



Host range and host preference of blister beetles

C. DURAIRAJ AND N. GANAPATHY

Dept. of Agrl. Entomology, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu.

Abstract: In the field surveys conducted in selected locations on blister beetles during 1996-1999, *Mylabris pustulata*, *M. thunbergii* and *Mylabris* sp. were found to be more cosmopolitan. Among the host plants, leguminous hosts dominated in number followed by *Malvaceae*. A total of 52 hosts was identified for *M. Pustulata*, 27 hosts for *Mylabris* sp. and 16 hosts for *M. thunbergii*. All these beetle species showed selective polyphagy among the hosts. *M. pustulata* beetles preferred solitary large sized (>4cm dia) yellow or white coloured flowers, while *M. thunbergii* and *Mylabris* sp. preferred small to medium sized (2-4 cm. dia) solitary flowers. Generally yellow and white flowers were most preferred by both species. But, the role of allelochemicals present in hosts in host preference was not ruled out. The above observations are first of its kind from India.

Key Words: Blister beetles - *Mylabris* sp., Host range.

Introduction

Blister beetles *Mylabris* sp. (Coleoptera: Meloidae) are pests of various agricultural crops. The adult beetles severely damage buds, flowers, tender pods and even tender leaves by feeding either solitarily or gregariously resulting in reduced yields (Anand, 1978). They are highly cosmopolitan and are reported to occur from tropical Tamil Nadu to temperate regions of Uttar Pradesh in India (Garg, 1985; Kashyap *et al.* 1990; Patnaik *et al.* 1993; Sahoo *et al.* 1993 and Durairaj and Ganapathy, 1996). Many species of blister beetles were reported on pulse crops. In northern India, *Mylabris phalerata* Pall was severe on pigeonpea (Garg, 1985; Dutta and Singh, 1989). Besides, *M. pustulata* Thunberg and *M. macilenta* Marshall were also reported on pulses (Kashyap *et al.* 1990). According to Prasad (1995), *M. phalerata* and *M. orientalis* were more harmful to pigeonpea in Uttar Pradesh. Similarly, in the southern parts of India *M. pustulata*, *M. thunbergii* Billberg and *Mylabris* sp. caused severe damage to pigeonpea (*Cajanus cajan* (L.) Millsp) and blackgram (*Vigna mungo* (L.) Hepper), greengram (*Vigna radiata* (L.) Wilczek) and cowpea (*Vigna unguiculata* (L.) Walper) (Giraddi *et al.* 1992; Durairaj, 1999). One of the many handicaps in the management of these beetles is the occurrence of a wide range of alternative hosts and the ability of these beetles to quickly adapt to newer hosts under crop ecosystem. Though some reports are available on the details of alternative hosts

in northern India (Garg, 1985), reports on their host range from southern parts of India are lacking. In this study conducted National Pulse Research Centre, Vamban during 1996-1999, investigations were carried out on the speciation of blister beetles available and their host range in selected locations in India.

Materials and Methods

Field observations were made on different blister beetles found both on cultivated crops and weed hosts in selected locations in India. The beetles were sampled in the districts of Pudukkottai, Trichy, Coimbatore in Tamil Nadu and Pantnagar in Uttar Pradesh.

Along with beetle samples, the host plants on which the beetles fed were also carefully noted. The blister beetles were got identified from International Institute of Entomology, London. The wild weed hosts were got identified from Botanical Survey of India, Coimbatore, India. In addition to host plant identity, specific observations were also made on qualitative traits like flower petal colour, size and flowering habit (single or clustered) etc. The diameter of flower corolla was measured from all the hosts and based on that the size of host plant flowers were classified into three categories, viz. small (less than 2.0 cm), medium (2.1 to 4.0 cm) and large (more than 4.0 cm). The host plants were classified upto family level and the highly preferred host plants were

