Pakistan J. Zool., vol. 47(3), pp. 739-743, 2015.

Studies on the Reproductive Activity of *Poekilocerus pictus* (Fabricius, 1775) (Pyrgomorphidae: Acridoidea: Orthoptera)

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Abstract.- Some observations have been made on the reproductive activity of the *Poekilocerus pictus* (Fab.) under room temperature. Egg laying in *P. pictus* begins from 20-30 days after final ecdysis and oviposition has been started after two to five days of mating. The insect laid eggs in moist soil at a depth of 6.96±0.64 cm. The pre-oviposition period was 14.5±1.43 days and oviposition period was 2.28±0.66 days. Deposition of eggs lasted 22.8±0.66 min, and secretion of foamy mass took place in 14.37±2.81 min. *P. pictus* took an average of 2.28±0.66 h for the oviposition. Total number of egg pods in crowded medium was 1.58±0.7 and 1.8±0.78 in isolated reared insects. In addition to this, the total number of eggs per pod in isolated reared insects was 81.2±16.9, while in crowded condition it was 79.8±16.12. Beside this, the total number of eggs per pod in mass reared medium was 81.2±16.9 as against 79.8±16.12 in isolated reared insects under laboratory conditions. It was also studied that average total number of eggs in pods gradually decreased with increase in oviposition number.

Key words: Reproductive activity, ecdysis, mating, oviposition.

INTRODUCTION

Poekilocerus, a principal pest of *Calotropis procera* (Akk) in India as well as in Pakistan, is famous for its bright and attractive coloration. It insensitively feeds on *C. procera* which was sometimes used for fiber and silky-smooth seeds for padding pillows while in some parts of West Africa, *C. procera* plays has medicinal role in treating problems of urogentital tract and barrenness and difficult labour in women. *P. pictus* normally occurs only on the leaves of wild akk (*C. procera*) plants in Pakistan (Ghouri, 1975). An outbreak occurred along the Chenab river in the Jhang district of the Punjab during May and June 1973 in which cotton seedlings, melon, chilli and cucurbit plantations were severely damaged. Rizvi (1992) noted that *P. pictus* also attacks the mango orchards, betel creepers, forest trees, trees of jasmine and mulberry cultivated in lower Sindh. However, in case of host plant depletion *P. pictus* can feed on a large number of plant species growing as agricultural and horticultural crops of economic importance (Bindra, 1958; Khan and Sharma, 1971; Butani, 1975; Umerani *et al*., 2005). These acridids are highly polyphagous that infest over 200 species of the host plants of vegetable farms, ornamental plants, guavas, lemon, citrus etc (Patel and Mital, 1991; Ivbijaro *et al.*, 1992; Moizuddin, 2002). Pest control has become all the more important with increasing demand for food. The reproductive potential has a direct bearing on the recruitment of new individuals to population. Several papers have been published on biology and physiology of *P. pictus* (Popov and Kevan 1979; Syed *et al.*, 1993; 1994 and Umerani *et al.,* 2005) but there is no update record on the reproductive activity of *P. pictus* from Pakistan.

MATERIALS AND METHODS

Collection of samples

The specimens of *Poekilocerus pictus*, both nymph and adults, were mostly collected from akk plant (*Calotropis procera)* during 2012-2013. A few of them were collected from agricultural crops, mixed vegetation of herbs, grasses, field boundaries surrounding different plantation and some were collected from water channels. Specimen were collected with help of hand net (9.1 cm diameter and 52.2 cm in length), hand picking or by using large forceps.

Rearing of insects

For rearing of the insect method described by Riffat and Wagan (2007, 2009) has been adopted. For the study of biological processes, specimens

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0030-9923/2015/0003-0739 $ 8.00/0

were collected from various fields and then reared in crowded and isolated condition in cages (length 6.5 width 13.5 cm) and in separate glass jam bottles at room temperature. For oviposition every cage was provided a glass-basin containing garden sand. Daily few drops of water were added to keep the sand moist. Fresh leaves of akk plant were kept in water for longer period and then were fed to the insects. Experimental rearing cages and plastic jam bottles were sterilized and kept in sun light for one to several hours after every week. Old paper sheet placed on the inside bottom of cage was changed daily.

