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Sujiol, a new potent insect growth regulator from *Juniperus communis* L. against last instar larvae of *Spodoptera litura*

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Abstract: Sujiol, a terpenoid isolated from the berries of *Juniperus communis*, exhibited growth regulating activity in the last instar larvae of *Spodoptera litura*. The larvae were treated with 0.1, 0.25, 0.5, 0.75, 1, 2 and 4% concentrations of Sujiol, in solvent acetone. Formation of non-viable adults, interference in ecdysis and development of mosaics were the important morphogenetic peculiarities observed. The resultant forms were ruled out from further development and reproduction.

1 Introduction

The growing awareness of hazards associated with the large scale use of synthetic insecticides has evoked a world-wide interest in pest control agents of plant origin (Marin-Bettelo, 1977; Feeny, 1992). These pesticides aim to exploit the insect hormonal systems, affecting metamorphosis and resulting in deformed progenies incapable of further reproduction (Suryakala et al., 1983; Gopalan et al., 1987). They are comparatively less toxic, biodegradable, have no residual effects and hold great promise as insect growth regulators (IGRs) (Philogene, 1981).

The berry of the plant *Juniperus communis* L. of family Pineaceae is known for its medicinal uses (Walsh, 1990) and also in the manufacture of food products. In the present study, Sujiol, a terpenoid isolated from the berries, is screened for its growth-regulating activity against the tobacco caterpillar *Spodoptera litura*.

2 Materials and methods

Sujiol was isolated from the berries of *J. communis* by open column followed by high pressure liquid chromatography (Johan and Jarl, 1954). *S. litura* larvae were reared in a culture room at 26 ± 1°C, 14 h : 10 h light : dark period and 70% relative humidity on an artificial diet (Nagarkati and Prakash, 1974). The larvae were reared individually in tubes.

Different concentrations of Sujiol (0.1, 0.25, 0.5, 0.75, 1, 2 and 4%) were prepared in acetone. Thirty freshly moulted last instar larvae were segregated and 1 μl of the concentrations was applied topically on the abdominal region with a Hamilton microsyringe. The experiments were replicated five times. Parallel controls treated with 1 μl of acetone were maintained. The treated larvae were transferred to the diet and observed daily to note changes.

3 Results

Severe morphogenetic abnormalities were observed in Sujiol-treated resultant insects, at various concentrations (table 1). At lower concentrations (0.1 and 0.25%), the larvae developed into apparently normal adults. But these forms died within a few hours after moulting (fig. 1). Larvae treated with 0.5–2% concentrations pupated normally but exhibited serious disturbances during adult eclosion: adults developed within the pupal cuticle and were unable to shed the exuviae. These abnormal, non-vaible forms (fig. 2) were much smaller and undifferentiated when compared to the controls (fig. 3a–c). At 4% concentration, the larvae formed into mosaics which had both larval and pupal characteristics (fig. 4). A mixture of larval and pupal cuticle, a distinct shrinking of the body and slippage of the head are the most important characteristics observed in these forms. These intermediates did not undergo subsequent developmental changes and ultimately died.

4 Discussion

The present study suggests that application of Sujiol prevented normal development of the last instar larvae of *S. litura*, the degree of effectivenss varying with the concentration. Application of lower concentrations resulted in the formation of adults that survived only for a few hours and therefore were not able to mate or oviposite. Similar observations were noticed with other IGRs (Gunderson et al., 1985; Koul et al., 1987). Increase in the dosage of Sujiol resulted in an interference in ecdysis and the formation of mosaics. These forms were ruled out from further development and reproduction. These observations signify a derangement in endocrine mechanisms. Application of

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Sl. no.	Concentation (%)	Dose μg/insect	No.of insects	Mosaics (%)	Ecdysis inhibition (%)	Adults (failed to survive, %)	Adults (survived, %)
1.	0.10	1	30	0	0	93.3	6.6
2.	0.25	1	30	0	0	83.3	0
3.	0.50	1	30	0	80	0	0
4.	0.75	1	30	0	93.3	0	0
5.	1.00	1	30	0	76.6	0	0
6.	2.00	1	30	0	90	0	0
7.	4.00	1	30	91.3	0	0	0
8.	Control acetone	1	30	0	0	0	100

Table 1. *Morphogenetic effects of Sujiol against last instar larvae of* Spodoptera litura

Fig. 1. *Treated resultant adults which failed to survive*
Fig. 2. *Non-viable adults within the pupal cuticle*

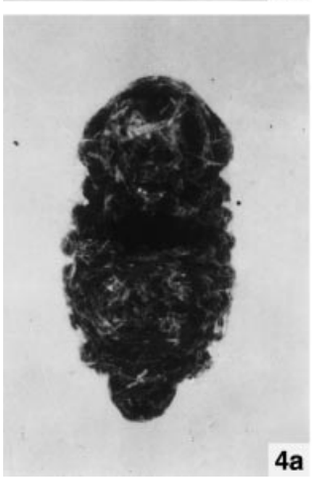

Fig. 3. *(a) Control larva, (b) control pupa, (c) control adult*
Fig. 4. *Mosaics with both larval (a) and pupal (b) characteristics*

Sujiol probably disturbed the delicate balance of timing and concentration of the hormones in the intact insect, resulting in the formation of abnormal, non-viable forms.

Hence, Sujiol shows effective IGR activity and exhibits great promise in suppressing field populations of *S. litura*.

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