The Effect of Plant Hormones on Moulting and Metamorphosis of Poikilocerus Pictus

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Abstract
Poikilocerus pictus, commonly known as the painted bug, is an insect species known for its striking coloration and complex life cycle involving moulting and metamorphosis. This research paper investigates the impact of plant hormones, specifically auxins and gibberellins, on the moulting and metamorphosis of *P. pictu*. The study aims to elucidate the role of these hormones in regulating developmental processes and their potential implications for pest management in agriculture.

Keywords: *Poikilocerus pictus* Metamorphosis, Moulting, Plant Hormones

Introduction
Insects undergo various developmental stages, transitioning from egg to larva, pupa, and finally to adult. This process is heavily regulated by hormones, including ecdysteroids and juvenile hormones (JH). However, in case of host plant depletion *P. pictus* can feed on many plant species growing as agricultural and horticultural crops of economic importance (Bindra, 1958; Khan and Sharma, 1971; Butani, 1975; Umerani *et al*., 2005).
However, recent studies have indicated that plant hormones, such as auxins and gibberellins, can also influence insect development. *Poikilocerus pictus* is an excellent model organism for studying these interactions due to its distinctive life cycle and ecological significance.
Plant Hormones
Auxins are a class of plant hormones that regulate various aspects of plant growth and development, including cell elongation, root formation, and response to light. They are synthesized primarily in the stem tips and young leaves and can influence insect behaviour by altering plant physiology.
Gibberellins are another class of plant hormones that promote stem elongation, seed germination, and flowering. They play a crucial role in the growth of both plants and insects. The interaction between gibberellins and insect development has gained attention in recent years, particularly concerning the timing of metamorphosis.
Moulting and Metamorphosis in *Poikilocerus pictus*
Moulting is a critical process in the life cycle of insects, allowing them to grow and develop. It involves the shedding of the exoskeleton and the transformation of juvenile forms into adults. Metamorphosis in *P. pictus* consists of distinct stages, including the egg, nymph, and adult phases. The timing and success of these transitions are regulated by hormonal signals, particularly ecdysteroids and juvenile hormones.

Material and Methodology

This study employed a controlled laboratory experiment to investigate the effects of auxins and gibberellins on the moulting and metamorphosis of *Poikilocerus pictus*

Experimental Design

1. **Sample Collection:** A population of *P. pictus* was collected from a local agricultural site.
2. Hormonal Treatment: The insects were divided into three groups: control (no hormone), auxin-treated, and gibberellin-treated. Each group received hormonal solutions at different concentrations.
3. **Observation**: The developmental stages of each group were monitored over four weeks, recording the timing of moulting and metamorphosis.

Data Analysis

Data were analyzed using ANOVA to assess the significance of differences between treatment groups concerning the timing of moulting and overall metamorphosis success.

Results

Preliminary results indicate that both auxins and gibberellins significantly influenced the timing of moulting in *Poikilocerus pictus.* 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 favourable 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 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).

Auxin Treatment: The auxin-treated group exhibited accelerated moulting, with a higher frequency of successful metamorphosis compared to the control group.

Gibberellin Treatment: The gibberellin-treated group showed a delay in the onset of moulting but resulted in a higher quality of adult specimens.

Control Group: The control group had the longest interval between moults and a lower overall success rate of metamorphosis.

The findings of this study suggest that plant hormones can significantly affect the developmental processes of *Poikilocerus pictus*. Auxins appear to promote rapid development, while gibberellins may enhance the quality of adult insects but delay the moulting process.

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 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 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.

Implications for Pest Management

Understanding the role of plant hormones in insect development can inform pest management strategies. By manipulating plant hormone levels in agricultural settings, it may be possible to regulate pest populations of *P. pictus,* potentially reducing crop damage without relying solely on chemical insecticides. This research highlights the complex interplay between plant hormones and insect development, specifically in *Poikilocerus pictus*. Future studies should focus on the underlying mechanisms of hormonal interaction and explore other plant hormones' effects on insect development. Such insights could contribute to sustainable agricultural practices and better pest management strategies.

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