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## Study on morphology and development of egg-pod and eggs of *Poekilocerus pictus* (Orthoptera: Pyrgomorphidae)

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### Abstract

During present study, some observation was taken on the analysis of egg pods and its morphological characteristic and hatching. It was noted that egg pods of *Poekilocerus pictus* were fragile, elongated and much bent and curved near the base surface, eggs in pod were arranged irregularly and overlap with each other. A significant variation in the morphology of egg-pods was observed. The weight of egg-pods was calculated (0.82gm), length was (45.11±1.19mm) and width was (12.34±4.37mm), while the egg's size was calculated (7.75±0.25 mm) for fresh eggs and (6.07±0.61mm) for dry eggs. *P. pictus* deposit (1.8±0.78) egg pods during entire period of life and total No. of eggs per pod were counted (79.8±16.12). Maximum hatching of *P. pictus* was reported 27.5% during the summer season opposing to this; lowest hatching i-e 7.3% was obtained for autumn season. This disparity in hatching mechanism might be due to hatching of some diapause eggs during autumn season which don't hatch in summer season.

**Keywords:** Development, hatching, morphology, Orthoptera, Pyrgomorphidae

### 1. Introduction

*Poekilocerus pictus* (Fab.) is commonly known as Akk grasshopper in India as well as in Pakistan Riffat et al [15]. It attacked varieties of crops i.e. cow pea, okra, brinjal, castor, citrus, papaya, wheat, alfalfa, corn and cotton but it is principal pest of *Calotropis procera* in Sindh Riffat et al [15]. Beside this, it is very famous due to its bright and attractive coloration amongst entomologist and students. It considered as model organism at college level. It is common pest in Pakistan, India, and Afghanistan. Shumakov [19], Uvarov [22], Cejchan [3], Sheri [18], Popov and Kevan [7].

Ghouri [5] reported that *P. pictus* normally occurs only on the leaves of wild Akk (*C. procera*) plants in Pakistan, an outbreak occurred along the Chenab river in the Jhang district of the Punjab during May and June (1973) in which cotton seedlings and melon, chili and cucurbit plantations were also severely damaged. Rizvi [17] noted that *P. pictus* is also attack on mango orchards, betel creepers, forest trees, trees of jasmine and mulberry cultivated in lower Sindh. *P. pictus* is major pest of *C. procera* and this host plant plays a vital medicinal role in treating complaints of uro-gential tract Popov and Kevan [7]. Its leaves used for fast healing of wounds as a purgative improve indigestion this can be used as to treat skin disease liver problems etc. Its flowers used as drink in a milk cure a variety of complain including cholera, asthma, indigestion etc Popov and Kevan [7]. Bark of the roots which can be used as to treat dysentery, skin disease such as athlete's foot, ringworm and as an anti-cancer. This plant is also useful for herbalist's treatments. Vats [20], Riffat et al [15-16].

Lot of work has been done on the taxonomy and egg laying habitats of this pest by Parihar [8-9], Butani [2], Mathur [6] from abroad and from Pakistan only few current references i-e Riazuddin, et al [11], Umerani, et al [21] are available on the Pyrgomorphidae. But no work is done on the morphology and development of egg-pod and eggs of this species from this region. Keeping in the view, the economic importance present study is being designed for the first time. The information which has been collected during the present investigation will not only develop base line data which will help to understand the differentiation occurring in the egg-pods but will also be useful for forecast exact hating dates so that control measured should be undertaken at earlier stages. Furthermore, present contribution will provide brick to knowledge on hatching how to adopt control measure at appropriate time.

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## 2. Material and Methods

### 2.1 Sampling collection

The specimen of *Poekilocerus pictus* both nymph and adults were mostly collected from Akk plant (*C. procera*) and few of them were collected from agricultural crops, mixed vegetation of herbs, grasses long with field boundaries surrounding by different plantation and some were collected from water channels. Specimen were collected by the help of traditional insects hand net having (9.1 cm) diameter and (52.2 cm) in length and mostly the specimen collected from Akk by hand picking, using large forceps, collection was made during the year 2015-16 from various localities of district Shikarpur.