Table 1. Host range for *Mylabris pustulata*

Sl. No.	Common Name	Botanical Name	Family	Flower size	Flower colour	Flower habit
1.	Butterfly pea	<i>Clitoria ternatea</i>	Leguminosae	Medium	White & Violet	Single
2.	Cowpea	<i>Vigna unguiculata</i>	Leguminosae	Medium	White	Single
3.	Blackgram	<i>Vigna mungo</i>	Leguminosae	Small	Yellow	Single
4.	Greengram	<i>Vigna radiata</i>	Leguminosae	Small	Yellow	Cluster
5.	Daincha	<i>Sesbania cannabina</i>	Leguminosae	Small	Pink	Single
6.	Sunhemp	<i>Crotalaria juncea</i>	Leguminosae	Medium	Yellow	Single
7.	Siratro	<i>Macroptelium lathyroides</i>	Leguminosae	Small	Yellow	Single
8.	Groundnut	<i>Arachis hypogaea</i>	Leguminosae	Medium	Yellow	Single
9.	Redgram	<i>Cajanus cajan</i>	Leguminosae	Medium	Yellow	Cluster
10.	Centro	<i>Centrosema pubescens</i>	Leguminosae	Small	Yellow	Single
11.	Garden bean	<i>Dolichos lab-lab</i>	Leguminosae	Medium	White	Cluster
12.	Stylo	<i>Stylosanthes hamata</i>	Leguminosae	Small	Yellow	Single
13.	Negro coffee	<i>Cassia occidentalis</i>	Leguminosae	Medium	Yellow	Cluster
14.	Tanner's cassia	<i>Cassia auriculata</i>	Leguminosae	Medium	Yellow	Cluster
15.	Sticky mallow	<i>Pavonia zeylanica</i>	Malvaceae	Small	White	Single
16.	Spindy sida	<i>Sida spinosa</i>	Malvaceae	Small	Yellow	Single
17.	Bhendi	<i>Abelmoschus esculentus</i>	Malvaceae	Large	White	Single
18.	Cotton	<i>Gossypium sp.</i>	Malvaceae	Large	White	Single
19.	Mesta	<i>Hibiscus cannabinus</i>	Malvaceae	Large	White	Single
20.	Holly hock	<i>Althia rosea</i>	Malvaceae	Large	Light pink	Single
21.	Country mallow	<i>Abutilon indicum</i>	Malvaceae	Medium	Yellow	Single
22.	Hibiscus	<i>Hibiscus sp.</i>	Malvaceae	Large	Red	Single
23.	Shoe flower	<i>Hibiscus rosa sinensis</i>	Malvaceae	Large	Red	Single
24.	Changing rose	<i>Hibiscus polypetalous</i>	Malvaceae	Large	White & Pink	Single
25.	Pumpkin	<i>Cucurbita maxima</i>	Cucurbitaceae	Large	Orange	Single
26.	Ribbed gourd	<i>Luffa acutangula</i>	Cucurbitaceae	Medium	Yellow	Single
27.	Bottle gourd	<i>Lagynaria vulgaris</i>	Cucurbitaceae	Medium	White	Single
28.	Wild mustard	<i>Cleome viscosa</i>	Capparideae	Small	Yellow	Single
29.	Mango	<i>Mangifera indica</i>	Anacardiaceae	Small	Brown	Cluster
30.	Indian night shade	<i>Solanum indicum</i>	Solanaceae	Medium	White	Cluster
31.	Thorn apple	<i>Datura metal</i>	Solanaceae	Large	White	Single
32.	Poovarasukodi	<i>Ipomoea carnea</i>	Convolvulaceae	Large	White	Single
33.	Sweet potato	<i>Ipomoea batatas</i>	Convolvulaceae	Large	Violet & Pink	Single
34.	Amaranthus	<i>Amarathus spp.</i>	Amaranthaceae	Small	Pink	Cluster
35.	Bougainvillea	<i>Bougainvillea spectabilis</i>	Nyctaginaceae	Large	Pink	Cluster
36.	Neerium	<i>Nerium odorum</i>	Amaryllidaceae	Large	Yellow	Single

37.	Mountain stage	<i>Lantana camara</i>	Verbenaceae	Small	Orange	Cluster
38.	Indian short	<i>Canna indica</i>	Araceae	Large	Orange	Single
39.	Flame tree of wood	<i>Ixora singaporensis</i>	Rubiaceae	Medium	Red	Cluster
40.	Purging nut	<i>Jatropha sp.</i>	Euphorbiaceae	Medium	Red	Single
41.	Powder puff	<i>Calliandra spp.</i>	Mimosaceae sp.	Large	Pink	Single
42.	Rose	<i>Rosa centifolia</i>	Rosaceae	Large	Pink	Single
43.	Wild passion fruit	<i>Passiflora foetida</i>	Passifloraceae	Large	White	Single
44.	-	<i>Stemodia viscosa</i>	Scrophulariaceae	Small	Violet	Single
45.	Sesamum	<i>Sesamum orientale</i>	Pedaliaceae	Medium	White	Single
46.	Curry leaf	<i>Murraya koenigii</i>	Rutaceae	Small	White	Cluster
47.	Vettukkaya keera	<i>Tridax procumbens</i>	Compositae	Small	White	Single
48.	Chrysanthemum	<i>Chrysanthemum indicum</i>	Compositae	Large	Orange	Single
49.	-	<i>Corchorus aestuans</i>	Tiliaceae	Small	Yellow	Cluster
50.	Guava	<i>Psidium guajava</i>	Myrtaceae	Medium	White	Single
51.	Prickly pear	<i>Opuntia dillenii</i>	Cactaceae	Large	Yellow	Single
52.	Indian privet	<i>Lawsonia inermis</i>	Lythraceae	Small	White	Cluster

