Spring	March	-	-	-	-	-	-	-	-
	April	-	5	6	6	-	-	9	8
	May	9	4	5	10	4	6	8	12
Overall		45				47			
		1	2	3	4	1	2	3	4
Summer	June	22	32	75	68	14	26	49	52
	July	36	21	18	10	31	35	27	19
	August	12	8	8	12	18	18	14	14
Overall		322				317			
		1	2	3	4	1	2	3	4
Autumn	Sep	19	8	4	6	10	8	12	5
	Oct	7	4	-	-	8	6	4	-
	Nov	-	-	-	-	-	-	-	-
Overall		48				53			
Total		415				417			

Table 4. Number of overall individuals of *Dolycoris indicus* collected in different seasons/ months/weeks in district Srinagar (Batapora) during 2013 & 2014.

Season	Month	Total catch per week							
		2013				2014			
		1	2	3	4	1	2	3	4
Spring	March	-	-	-	-	-	-	-	-
	April	-	6	9	5	-	-	10	8
	May	7	5	7	10	2	4	7	12
Overall		49				43			
		1	2	3	4	1	2	3	4
Summer	June	20	30	75	60	14	26	42	50
	July	38	21	18	08	32	32	24	15
	August	10	05	11	12	15	22	15	12

Overall		308				398			
		1	2	3	4	1	2	3	4
Autumn	Sep	15	10	2	5	10	7	16	6
	Oct	6	3	-	-	8	6	3	-
	Nov	-	-	-	-	-	-	-	-
Overall		41				56			
Total		398				416			

With T being the current temperature, T0 being the base temperature of species and K being a thermal constant for the species. A generation is defined as the duration required for the time-integral of rto equal 1.Using linear approximations, the authors estimated that if the temperature is increased by ΔT or instance may be $\Delta T = 2^0C$ for climate change by 2100 relative to 1990), then the increase in

$$\Delta N \approx \frac{\Delta T}{K} (206.7 + 12{:}46 (m - to))$$

Where m is the current annual mean temperature of allocation in particular. The authors suggest that 20^0C warming might lead to one extra generation for Heteroptera. Temperature change is argued to be the biggest direct abiotic impact of the climate change on the herbivorous insects. In temperate regions, global warming will effect overwintering and warmer temperature will extend the summer season allowing for more growth and reproduction.

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