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Investigations on the Host - Specificity of *Epiblema strenuana* (Walker) (Lepidoptera : Tortricidae), Introduced for Biological Control Trials against *Parthenium hysterophorus* in India

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ABSTRACT

The host-specificity of *Epiblema strenuana* (Walker) (Lepidoptera:Tortricidae) of Mexican origin, introduced from Australia for biological control trails against *Parthenium hysterophorus*, was tested under quarantine conditions in Bangalore. A total of 49 species of plants belonging to 28 families were used for the studies. *E. strenuana* did not accept 31 of the test plants for feeding. Slight nibbling and survival of larvae for 4 days was noticed on ten species of plants, while feeding and survival for 6-11 days was observed on another 7 species of plants. The insect was found capable of completing development on niger, an important oilseed crop in India, in addition to *Parthenium*. Hence the utility of *E. strenuana* in the biological control of *Parthenium* is very much limited in India.

Key words : *Epiblema strenuana*, bio-control of *Parthenium*, host specificity

Parthenium hysterophorus L., the composite weed of American origin, has found its way into many countries in Africa, Asia and Australia and is causing serious problems in some of them (Towers *et al*, 1977). In India, the weed which was first reported from Pune in 1955 (Rao, 1956), has spread throughout the country, infesting more than 5 million hectares of land (Gidwani, 1975). Although *Parthenium* is mainly a waste land weed, it encroaches into agricultural and pasture lands (Krishnamurthy *et al.*, 1977) and also constitutes a public health hazard (Lonkar *et al.*, 1974).

Biological control efforts against *Parthenium* were initiated in India in 1983 with the introduction of *Zygogramma bicolorata* Pallister (Coleoptera : Chrysomelidae). Although establishment of this leaf feeding insect has been obtained under field conditions in Bangalore, the results have not so far been encouraging (Jayanth, 1987). Hence a culture of *Epiblema strenuana* (Walker) (Lepidoptera : Tortricidae), originating from Mexico, was obtained from the Sir Alan Fletcher Research Station, Department of Lands, Queensland, Australia. The results of the host-specificity tests conducted under quarantine conditions in Bangalore are presented in this paper.

MATERIALS AND METHODS

The shipment of *E. strenuana*, consisting of 200 pupae and 50 larvae, was received on 30th January 1985.

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A laboratory culture was established and maintained under quarantine conditions by following the method described below. Freshly emerged adults of the moth were released in 16x20 cm clear plastic jars with wire-mesh windows for aeration. A seedling stage *Parthenium* plant with its roots dipping in water, collected in a small plastic container, was placed inside for oviposition and 50% honey was provided on a cotton swab for adult feeding. Exposed plants were collected out and fresh plants were introduced into the oviposition cage on alternate days.

Parthenium plants with eggs of *E. strenuana* were placed in separate jars for hatching. For purpose of multiplication, 2-3 day old larvae were transferred at the rate of 2 per *Parthenium* plant in the flower initiation stage. *Parthenium* plants planted in polythene covers were used for this purpose. The inoculated plants were placed inside 90x60x60 cm wooden cages with glass front and nylon wire-mesh on three sides and the top. The plants were watered at intervals of 2 days. After about 20 days, the infested plants were carefully cut open and pupae were collected.

Host-specificity tests were conducted with 49 plants belonging to 28 families. The studies were carried out in 14x11 cm plastic jars with wire-mesh windows, by releasing 1-3 day old larvae of *E. strenuana* on seedlings or twigs of the test plant. The roots or cut ends of the test plants were kept dipping in water collected in small plastic containers. Five larvae were released on each plant and the tests were replicated three times. Observations were recorded on the number of days the larvae survived and the amount of feeding.

