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Role of humidity, rainfall and temperature on population of *Bagrada* bugs (Heteroptera: Pentatomidae)

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ABSTRACT

Bagrada hilaris, formerly *Bagrada cruciferarum* Kirkaldy or *Bagrada picta* is native to Africa, India and Asia, where it is known by various names such as bagrada bug painted bug or harlequin bug. Bagrada bug is a common insect in India, belongs to order hemiptera and suborder heteroptera. Theis insects can be recognized by an x- shaped design on the back, which is formed by the wings at rest. This bug is most prevalent near Distt. Saharanpur, U.P. because of variable ecological factors in this region (so called tarai area). The present study deals with the ecological factors (rainfall, temperature and humidity) affecting on population of the *Bagrada* bugs. The experiments were carried out in the laboratory and in field in an around Saharanpur District, U.P. Population of bugs was studied by the quadrate method. The results demonstrate that the nymphal and adult population increases and decreases depend upon the rainfall, temperature and humidity.

Key words: *Bagrada cruciferarum*, nymph, population of bug, rainfall, temperature and humidity.

Introduction:

The heteroptera ar a group of about 40,000 species of insects in the order hemiptera. They are some times called true bugs. In Greek, term heteroptera means different wings. Most species have forewings with both membranous hardened portions called hemeiytra. *Bagrada hilaris*, formerly *Bagrada cruciferarum* Kirkaldy or *Bagrada picta* is native to Africa, India and Asia (Howard 1906). The main host plant of Bagrada bugs belongs to the family Cruciferae but they can infest other plants also mainly on cabbages, cauliflower, and other crucifers such as broccolli, brussels sprouts, radish, turnips etc. *Bagrada* is a polyphagus bug and it desaps different host plants. *Bagrada bug* is one of the most serious pests of mustard, cabbage, cauliflower, radish, knol-khol and it is also known as painted bug or Herlequin bug. The bug has been reported to be a serious pest of cruciferous crops in India, Burma, Sri Lanka, Pakistan, Arabia, Iraq, Kenya, Ethopia etc (Narayanan, 1954). During spring, it feeds on mature pods or remains under the heaps of harvested rape, mustard and radish (Atwal 1986). Pentoja *et al* (2000) studied on effect of

population dynamics on *Oebalus ornatus*. Didinet *et al* (1995) studied on nyphal development and survival of *Podisus nigriopinus* Dallas. Didinet *et al* (1996) worked on the temperature which effects on reproduction and longevity of *Podisus nigrispinus* Dallas. Lohar *et al* (1996) studied on biology and food preference of *Bagrada cruciferarum*. Silva *et al* (1996) worked on nyphal development of *Supputius cincticeps* Stal. In some cases the damage is very serious, causing the young plant to wilt and die, spoiling the heap of cabbage or cauliflower and greatly reducing the yield of seed of mustard crop. Thus the annual loss is brought about by the pest in this country are heavy.

Materials and Methods:

The Life history of *B. cruciferarum* was worked out in the laboratory, for which 5^{th} instar and adult were collected from the field and kept in the chimneys coverd at top with thin muslin cloth. Fresh food was supplied as and when necessary. The adult which started copulation were collected and placed in separate glass globe chimneys. The copulation time and pre-oviposition period was recorded, after copulation and just prior to egg lying. After hatching of egg, first instar nymph emerges out. All emerge nymphs collected and placed in a separate glass vials covered a top with thin muslin cloth. The muslin cloth gives completely air and provided the proper food for new emerge nymphs. These experiments had been repeated upto fifth instar and finally imago stage appears. Population of bugs was studied by quadrate method in which the field was divided into five quadrate, one metre square each i.e. four on the corner and one in the centre. Whole survey of plants, including their number per sq. metre in a row and inflorescence with the bug population studied. All the bug and nymph are counted separately in this study. The data are repeated and noted elsewhere in the field to get more elaborate reading and accurate average number of population. All data from field observations were recorded.

