



Efficacy of Andrographolide on pupal - adult transformation of *Corcyra cephalonica* Stainton

A. Jagajothi and P. Martin*

ABSTRACT

Corcyra cephalonica, the rice moth was treated with andrographolide at a concentration of 5 µg per day in fluid volume of 5 µl of acetone. The effects of such a treatment were studied till the adult emergence. There was nearly 60 % pupal mortality and the adults that emerged, demonstrated morphological aberrations. The application of andrographolide mimics the juvenile hormone, appears to cause desruption in the metamorphic events leading to mortality of pupae, delayed pupal – adult transformation and structural abnormalities. From this study it is evidence that andrographolide possesses properties similar to juvenile hormone and its analogue.

Key words: *Corcyra cephalonica*, andrographolide, Juvenile hormone.

INTRODUCTION

In the recent years, the use of synthetic pesticides for pest management has become highly controversial. These insecticides cause extensive environmental hazards as these pesticides accumulate themselves at various concentrations in different levels of ecosystem, and also the development of pesticide resistance in the insects against the insecticides. Eventhough the insects are exposed to an insecticide for long duration manifests slowly the insect not only develops resistance against the specific insecticides to which they are expose to but also a group of insecticides by way of cross-resistance. To overcome these problems, attempts were made to develop alternate methods of pest control such control measures including the use of cultural practices, biological control, use of antifeedants, hormonal insecticides, plant extracts *etc.* (Rathore, 1978; Kalyanasundaram and Das, 1985; Kalyanasundram and Babu, 1982; Sahayaraj and Paulraj, 2001; Opende *et al.*, 2002; Balasubramanian *et al.*, 2008; Yankanchi and Patil, 2009).

In this line of exploration Slama and Williams (1965) discovered that some of the plants do posses compounds, which could mimic the juvenile hormone activity. Slama and Williams (1965) discovered the plant extracts, containing juvenile hormone analogue causing abnormal moulting an metamorphosis there have been number of investigations, to screen the extracts of various plants for their juvenilizing effect. The juvenile hormone and its analogue besides controlling moulting and metamorphic events play a significant role in regulating the reproduction (Engelmann, 1970; Prabhu and John, 1976). Therefore in

the present work an attempt has been made to evaluate the pesticidal properties of a commercial obtained trepenoid lactone andrographolide against the pupae of *Corcyra cephalonica* (Lepidoptera: Pyralidae) as a laboratory model reared Lepidopteran. Being terpenoid it is presumed that the andrographolide may possess properties similar to the juvenile hormone and its analogue. Hence the impact of andrographolide was evaluated during the pupal – adult transformation in the rice mouth *C.cephalonica*.

MATERIALS AND METHODS

The rice moth *C.cephalonica* (Lepidoptera: Pyralidae) was used as a laboratory model for lepidopteran in the present study. The eggs *C.cephalonica*, obtained from the research centre were reared in the laboratory conditions (28 ± 2°C and relative humidity of 65 ± 5%). Broken cholam grains (*Sorghum* sp.) 750 gm and rice bran 500 gm were mixed by taking 1.250 Kg., each in the dissection tray (60 x 40 x 8 cm). Two yeast tablets 10 mg were powered and sprinkled over the ingredients taken in the tray and it was covered with muslin cloth. Young *Corecya* larvae hatched out from the egg within 3 - 4 days and the larvae fed on the grains by webbing. The larval period lasted about 20 - 25 days and pupation took place inside the web itself moths start emerging after 35 – 40 days. A commercial terpenoid, andrographolide, with the empirical formula of C₂₀H₃₀O₅ extracted from a herb, Nila vembu (*Andrographis paniculata*) was used for this study. One mg of andrographolide was dissolved in 1 ml of acetone (AR) to get 1% solution. From this preparation, 1µl was very

carefully applied topically on the abdominal segments of the newly transformed pupae using micro capillary tube. The control pupae received only acetone. All treated and control insects were kept at $27 \pm 2^\circ\text{C}$ and $70 \pm 5\%$ RH. The andrographolide was administered continuously for four days. Pupal mortalities and deformities were observed during the pupal period. All mortalities were counted and expressed in percentage.

RESULTS AND DISCUSSION

In the present study an attempt has been made to study the effect of the bioactive principle of the plant extract, andrographolide on the rice moth *C. cephalonica*. Chemically andrographolide is a terpenoid compound resembling the juvenile hormone secreted by the corpora allata. Slama and Williams (1965) identified the juvenilizing effects of the plant extracts on insects. A number of workers have attempted to screen several plants for their juvenile hormone mimicking effects. The deformities were observed among the pupae as a response to the morphogenic activity of andrographolide. In the present work, it was attempted to record the impact of andrographolide on the morphogenesis of *C. cephalonica*. The results showed that andrographolide affects the metamorphosis significantly. Of the 25 pupae treated with andrographolide, 16 pupae did not survive during their pupal period of 5 – 7 days. Nearly 15 % of the pupae died 24 hours after the andrographolide treatment. The mortality rate was 30 % at the end of 48 hours and it was increased to 50 and 60 % by 72 and 96 hours respectively. Of the 25 pupae that received the terpenoid only 9 of them emerged as adults. The newly emerged adult insects were morphologically aberrant.

The abdomen had not undergone complete metamorphosis and many pupal features (Fig 1). The integument resembled those of pupae. The wings of such adults were in highly shriveled condition (Fig 2). The insects were unable to fly actively and all of them died within 24 hours of emergence. The pupal and adult deformities had been observed in *Bombyx mori* by Azt Koul *et al.*, (1987); in *Aulacophora foveicollies* (Gujar and Mehrotra, 1983), in *Aedes aegypti* (Naqvi, 1986). Plant extracts in general appear to show insecticidal property and are increasingly being used as an alternative to the synthetic chemical insecticide. The two major problems of the use of the synthetic insecticide such as development of the resistance and causing of a severe imbalance in the ecosystem can be overcome to a certain extent by the use of plant extracts as insecticides. Especially, plant extracts, whose actions are analogous to those of juvenile hormone could be most preferred as insecticides against harmful

insects (Mulla *et al.*, 1978; Elliot *et al.*, 1974). The pest insects may not be able to develop resistance to a chemicals which are analogous to a substance found in their own system or the residues of such chemicals may not have any effect on the vertebrate in general and human beings in particular. Insect hormones have not been reported to influence the physiology of the higher vertebrates so far. Similar finding were also reported in *Murraya exotica* leaf extract against *Culex fatigans* larvae (Tiwari and Saxena, 1984). Further, the morphogenetic aberrations induced by plant extracts acting as juvenile hormone analogues have been reported by Prabhu and John (1976) and George and Mulla (1975). As for as andrographolide is concerned more conclusive evidence is required to confirm the hypothesis that the substance is a juvenile hormone mimic. Critical studies are required to evaluate the hormone mimic properties of andrographolide.

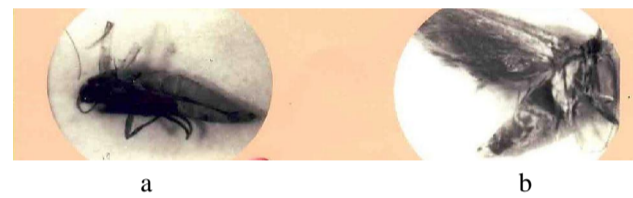


Figure 1. Abnormal adult insect showing pupal characters due to the administration of andrographolide (a) and Abnormal adult insect that emerged from andrographolide treated pupa (b)

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