* Small = <2 cm dia of standard petal; Medium = 2.1 to 4.0 cm; Large = > 4.0 cm

determined based on the intensity of damage and the beetle density on the host.

Results and Discussion

The three common blister beetle species identified were *M. pustulata*, *M. thunbergii* and *Mylabris* sp. Among these, *M. pustulata* and *Mylabris* sp. were cosmopolitan while *M. thunbergii* was less prevalent. The host plants that were attracted by these three species showed marked variation. A total of 52 host plants was identified for *M. pustulata*, 27 for *Mylabris* sp. and 16 for *M. thunbergii*. Host plants belonging to 25 botanical families were attractive to *M. pustulata*, while host plants from nine and seven botanical families were attractive to *M. thunbergii* and *Mylabris* sp. respectively (Table 1, 2 and 3).

Among the host plants recorded for *M. pustulata*, 14 plant species were from Leguminosae followed by 10 plant species from Malvaceae. The floral morphology also contributed for the host preference. Though the size of flowers had not shown marked variation in host preference by *M. pustulata*, flower habit

showed striking differences. The preference was found to be more for solitary, single flower than clustered inflorescences. In addition, among the host plants identified, white and yellow petalled flowers were more preferred than either red, pink or orange flowers (Table 1).

In the case of *Mylabris* sp. out of 27 host plants identified from nine botanical families, leguminous hosts outnumbered others. Smaller sized flowers were more preferred for feeding followed by medium sized flowers whereas larger flowers were the least preferred. This species also preferred single flowers than inflorescence clusters. Yellow petalled plants were more attacked than either white or pink (Table 2).

In the case of the least dominant species, *M. thunbergii*, only sixteen host plants were recorded as hosts from seven botanical families. Among them, eight host plants belonged to the family Leguminosae and three hosts to Malvaceae. Leguminous hosts constituted 50.0 per cent of total host plant species identified in this investigation. As in other two species, this species also preferred solitary, smaller sized, yellow and white flowered plants (Table 3).

Table 2. Host range for *Mylabris* sp.

Sl. No.	Common Name	Botanical Name	Family	Flower size	Flower colour	Flower habit
1.	Wild indigo	<i>Tephrosea purpurea</i>	Leguminosae	Small	Pink	Single
2.	Cowpea	<i>Vigna unguiculata</i>	Leguminosae	Medium	White	Single
3.	Blackgram	<i>Vigna mungo</i>	Leguminosae	Small	Yellow	Single
4.	Greengram	<i>Vigna radiata</i>	Leguminosae	Small	Yellow	Cluster
5.	Daincha	<i>Sesbania cannabina</i>	Leguminosae	Small	Yellow	Cluster
5.	Groundnut	<i>Arachis hypogaea</i>	Leguminosae	Medium	Yellow	Single
7.	Redgram	<i>Cajanus cajan</i>	Leguminosae	Medium	Yellow	Cluster
3.	Butterfly pea	<i>Centrosema pubescens</i>	Leguminosae	Small	Yellow	Single
1.	Stylo	<i>Stylosanthes hamata</i>	Leguminosae	Small	Yellow	Single
10.	-	<i>Indigofera aspalathoides</i>	Leguminosae	Small	Yellow	Single
11.	-	<i>Rothia indica</i>	Leguminosae	Small	Yellow	Single
2.	Sticky mallow	<i>Pavonia zeylanica</i>	Malvaceae	Small	White	Single
3.	Spiny sida	<i>Sida spinosa</i>	Malvaceae	Small	White	Single
4.	Mesta	<i>Hibiscus cannabinus</i>	Malvaceae	Large	White	Single
5.	Sida	<i>Sida acuta</i>	Malvaceae	Small	White	Single
6.	Country mallow	<i>Abutilon indicum</i>	Malvaceae	Medium	Yellow	Single
17.	Wild mustard	<i>Cleome viscosa</i>	Capparideae	Small	Yellow	Single
18.	Rat ear leaf	<i>Merremia hederacea</i>	Convolvulaceae	Small	White	Single
19.	Vishnu kiranthi	<i>Evolvulus alsinoides</i>	Convolvulaceae	Small	Pink	Single
20.	-	<i>Ipomoea pestigridis</i>	Convolvulaceae	Medium	White	Single
21.	-	<i>Stemodia viscosa</i>	Scrophulariaceae	Small	Violet	Single
22.	Sesamum	<i>Sesamum orientale</i>	Pedaliaceae	Medium	White	Single
23.	Chag root	<i>Oldenlandia umbellata</i>	Rubiaceae	Small	White	Cluster
24.	-	<i>Andrographis echioides</i>	Acanthaceae	Small	Pink	Single
25.	-	<i>Justica tranquebariensis</i>	Acanthaceae	Small	Yellow	Single
26.	-	<i>Polygala arvensis</i>	Polygalaceae	Small	Yellow	Single
27.	Indian Ash tree	<i>Odina wodier</i>	Anacardiaceae	Small	Yellow	Single