Study on oviposition behaviour

Study of oviposition was adopted after Pruthi and Nighm (1939) and Riffat and Wagan (2007). For this wood cages were set at room temperature where the temperature range between 27±2°C and 38±2°C and relative humidity was 25±5% to 50±5%. A small glass-basin filled with moist sand was kept in all cages for oviposition purpose. The top of glass-basin was covered with muslin cloth, and hence the grasshoppers were forced to oviposit on the central margin space. The process of oviposition and boring could be easily observed from outside. The soil was kept moist by adding water when needed. In another set of experiments no muslin cloth was used on glass-basin. Likewise there was another set of jars in which no sand medium was provided for oviposition and the grasshopper directly bore into the loose moist sand and laid eggs inside this. The insects laid eggs on leaves of plant.

Identification of insects

The identification of specimens was conducted in laboratory under the stereoscopic dissecting binocular microscope with help of the keys of Popov and Kevan (1979).

RESULTS

On attaining sexual maturity the males took 3 to 4 days for copulating after final ecdysis, while the females took 1 to 2 days or in rare cases copulation started immediately after final moult in both sexes. The female copulated 14.3±2.1 times till first oviposition. In the Pyrgomorphidae the mechanism of oviposition mostly resembled that of Acrididae. Oviposition mostly started after 6 to 9 days of final mating and female could easily be recognized by their thick abdomens before they prepare for oviposition process. They search oviposition sites by their maxillary palpi, antennae and ovipositor valves. After finding suitable places they dug deep burrow of 6.96±0.64 cm in soil and checked the burrow by inserting their ovipositor into the burrow by opening and closing the valve in it. It was usual for a female to bore a number of chambers before the final one in which it oviposited. The reason for rejecting the chamber might be due to unsuitable texture of sand, scarcity or excess of moisture or a hard obstacle, which cannot be pierced through. In the laboratory maintained culture it was noted that when a female was ready to lay could be seen to tap the cage with the end of its abdomen and to touch it with the antennae and palps and this may suggests an active exploration of the ground from the point of view of its suitability for oviposition. Having found suitable place, female raised its legs and curved the abdomen over until the tip rested on the soil and ovipositing hooks were then pressed. After deposition of the froth, the female withdrew its abdomen from the chamber. During the process of egg laying the abdomen could be extended to three times its normal range. All eggs dropped within 22.8±0.66 min, and secretion of foamy mass took place in 14.37±2.81 min (Table I). It was also observed that when suitable site for egg laying was not found, the females laid eggs on the paper sheets because fully mature eggs can be retained by the

Table I- Reproductive activates in *P. pictus* under laboratory condition.

Parameters	Mean ±SD (Range)
Depth of sand (cm)	6.96±0.64 (5-9)
Interval between each oviposition (days)	13.35±1.98 (10-16)
Duration of oviposition (h)	2.28±0.66 (1.6-2.6)
Secretion of foamy mass (min.)	14.37±2.81 (13-16)

female up to maximum of 2-3 days and thereafter they have to be released. After the process of oviposition the females changed place, and usually retired for feeding. Each female deposited 80-103 eggs at the bottom of the hole. The remaining upper part of the hole was filled with the frothy secretion which hardened into a waterproof plug. The foamy mass was whitish yellow when fresh but after drying they turned into brownish. The pre-oviposition period was 14.5±1.43 days (Table II). It was also noted that oviposition normally occurred during the daytime

Table II.- Comparative summary of ovipositional behavior of *P. pictus* under laboratory condition during 2013.