Detailed tests were conducted with plants on which nibbling or feeding were observed in the above tests. Initially newly hatched and half-grown larvae were separately released on potted test plants, placed in wooden cages of the type described above, and development of larvae and damage to test plants monitored. In addition, 3 pairs of adults were released on potted test plants kept in cages. After 3 days, the number of eggs were counted and these were allowed to hatch and larval development was observed. Finally, niger on which the larvae were found capable of completing development was tested together with *Parthenium* in a dual choice situation. This study was carried out inside a wooden cage within a quarantine glass house by releasing 3 pairs of moths for 3 days. Here again oviposition and larval development were monitored. Laboratory studies were conducted at 28 ± 2°C and 40—60% R.H.

RESULTS AND DISCUSSION

E. strenuana larvae did not nibble or feed on 31 of the test plants (Table 1) in the no-choice tests and died in 2-3 days. Slight nibbling was observed on 10 species of plants belonging to 5 families (Table 2). However, only 2-5 small nicks could be made on these plants and larvae did not survive for more than 4 days. Table 3 lists out 7 species of plants belonging to Compositae, Leguminosae and Malvaceae on which slight feeding and survival of larvae for 6 to 11 days was observed.

Table 1. Test plants on which larval feeding by *E. strenuana* was not observed.

Sl. No.	Family	Name	Common name	Max. No. of days survived
1.	Amaryllidaceae	*Polyanthes tuberosa*	Tube rose	3
2.	Anacardiaceae	*Mangifera indica*	Mango	2
3.	Annonaceae	*Annona squamosa*	Custard apple	3
4.	Bromeliaceae	*Ananas comosus*	Pineapple	3
5.	Cannaceae	*Canna indica*	Canna	3
6.	Caricaceae	*Carica papaya*	Papaya	2
7.	Chenopodiaceae	*Beta vulgaris*	Beet root	2
8.	Compositae	*Chrysanthemum* sp.	Chrysanthemum	3
9.	Cruciferae	*Brassica nigra*	Mustard	3
10.	Cruciferae	*Raphanus sativus*	Radish	2
11.	Euphorbiaceae	*Ricinus communis*	Castor	3
12.	,,	*Codiaeum variegatum*	Croton	3
13.	Irridaceae	*Gladiolus* sp.	Gladiolus	3
14.	Leguminosae	*Pisum sativum*	Pea	3
15.	Lilliaceae	*Allium sativum*	Garlic	2
16.	Malvaceae	*Gossypium hirsutum*	Cotton	3
17.	,,	*Hibiscus sinensis*	Hibiscus	2
18.	Musaceae	*Musa paradisiaca*	Banana	2
19.	Moraceae	*Morus alba*	Mulberry	3
20.	Myrtaceae	*Psidium quajava*	Guava	3
21.	Oleaceae	*Jasminum grandiflorum*	Jasmine	2
22.	Punicaceae	*Punica granatum*	Pomogranate	3
23.	Rosaceae	*Rosa alba*	Rose	3
24.	Sapotaceae	*Achras zapota*	Sapota	3
25.	Rutaceae	*Citrus sinensis*	Citrus	2
26.	Solanaceae	*Solanum tuberosum*	Potato	3
27.	Solanaceae	*S. melongena*	Brinjal	2
28.	Umbelliferae	*Coriandrum sativum*	Coriander	4
29.	Vitaceae	*Vitis vinifera*	Grape	2
30.	Zingiberaceae	*Curcuma longa*	Turmeric	3
31.	,,	*Zingiber officinale*	Ginger	3

Table 2. Test plants on which nibbling by *E. strenuana* was observed but no development

Sl. No.	Family	Name	Common name	Max. No. of days survived
1.	Compositae	*Callistephus chinensis*	Aster	3
2.	,,	*Gerbera* sp.	Gerbera	3
3.	,,	*Coreopsis* sp.	Coreopsis	2
4.	Cruciferae	*Brassica oleraceae*	Cabbage	2
5.	Cucurbitaceae	*Citrullus vulgaris*	Water melon	3
6.	Graminaceae	*Oryza sativa*	Rice	3
7.	,,	*Triticum vulgare*	Wheat	3
8.	,,	*Eluesine coracana*	Ragi	4
9.	Solanaceae	*Lycopersicon esculentum*	Tomato	2
10.	,,	*Nicotina tabacum*	Tobacco	2