† Small = <2 cm dia of standard petal; Medium = 2.1 to 4.0 cm; Large = > 4.0 cm

The range of host plants recorded in this study clearly indicated that leguminous hosts were more predominant than others for all the three species. The host range of *M. pustulata* was very wide compared to either *Mylabris* sp. or *M. thunbergii*. Since legumes are nutritionally superior, these beetles might have shown marked preference towards them. Earlier record on the host range of *M. pustulata*, *M. phalerata*, *M. macilentia* and *M. tiffensis* Billberg showed that the flowers, buds and tender growing parts of cucurbits, malvaceous plants, beans, pulses, potato (*Solanum tuberosum* L.), flax (*Linum usitatissimum* L.),

sunhemp (*Crotalaria juncea* L.), sandal (*Santalum album* L.), mustard (*Brassica juncea* Corr.), maize (*Zea mays* L.), groundnut (*Arachis hypogaea* L.), blackgram, chrysanthemum (*Chrysanthemum morifolium* Vis.) and brinjal (*Solanum melongena* L.) were devoured by these beetles (Isaac, 1934; Subramania Iyer, 1921; Sharma *et al.* 1964; Sivarama Krishnan, 1984; Sood and Kakar, 1991; Dhamadhare *et al.* 1995). Sangha and Mavi (1995) recorded *M. phalerata* on ridge gourd (*Luffa acutangula* Roxb.) cowpea, canna (*Canna edulis* Kerr-Gawl.), china rose (*Rosa* sp.), cotton (*Gossypium hirsutum* L.)

Table 3. Host range for *Mylabris thunbergii*

Sl. No.	Common Name	Botanical Name	Family	Flower size	Flower colour	Flower habit
1.	Blackgram	<i>Vigna mungo</i>	Leguminosae	Small	Yellow	Single
2.	Cowpea	<i>Vigna unguiculata</i>	Leguminosae	Medium	White	Single
3.	Groundnut	<i>Arachis hypogaea</i>	Leguminosae	Medium	Yellow	Single
4.	Greengram	<i>Vigna radiata</i>	Leguminosae	Small	Yellow	Cluster
5.	Madrasthorn	<i>Pithecellobium dulce</i>	Leguminosae	Small	White	Single
6.	Redgram	<i>Cajanus cajan</i>	Leguminosae	Medium	Yellow	Cluster
7.	Wild indigo	<i>Indigofera viscosa</i>	Leguminosae	Small	Pink	Cluster
8.	Stylo	<i>Stylosanthes hamata</i>	Leguminosae	Small	Yellow	Single
9.	Bhendi	<i>Abelmoschus esculentus</i>	Malvaceae	Large	White	Single
10.	Country mallow	<i>Abutilon indicum</i>	Malvaceae	Medium	Yellow	Single
11.	Sida	<i>Sida acuta</i>	Malvaceae	Small	Yellow	Single
12.	Ash gourd	<i>Cucumis moschata</i>	Cucurbitaceae	Large	White	Single
13.	Cylon spinach	<i>Talinum triangulare</i>	Portulacaceae	Small	Pink	Single
14.	Small caltrops	<i>Tribulus terrestris</i>	Zygophyllaceae	Small	Yellow	Single
15.	-	<i>Cyanotis cucullata</i>	Commeliniaceae	Small	Blue	Single
16.	Australian asthma weed	<i>Euphorbia hirta</i>	Euphorbiaceae	Small	Brown	Cluster