Parameters	Mean ±SD (Range)
Pre-oviposition period (days)	14.5±1.43 (13-15.5)
Oviposition period (h)	2.28±0.66 (1.6-3.0)
Longevity (days)	80.75±9.11 (78-82)
Pods per female	1.8±0.78 (1.6-2.0)
Eggs per pod	79.8±16.12 (77-82)
Total eggs during entire life	161±77.78 (156-165)

mainly early in morning. In some cases it was also noticed that *P. pictus* took an average of 2.28±0.66 h for the oviposition but there was no major difference in the duration of secreting foamy mass except for 2-5 min (Table I). Total number of egg pods in crowed medium was 1.58±0.7, while in isolated reared insects it was 1.8±0.78. The total number of eggs per pod in isolated reared insects was 81.2±16.9, while in crowded condition it was 79.8±16.12. These results showed that overall interval time between each oviposition was 13.35±1.98 days. Beside this, the total number of eggs per pod in mass reared medium was noted 81.2±16.9 as opposed to 79.8±16.12 in isolated reared insects under laboratory conditions. It was also observed that there was no difference in the average of total eggs per pod laid by insects either reared separately or in crowed condition. During recent investigation it was reported that number of eggs remarkably reduced with the increase in the frequencies of oviposition. The number of oviposition usually recorded 2 in entire life of *P pictus*.

DISCUSSION

Earlier, many co-workers gave different timing of copulation in *P. pictus.* Sheri (1976) observed that *P. pictus* remain together for 6-9 h while Riazuddin *et al.* (1977) reported that *P. pictus* caged with female usually became receptive to courting male 3-5 days after his final moult, or even sooner when crowded. They copulation period was prolonged and it took 12-24 h for completion. The number of eggs per-pod were calculated 66 to 136 but it varied considerably in every individual. Riazuddin *et al.* (1977) studied this copulation duration 12-24 h. However, at the present we have observed that copulatory pairs remain together for 8-9 h, which might be due to feeding of host plants or might be due to favorable climatic factors as earlier reported by Riffat and Wagan (2008) for *Hieroglyphus* species. Similarly 60-140 eggs per pod were reported by Pruthi and Nigam (1939) in the same individuals of *P. pictus*. Beside this, Sheri (1976) recorded 106-216 eggs per pod and Riazuddin *et al.* (1978) collected 66-136 eggs per pod in *P. pictus.* During present study we have collected 80-103 eggs per pod. This variation in the number of eggs in *P. pictus* collected from different region might be due to energetic feeding of insects. Pruthi and Nigam (1939) stated that oviposition process started 25-30 days after final moult and could be stimulated by wetting sand. Similarly, Riazuddin *et al.* (1977) observed that oviposition process began 17-31 days after the final ecdysis. Each female laid one or more egg pods with an average of 156 eggs per pod which were deposited 6-8 inches deep in soil (Sheri, 1976). The present finding is in conformity with this report. It was also found that a female may also withdraw its abdomen because of disturbance in cage although most authors agreed that female actually engaged in laying was not easily disturbed. Present study reports that if female has not found suitable place it lay eggs on leaves, or any other place. It does not

hold eggs for longer period in her body. During the present study significant variation was recorded in the size of egg pods. The present study suggests that it mostly depends on the type and the condition of soil at the time of oviposition; and it might be because of lengthening of the plug, which is usually large or short in pods laid in humid habitats and arid areas. However, this actually depends on the condition in which eggs are laid. Beside this, during the present study arrangement of eggs was found irregular and they overlap with each other. Present study shows that arrangement of eggs depends on some complicated movement of the ovipositor parts while they are being laid as reported earlier by Uvarov (1966) in *Dociostaturus* and *Locusta*. Chapman and Roberson (1958) described 2 distinct types of egg arrangements. In first type the eggs were arranged radially so that their micropylar ends were visible all-round the pod, while in the second type eggs were oriented in approximately the same way with their micropylar ends visible at only one side of the pod which is its ventral side. The pods of *P. pictus* may be of either type. The pods of *P. pictus* are fragile and hence the arrangement of eggs is often entirely lost when the pod is dug out. It is therefore, hardly practicable to use these, models of egg arrangement as one of the principal characteristics for the identification of pods and was done by Zimin (1938) and Chapman (1961). They stated that the arrangement of eggs in the pod, radial or bilaterally symmetrical actually indicate the phylogenetic relationship, whereas the structure of the pods depends on the ecological factors. The present findings would help managing the pest during its reproductive activity.

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(Received 14 June 2014, revised 26 November 2014)