### 2.2 Rearing of insects

For rearing of the insect method described by Riffat and Wagan [12] has been adopted. For this insects were reared in crowded and isolated condition in cage (Length 6.5 width 13.5 cms) and in separate glass jars (ordinary jam bottles) at room temperature and under normal lighting. For the oviposition process all cage were provided a glass basin containing garden sand. Daily few drops of water were added to keep sand moist. Fresh leaves of Akk plant were plugged and kept in water. Daily experimental rearing cages and plastic jam bottles were sterilized and kept in sun light for more than an hour. Paper sheet placed on bottom of cage/jars were also replaced daily in order to maintain clean environment for insect. Experiment was performed in Entomology and Bio-control Research Lab (EBCRL), Department of Zoology, University of Sindh, Jamshoro.

### 2.3 Collection of egg-pods and eggs

All the glass basin jars were observed for collecting the eggs and egg-pods regularly. Eggs were sorted out according to date wise, size of eggs and egg-pod was noted and arrangement of eggs in pod was also observed.

### 2.4 Development and hatching of eggs

A total of 728 eggs of *P. pictus* were kept in Petri dishes having moist cotton and filter paper on its surface under laboratory conditions. The temperature varies between  $27\pm2^{\circ}\text{C}$  to  $38\pm2^{\circ}\text{C}$  with relative humidity of  $25\pm5\%$  to  $50\pm5\%$ . All the Petri dishes were named and arranged in order on different dates. The water was daily sprinkled with the dropper without disturbing the position of the egg in dishes. The break-up of kept eggs for hatching was given in (Table 3-4) the method for development and hatching of eggs was adopted from Riffat and Wagan [13]. Nymph and adults obtained from the eggs laid were used for the subsequent experiment.

## 3. Results and Discussions

### 3.1 Morphology of egg-pods and eggs

*P. pictus* laid soft elongated and fragile egg-pods that were significantly bent and curved from the base side. They were downward from posterior pole and lengthen from anterior pole. Eggs in these pods were arranged irregularly and overlap with each other and arranged radially so that their micropylar end were visible all around the pods. However, eggs were found elongated, cylindrical and normally bent from bottom and eggs wall showed mosaic pattern of hexagonal length. During the collection of egg-pods from the field it was found that in some cases fragile pods has occur in collection the arrangement of eggs in fragile pods was often entirely lost when the pod was dug. Measurement and weight of egg-pods has been discussed in (Table 1) according to this

table maximum length of egg -pods was noted ( $45.11\pm1.19$  mm) along with foamy mass its weight was calculated ( $0.85\pm0.03$  gms) and width was noted ( $12.34\pm4.37$  mm). Similarly, in case of freshly laid eggs length was noted ( $7.75\pm0.25$  mm) whereas weight was calculated ( $0.02\pm0.12$  gms), while in dry eggs it value was ( $0.01\pm0.06$  gms) and ( $6.07\pm0.6$ ) and ( $1.63\pm0.26$ ) for length and width respectively. (Table 2). All egg pod were found full of eggs without any empty space, however at the base there were greater number and at the top they become decreased (Figure 1. a-d).

Number of eggs per pod was also reported vary in between individual. Pruthi and Nigam [10] recorded 60-140 eggs per pod Sheri [18] reported 106-216 eggs per pod and Riazuddin *et al* [11] collected 66-136 eggs per pod laid by *P. pictus*. At the present, we have collected 80-103 eggs per pod. This variation in the numbers of *P. pictus* collected from different region might be energetic feeding of female. During the present study significant variation have been recorded in the size of egg pods present study suggests that it mostly dependence on the type and the condition of soil at the time of oviposition and it might be lengthening of the plug. This is usually large or short in pods laid in humid habitats and arid areas. However, this is subject to the actual condition in which eggs are laid. Further, arrangement of eggs was found irregular and they overlap with each other. Present study suggests that arrangement of eggs must depend on some complicated movement of the ovipositor parts while they are being laid. Earlier, same observation was reported by Wagan and Mughal [23] for *Dociostaurus* and *Locusta* and Riffat and Wagan [14] for *Hieroglyphus* species.