* Small = < 2 cm dia of the standard petal; Medium = 2.1 to 4.0 cm; Large = > 4.0 cm.

greengram, okra (*Abelmoschus esculentus* L.) soybean (*Glycine max* (L.) Merrill.), tobacco (*Nicotiana tabacum* L.) and rice (*Oryza sativa* L.). Balasubramanian (1995) listed fourteen plant species as feeding hosts for *M. pustulata* in Tamil Nadu besides *Opuntia dilenii* and *Canavalia ensiformis*. Natarajan (1990) reported that *M. pustulata* beetles were found to be feeding on mesquite (*Prosopis chilensis* (Molina) in Tamil Nadu, India while Krishnan and Jayakumar (1993) estimated nutritional indices for *M. pustulata* on *Ipomoea carnea* and *I. tuberosa*. Besides, tree crops like mango and Madrasthorn were also attacked by *M. pustulata* and *M. thunbergii* respectively.

The robustly built beetles of *M. pustulata* preferred larger sized flowers for feeding as they would require more niche for their foothold. Moreover, white and yellow coloured flowers were more attracted, obviously evidencing some amount of colour preference by this species. The small sized *Mylabris* sp preferred smaller flowers to accommodate their smaller bodies on floral surface. Besides *Mylabris* sp. was

gregarious, attacking the host in small swarms. This gregarious feeding was conspicuous in pigeonpea and stylo only. In order to facilitate easy mass feeding, smaller flowers might be more convenient besides eliminating competitive feeding by individual beetles on host flowers. The third species, *M. thunbergii* also preferred smaller solitary yellow coloured flowers but was less aggressive in feeding.

The foregoing results also revealed that out of 52 host plants attractive to *M. pustulata*, only 36 were found to be specific to this species. Similarly, ten plant species were specific for *Mylabris* sp. while seven host plants alone were attractive to *M. thunbergii*. However, cowpea, blackgram, greengram, groundnut, redgram, stylo and country mallow were attractive to all the three blister beetle species recorded.

As regards to intensity of damage, *M. pustulata* preferred pigeonpea, cowpea, blackgram, greengram, stylo, country mallow, powder puff, shoe flower and changing rose more while datura and sunnhemp were least preferred. More

than 5.0 beetles/flower were observed on these hosts while single beetles alone were observed on the least preferred hosts with low feeding either on petals or reproductive parts. In the case of *Mylabris* sp. cowpea, greengram, blackgram, redgram and stylo were highly preferred while raincha and wild mustard were least preferred. The least abundant beetle species, *M. thunbergii* was more attracted to stylo and country mallow only.

But a deep insight into this investigation revealed some degree of selective polyphagy exhibited by these beetles. When leguminous plants hosts were the most sought hosts, few legumes like *Cassia siamea*, *Macrotyloma uniflorum* Lam., *Gliricidia sepium* and *Crotalaria juncea* which bore yellow, pink or white flowers were not at all preferred by any of the species. Similarly, in the case of cucurbits, *Coccinia indica*, *Citrullus colocynthis*, *Momordica charantia* which also bore yellowish, single flowers were not preferred. The bright yellow coloured, larger flowers of *Allamanda cathartica* were totally spared by *M. pustulata*.

All these observations revealed that apart from morphological features, either nutritional or plant kairomonal factors might play a significant but dominant hidden role in the host selection process by these beetles. Zhu and Higgins (1994) found that among the alfalfa cultivars raised, "Kansas Common" and "Arrow" alfalfas were more preferred for feeding by the blister beetle, *Epicauta funebris* Werner and *E. occidentalis* Werner than the hairy and glandular alfalfa lines like "Riley" and "KS 210". The former two cultivars were found to be nutritionally superior than the latter two.

Acknowledgements

The first author wishes to express his gratitude and thanks to Indian Council of Agricultural Research (ICAR), New Delhi, India for the financial assistance in the form of Adhoc. Scheme. The authors acknowledges the assistances of Dr.K.Srinivasan, and Dr.T.Senguttuvan in the course of the above investigation. Authors also acknowledges the valuable assistance of Dr.T.G.Shanower, Research Entomologist, Northern Plains, Agricultural Research Lab, 1500 North

Central Avenue, Sidney, MT 59270, USA for reviewing this manuscript.