Table 3. Test plants on which feeding by *E. strenuana* was observed but no development

Sl. No.	Family	Name	Common name	Max. No. of days survived
1.	Compositae	*Solidago* sp.	Golden rod	6
2.	"	*Carthamus tinctorius*	Safflower	11
3.	"	*Helianthus annuus*	Sunflower	11
4.	"	*Tagetes erecta*	Marigold	8
5.	"	*Zinnia* sp.	Zinnia	8
6.	Leguminosae	*Vigna sinensis*	Cowpea	7
7.	Malvaceae	*Abelmoschus esculentus*	Bhendi	6

However, development and pupation were not noticed on any of these species of plants. *E. strenuana* larvae successfully completed development and pupated only on niger (*Guizotia abyssinica L.*) among the test plants other than *Parthenium*. Five of the 15 larvae in 3 replications pupated and 2 moths emerged from niger while 11 pupae and 9 moths were obtained from *Parthenium*.

When test plants on which nibbling or feeding were observed were potted and newly hatched and half-grown larvae were released, pupation was again observed only on niger and *Parthenium*. In oviposition tests, 1-8 eggs per plant were observed on gerbera, coreopsis, goldenrod, dahlia, aster, cowpea and tomato, 38.66 on niger and 75.66 on *Parthenium*. Although normal hatching of eggs was noticed in most of the cases, feeding by newly hatched larvae was observed only in *Parthenium*, niger and cowpea. However, development upto pupal stage was not noticed in cowpea.

In the dual-choice oviposition tests involving niger and *Parthenium*, egg laying was observed on both. A total of 15 pupae could be collected from 3 niger plants, out of which 8 moths emerged. Due to lack of synchronization in adult emergence, only one female mated and laid 208 eggs in 8 days and 191 of these were observed to hatch normally. Females of *E. strenuana* that emerged from *Parthenium*, however, lived for 9 to 16 days laying 377 to 792 eggs (mean 654.2).

The results of the above studies clearly showed that *E. strenuana* moths were capable of ovipositing on niger, when provided alone or together with *Parthenium*. The larvae were capable of feeding and developing on niger and the moths that emerged laid viable eggs. As niger is an important oilseed crop in India, the quarantine culture of this insect was terminated.

Earlier tests in Mexico involving 15 species of plants belonging to the family Compositae had shown that *E. strenuana* attacked *P. confertum* and *Ambrosia psilostachya* in addition to *P. hysterophorus* (McClay, 1981). Similarly, among the 49 species of plants belonging to 27 families that were tested in Australia, the insect was found capable of multiplying on *Xanthium strumarium* and *A. artemisifolia* (McFadyen, 1982). Field

releases were however, carried out in Mexico and in Australia as *P. confertum* and *A. psilostachya* are not of economic importance in Mexico and *X. strumarium* and *A. artemissifolia* are considered to be weeds in Australia. Within 18 months after releases of *E. strenuana* in Australia, the insect spread over most of the 120,000 km² area affected by *Parthenium* and the prospects of substantial control appeared very bright there (McFedyen, 1984). It was also reported that *E. strenuana* attacked *A. artemissifolia* and *X. strumarium* under field conditions.

It is thus very clear that *E. strenuana* is not specific to *P. hysterophorus*. and the present study indicates that it has a wider host-range. There have been instances where exotic weed insects have been released into the field inspite of limited breeding on crop plants under starvation tests. Thus two oligophagous stem borers *Mecas saturnina* LcC. and *Nupserha antennata* Gahan(Coleoptera:Prionidae), introduced for trials against *Xanthium* spp. in Australia, were found to accept related Compositae including sunflower. However, field releases were made after a cost/benefit consideration of importance of the weed against possible crop damage was done (Haseler, 1977). Neither species subsequently attacked crop plants, particularly sunflower in the field in Australia (Aasler, 1980). However, in view of the results obtained in the present study, preference should be given to monophagous insects or to those restricted to single plant genus, provided all such plant species except the target plants are of no economic importance, in importation programmes for the biological control of weeds.

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