### 3.2 Egg development and hatching under laboratory condition

For the development of *P. pictus* maximum numbers of eggs were kept in Petri dishes in the different date during Summer and Autumn season under normal laboratory conditions where their major hatching occurred within few weeks i- e 27.5% followed by 16.85% in the month of November and minimum /hatching percentage i-e 5.27% were obtained for the month of September 2015 for those insects which were obtained in summer. Beside this, very low percentage of hatching was obtained for eggs were maintained in autumn season i-e 7.3% to 2.03% in the month of May in autumn (Table 4).

Descamps [4] reported that *Poekilocerus* has completed nymphal development in about 210 days in Cameron. At the present, we have recorded 62.6 days for the development of *P. pictus* on the Akk plant. The disparity within the different species of *Poekilocerus* group might be due to feeding habits and climatic factors of the regions. During the present study, significant hatching was noted in the month of November and low percentage of hatching was noted in the month of September in the insect eggs which were laid during the summer s however, opposing to this, minimum percentage of hatching was noted in those eggs which were laid in the Autumn this disparity in the hatching rate of these two season insects suggests that there is diapauses phenomenon in the Autumn laid eggs that's why their minimum eggs was hatched out compare to Summer season insects.

Parihar [9] observed that egg pods of *P. pictus* were found soft elongated and slight curved from bottom, egg point was downwards at the posterior pole. The eggs are elongated, cylindrical and normally bent. The egg wall showed a mosaic pattern of hexagonal. An egg mean length and width length increase 0.78 mm and 0.70 mm respectively. About 62-66 micropylar canals of ring shape possess in egg, which does

not seem to penetrate the vitelline membrane. Amatubi [1] studied the effect on eggs developments and time of nymphal emergence of grasshopper pest during rain fall in the Sudan, Savannah of Nigeria. In sand soil egg pods of grasshopper were placed, contained in polythene bags and exposed to rain showers. Nymphal emergence was reported is 69-73 days when minimum amount of rainfall in the month of (April to July) when temperature range was 28.7 to 29.1°C. Application of insecticide dust on the soil surface around the bases of trees and shrubs in the infested area about 69 days from first heavy rain (about 7 mm) of season was considered a possible control measure for grasshopper nymphal hatching. The result of this

study will also assist plant protection agencies, agriculturalists ecologists and entomologists. In the view of above mentioned facts they will be able to forecast exact hatching dates, which will consequently reduce economic losses cause by *P. pictus*.

**Table 1:** Measurement of egg pods of *Poekilocerus pictus* recorded from laboratory culture during the year 2015-2016.

Parameters	Egg pods (Means $\pm$ SD)	Range
Weight	0.85 $\pm$ 0.03 gms	0.6-1
Length	45.11 $\pm$ 1.19 gms	43-46
Width	12.34 $\pm$ 4.37 gms	10-15

**Table 2:** Measurement of eggs of *Poekilocerus pictus* obtained from laboratory rearing insect during the year 2015-2016.

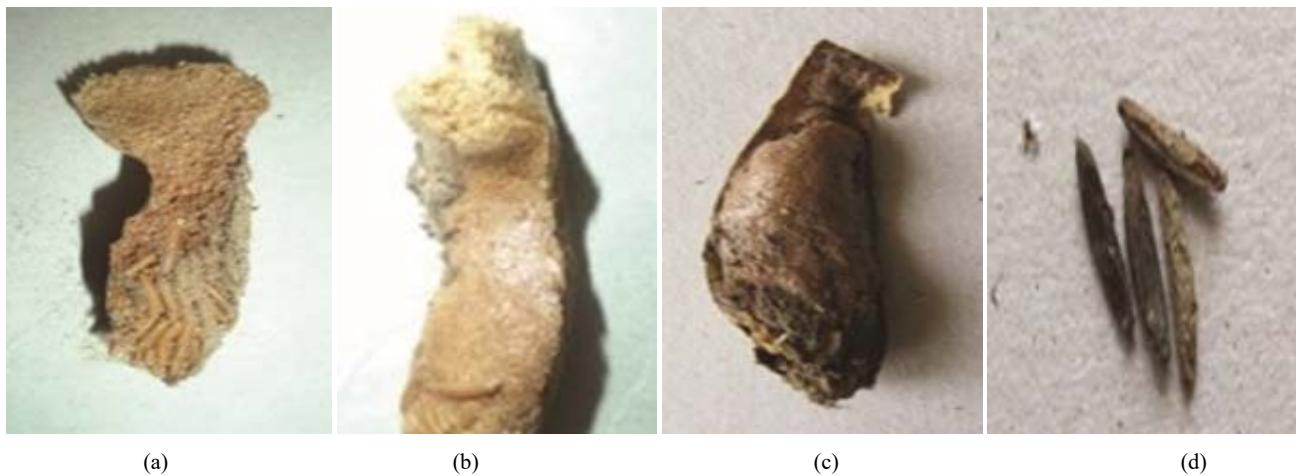
Freshly laid eggs			Weight (Mean $\pm$ SD) (mg)	Length (Mean $\pm$ SD) (mm)	Width (Mean $\pm$ SD) (mm)
Weight (Mean $\pm$ SD) (mg)	(Mean $\pm$ SD) (mm)	Width (Mean $\pm$ SD) (mm)			
0.02 $\pm$ 0.12	7.75 $\pm$ 0.25	1.32 $\pm$ 0.2	0.01 $\pm$ 0.06	6.07 $\pm$ 0.61	1.63 $\pm$ 0.26