References

- Anand, R.K. (1978). First record of *Meloe proscarabeus* Lin. and *M. violaceus* Marshall (Coleoptera: Meloidae) from India along with further description and a key to Indian species. *J. Ent. Res.* 2: 40-42.
- Balasubramanian, P. (1995). Food plants of blister beetle, *Mylabris pustulata* Thunb. (Coleoptera: Cantharidae) from Point Calimere Wildlife Sanctuary, Tamil Nadu. *J. Bom. Nat. His. Soc.* 89: 262-263.
- Dhamadhare, S., Dhamadhare, S.V. and Mathur, R. (1995). Occurrence and succession of pests of brinjal, *Solanum melongena* L. at Gwalior, India. *J. Ent. Res.* 19: 71-77.
- Dutta, M. and Singh, V. (1989). Blister beetle (*Mylabris phalerata*), a serious pest of pigeonpea in the lower hills of Uttarpradesh. *Int. Pigeonpea Newsl.* 10: 29-30.
- Durairaj, C. (1999). Management of blister beetle in pulse crops. Final report of ICAR adhoc scheme sent to ICAR, New Delhi: 47p.
- Durairaj, C. and Ganapathy, N. (1996). Identification of blister beetle complex on pigeonpea in Tamil Nadu, India. *Int. Chickpea and Pigeonpea Newsl.* 3: 96.
- Garg, D.K. (1985). Blister beetles feeding on pigeonpea and other crops in Kumaon Hills of Uttar Pradesh, India. *Int. Pigeonpea Newsl.* 4: 54-55.
- Giraddi, R.S., Goudreddy, B.S. and Lingappa, S. (1992). Survey and surveillance of insect pests of redgram with special reference to *Heliothis armigera* (Hb.) in Bider district, Karnataka. *J. Agric. Sci.* 5: 273-274.
- Isaac, P.V. (1934). Scientific reports for Institute of Agricultural Research, Pusa, (1932-32): 161-166.
- Kashyap, N.P., Mehta, P.K. and Dhindsa, S.S. (1990). Insect pests associated with pigeonpea at Palampur, Himachal Pradesh. *Int. Pigeonpea Newsl.* 12: 26-27.
- Krishnan, N. and Jayakumar, G. (1993). Effect of feeding regimes on reproduction in *Mylabris pustulata* (Coleoptera : Meloidae). *Uttar Pradesh J. Zoology.* 13: 107-110.

- Natarajan, V. (1990). Insects infesting mesquite (*Prosopis chilensis* (Molina) S. at Point Calimere Wildlife Sanctuary. *J. Bom. Nat. His. Soc.* 87: 467.
- Patnaik, H.P., Mohapatra, H.K. and Senapati, B. (1993). Blister beetle incidence and some observations on its ovipositional behaviour on pigeonpea in Orissa, Indian. *Int. Pigeonpea Newsl.* 18: 27-30.
- Prasad, C.S. (1995). Insect pests in Kumaon Hills of Uttar Pradesh. *Int. Chickpea and Pigeonpea Newsl.* 2: 72-74.
- Sahoo, B.K., Jena, B.C. and Behera, P.K. (1993). Seasonal occurrence of blister beetle on pigeonpea varieties at south coastal districts of Orissa. *Environment and Ecology*, 11: 135-236.
- Sangha, H.S. and Mavi, G.S. (1995). Seasonal activity and host range of blister beetle, *Mylabris phalerata* (Pallas). *J. Insect Sci.* 8: 106-107.
- Sharma, P.L., Agarwal, S.C. and Bhalla, O.P. (1964). New record of damage of silk and milk grains of maize by blister beetles. *India J. Ent.* 26: 238-239.
- Sivaramakrishnan, V.R. (1984). *Mylabris pustulata* Thunberg. *Indian Forestry*. Dehradun (ed N.K.Mathur, 110: 1201-1202.
- Sood, A.K. and Kakar, K.L. (1991). Relative persistence toxicity of some insecticide against blister beetle, *Mylabris* spp. on chrysanthemum flowers. *J. Insect Sci.* 4: 9-98.
- Subramania Iyer, T.V. (1921). *Journal of Mysore Agricultural and Experimental Union*, 19-19.
- Zhu, Y.C. and Higgins, R.A. (1994). Host plant influences on feeding, survivorship, population distribution and management of blister beetles (Coleoptera:Meloidae) in Kansas. *Environ. Ent.* 23: 1472-1479.

(Received : February 2002; Revised : March 200