Luperomorpha vittata Duvivier: A new association with *Parthenium hysterophorus* L. and other weeds

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We report the occurrence of the flea beetle *Luperomorpha vittata* Duvivier (Coleoptera: Chrysomelidae) on the exotic weed *Parthenium hysterophorus* L. in Bangalore city, South India. The adults caused characteristic skeletonized spots on leaves by scraping the epidermis. The beetles also fed on stems by scraping the epidermis and scooping the cortex portion. Leaves and stems were preferred to inflorescences for feeding. We also observed the beetle on ten other weeds growing in the same habitat, of which nine are new records. We suggest possible interaction of *L. vittata* with the introduced biocontrol agent *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae).

THE exotic weed *Parthenium hysterophorus* L., which was first noticed in India in 1956[1] and rapidly spread throughout the country[2], has attracted a large number of native insects[3] and mites[4] from time to time. The natural enemies of the weed in India have been recently reviewed[5]. In this paper we report the occurrence of a flea beetle on this weed and other weeds growing in the same habitat.

During June to September 1990, we observed the flea beetle *Luperomorpha vittata* Duvivier (Coleoptera: Chrysomelidae) attacking *P. hysterophorus* growing in diverse habitats in parts of Bangalore city, (South India). Adults were seen feeding singly on leaves and flower heads. The beetles scraped the epidermis on the upper surface of leaves leaving behind skeletonized patches, which later turned brown. Attacked leaves showed characteristic shot holes that were visible from a distance. The beetles often fed on large areas of leaves, including the main and lateral veins. They also fed on stems by scraping the epidermis and scooping large portions of cortex, which resulted in the formation of deep furrows. Black faecal matter of the beetle was seen adhering to the surface of newly damaged leaves and stems. Although some beetles were observed on inflorescences in the field, a close examination of capitula from infested plants revealed only little damage to disc florets. When allowed to feed on healthy parthenium plants in the laboratory, the beetles preferred leaves and stems to inflorescences, as evident from the feeding injury. Even when only inflorescences were provided to the beetles, the latter nibbled the corolla of a few ray florets and opened disc florets, which subsequently turned brown.

Besides parthenium, we collected *L. vittata* adults on several other weeds in the same habitat (Table 1). All these plants showed symptoms of damage on leaves similar to those found on parthenium. In addition, the beetles fed on petals of *Cassia uniflora*, the plant that is currently being evaluated for its potential to fight parthenium through competitive replacement and allelopathic activity[6], *Sida cordifolia* and *S. rhombifolia*. Among the hosts observed by us, *Amaranthus spinosus*, *A. tricolor*, *Datura metel*, *Ipomoea turbinata* and *P. hysterophorus* showed higher levels of damage than the other plants. *L. vittata* was earlier recorded on several crop plants[7] and ornamental plants[8]. With the exception of *A. spinosus*, which was reported as a host for *L. vittata*[7], all other hosts observed by us are new host records for this beetle. Although this beetle was described from India as early as 1926 by Maulik[9], who did not mention its host plants, it is interesting to note that no host records for this beetle were made until a much later period.

Table 1. Host plants of *Luperomorpha vittata* Duvivier in Bangalore city, South India.

Host	Family	Plant parts damaged
Achyranthes aspera L.	Amaranthaceae	Leaves
Alternanthera pungens H.B. & K.	Amaranthaceae	Leaves
Amaranthus spinosus L.	Amaranthaceae	Leaves
Amaranthus tricolor L.	Amaranthaceae	Leaves
Cassia uniflora Mill.	Fabaceae	Leaves and flowers
Datura metel L.	Solanaceae	Leaves
Ipomoea turbinata Lag. (syn *I. muricata* (L.) Jacq.)	Convolvulaceae	Leaves
Leucas biflora R. Br.	Lamiaceae	Leaves
Parthenium hysterophorus L.	Asteraceae	Leaves and flowers
Sida cordifolia L.	Malvaceae	Leaves and flowers
Sida rhombifolia L.	Malvaceae	Leaves and flowers