**Table 3:** Summary of egg hatching of *Poekilocerus pictus* in summer season during the year 2015-2016.

S. No.	Date of collection of egg-pod	Period of hatching and its duration	Approximate period from egg-laying to hatching	Total No. of hopper and hatched No.		Average Hatching of eggs in Petri dishes
				In the Petri dishes/lot	Hatched No.	
1	7 <sup>th</sup> July 2015	Oct.-Nov. 2015	76.5 $\pm$ 15.20 (days)	89	34	11.63%
2	15 <sup>th</sup> July 2015	Sept. 2015	66.8 $\pm$ 8.31 (days)	112	26.35	5.27%
3	23 <sup>th</sup> July 2015	October 2015	74.1 $\pm$ 13.66 (days)	124	47	15.89%
4	13 <sup>th</sup> Aug 2016	November 2016	73.1 $\pm$ 12.46 (days)	205	67.34	16.85%
5	21 <sup>th</sup> Aug 2016	November 2016	72.4 $\pm$ 12.55 (days)	198	82.5	27.5%
Total and Range	Sep-Nov 2016	Sep-Oct 2016 (Mostly in Sep)	66-72 $\pm$ 8-16 (days)	728	34-82.5	5.27-27.5%

**Table 4:** Summary of egg hatching of *Poekilocerus pictus* in autumn season during the year 2015-2016.

S. No.	Date of collection of egg-pod	Period of hatching and its duration	Approximate period from egg-laying to hatching	Total No. of hopper and hatched No.		Average Hatching of eggs in Petri dishes
				In the Petri dish/ lot	Hatched No.	
1	13 <sup>th</sup> Nov 2015	11 <sup>th</sup> April 2016	155 $\pm$ 13.08(days)	170	18.66	3.73%
2	20 <sup>th</sup> Nov 2015	27 <sup>th</sup> May 2016	169.4 $\pm$ 17.87(days)	90	28.12	7.03%
3	2 <sup>nd</sup> Dec 2015	11 <sup>th</sup> June 2016	168.5 $\pm$ 21.13(days)	115	32.77	4.68%
4	11 <sup>th</sup> Dec 2015	12 <sup>th</sup> May 2016	149.8 $\pm$ 17.17(days)	55	10.18	2.03%
5	23 <sup>th</sup> Dec 2015	15 <sup>th</sup> June 2016	177.2 $\pm$ 6.82(days)	213	33.07	5.51%
Total and Range	13 <sup>th</sup> Nov-23Dec	April-June (Mostly in June)	155 $\pm$ 13.08-177.2 $\pm$ 6.82(days)	643	10.18-32%	2.03-7.03



**Fig 1:** (a-d) Image of egg-pods and eggs of *Poekilocerus pictus* obtained from laboratory culture

#### 4. Conclusion

Overall it could be concluded that egg pods of *P. pictus* has significant difference in the arrangement of egg and shape of pods. Further, present study also recommends that oviposition mostly take place in summer and autumn season. So, in these season oviposition sites should be irrigated to break the emergence of the nymphal instars because mostly *P. pictus* ignore to laying eggs when surface in moist.

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