Statistical analysis:

For the calculation of the frequency, abundance and density the following formulae are used:-

$$\text{Frequency} = \frac{\text{Total Number of quadrate in which species occurred x 100}}{\text{The total number of quadrate studied}}$$

$$\text{Density} = \frac{\text{Total number of individuals in all quadrates}}{\text{Total number of quadrate studied}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals in all quadrates}}{\text{Total number of quadrate in which species occurred}}$$

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Results and Discussion:

According to food preference, the bug is found in the month mid March to mid November. However abundantly found in the month of March and April when the temperature rises up. For experiments the bugs provided the different food viz. mustard, raddish, wheat, cabbage etc. The bugs preferred the *Triticum aestivum* and *Brassica compestris* than other food (Hill 1983). The bugs also sucked the sap of plants for completing the life cycle.

In year 2007, month of March (dated 02.03.2007) on the Brassica, the temperature maximum 32.6^{o}C, minimum 17.6^{o}C, humidity maximum 72, minimum 46 and rainfall 0.9 mm, here the temperature, humidity and rainfall were normal so the number of nymphs 908 and adults 83 were recorded. In year 2007, month of April (dated 08.04.2007) on Triticum when the temperature, humidity and rainfall become increases temperature maximum 34.9^{o}C, minimum 19.2^{o}C, humidity maximum 63, minimum 23 and rainfall 0.8 mm so the bugs population becomes increase total number nymphs 1044 and adults 88 were recorded.

In the year 2008, month of March on Brassica the temperature, humidity and rainfall were normal as the temperature maximum 30.9^{o}C, minimum 16.7^{o}C, humidity maximum 67, minimum 41 and rainfalls 0.7mm, the nymphs 844 and adults were 84 in number. Similarly in the year 2008, month of April the bugs prefer maximum on *Triticum aestivum*, the bugs were found very much population while the ecological parameters in favorable condition become the temperature maximum 39.9^{o}C, minimum 17.9^{o}C humidity maximum 62, minimum 19 and rainfall 0.0 mm the bugs population nymph 856 and the adults 87 in numbers were recorded.

In the year 2009, month of March on Brassica the temperature, humidity and rainfall were normal as the temperature maximum 31.4^{o}C, minimum 18.1^{o}C, humidity maximum 79, minimum 55 and rainfalls 0.2mm, the nymphs were 764 and adults were 80 in number. Since the ecological parameters are favorable in the month of April, the bugs are found in greater number (nymphs 630 and adults 85) on *Triticum aestivum.* The temperature varied from 36.2^{o}C maximum to 18.8^{o}C minimum) and humidity from 61 (maximum) to 22 (minimum) with the lowest level of rainfall 0.4 mm in the month of April.

The above data shows that the temperature, humidity and rainfall show the significant effect on their population as the humidity increases, the number of bugs increase proportionately, however in heavy rainfall their survival becomes difficult and it affects the population of bugs. All those environmental conditions favour the growth of host plants and favour the growth rate of population. The developmental stage like nymphs, instars and imagoes are influenced by the environmental factors. When the temperature rises up the bugs come out from the hidden places. They start feeding upon the host plants. Then undergo copulation to increase their population.

The fluctuation in the environmental conditions affect directly on the growth of host plants so the population of nymphs and adults are affected. Bagrada bugs also can kill the apical

meristem (Palumbo and Natwick, 2010). Esselbaugh (1946) studied the egg of the Pentatomidae. In our experiment, the eggs hatching time about 96 hours at 30^{o}C while according to Atwal (1959) reports it would takes 95.5 hours at 30^{o}C. So it is slightly different but proving our results. If the temperature become raises the hatching become decreases at about 35^{o}C and it takes 73 hours in hatching but at 40^{o}C the egg takes total 70 hours for the hatching. In our experiment at the 45^{o}C temperature no hatching were found, this report is very similar from Atwal (1959) in natural condition. The relative humidity 20-80% does not affect on the speed of development of eggs. So this range of humidity or moisture reported as most favorable for the life of eggs.

Rakhspal (1949) and Akbar (1958) studied on the biology and population of Bagrada bug. The favorable temperature of the seasonal survival for bugs are ranges 20-40^{o}C. This kind of observations are also reported by Mukhopadyay *et al.* (1987), that is showing the confirmation of our results. The nymphal and adult population increases and decreases depend upon the ecological factors (humidity, temperature and rainfall). Increasing the population of bug is harmful for the crops because the bug sucks the inflorescence, pods and other soft part of the plants. After desapping the inflorescence and pod, become dry and damage for seedlings.

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