L. vittata adults seem to exhibit considerable variation in selection of feeding sites on different host plants. The beetle was found feeding exclusively on leaves of a good number of cultivated plants[7] and on petals of three ornamental plants[8]. In our survey too, the beetle damaged leaves of all the 10 plants recorded as new hosts but fed on the flowers of only three of them. The selection of plant parts for feeding may be governed by morphological features, chlorophyll content, nutritional composition and allelochemics. It is likely that the polyphagous *L. vittata* meets its overall nutritional requirements by feeding on various parts of a variety of plants in diverse habitats, which may incidentally provide the beetle an opportunity to dilute any toxic secondary metabolites present in some of its hosts. Alternatively, the beetle may be overshooting its annual weed hosts and spilling over to parthenium, which is available throughout the year. In contrast to this, parthenium, along with some other weeds, is known to harbour the lantana bug *Orthezia insignis* Browne (Homoptera: Ortheziidae) for a short period when the latter's primary host *Lantana camara* L., a perennial shrub, becomes unsuitable[10,11]. Thus, it will be interesting to examine the possibility that the beetle may establish on the more continuously available parthenium. It will also be worthwhile to ascertain the impact *L. vittata* may have on the recently introduced biocontrol agent *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae). As *Z. bicolorata* undergoes diapause in dry months and emerges from diapause with the onset of heavy rains[12], will *L. vittata* displace *Z. bicolorata* in the event of delayed or inadequate or erratic rainfall for a couple of years? Long-term studies on the biologies and interactions of these two beetles may provide an answer.

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Effect of polyamine biosynthesis inhibitors on polyamine levels in bean seedlings

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α-Difluoromethylornithine (DFMO) and α-difluoromethylarginine (DFMA), inhibitors of polyamine (PA) biosynthesis, are known to control fungal infections of plants. To see if these inhibitors affect plant polyamine metabolism and growth, changes in endogenous polyamine (PA) pools of bean plants (*Phaseolus vulgaris* L. var Pinto) were examined following a single spray of DFMO and DFMA onto unifoliolate leaves. The level of PAs did not decline after inhibitor treatment; rather putrescine and spermidine levels rose in plants sprayed with inhibitor. PA concentrations were greater in unexpanded trifoliolate leaves, compared with unifoliolate leaves, suggesting that PA biosynthesis is greatest in rapidly growing parts of the plant. There was no effect of DFMO or DFMA spray on growth of the plants. These findings further substantiate the idea that DFMO and other PA inhibitors might be used to protect crop plants from pathogenic fungi.

POLYAMINE (PA) research has increased greatly since the specific and enzyme-activated irreversible inhibitors of PA biosynthetic enzymes, such as α-difluoromethylornithine (DFMO) and α-difluoromethylarginine (DFMA) were synthesized. The availability of these and other inhibitors has not only enabled researchers to confirm the role of PAs in cell growth and differentiation in many systems[1,2], but has also had very exciting spin-offs[3–5]. For example, DFMO, an inhibitor of the PA biosynthetic enzyme ornithine decarboxylase (ODC), has proved to be an effective drug against cancer and protozoan infections[3,4]. Furthermore, Rajam *et al.*[5,6] showed that DFMO at 0.5 mM or higher completely controlled rust infection of french bean (*Phaseolus vulgaris* L. var. Pinto) caused by *Uromyces phaseoli* L. with systemic action. This novel approach has attracted the attention of several workers, who have also reported the protective effect of DFMO in the control of several other plant diseases caused by pathogenic fungi. For instance, rust infections of broad bean[7], wheat leaf and stem[8], oat and corn[9]; powdery mildews of wheat[8], barley[10], bean and apple[9]; leaf blight of corn[9]; and wilt of tomato[11] might be controlled by using DFMO and other inhibitors of PA biosynthesis. Thus the use of DFMO and other PA biosynthesis inhibitors for control of phytopathogenic[3–15] and human-pathogenic fungi[16–18] appears to be a promising area for future research. In the present investigation, we examined the effect of DFMO and DFMA on PA levels in bean seedlings to establish the extent to which DFMO and other PA biosynthesis inhibitors can be used for plant protection.

Unifoliolate leaves of 10-day-old greenhouse-grown bean (*P. vulgaris* L. var Pinto) seedlings (12 seedlings per treatment) were sprayed with three concentrations (0.01, 0.1 and 1.0 mM) of DFMO and DFMA in 0.01% Tween-20 at pH 7.0. Control plants were sprayed similarly with Tween-20 without inhibitor. PAs were determined in unifoliolate bean leaves 1 and 3 days later, while the first trifoliolate leaves, unexpanded at

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