

Is the Mexican beetle *Zygogramma bicolorata* (Coleoptera: Chrysomelidae) expanding its host range?

Zygogramma bicolorata Pallister, the Mexican beetle, was mass released in Karnataka during 1984, to control the noxious weed, *Parthenium hysterophorus* L. (Asteraceae)¹. The pre-release tests suggested that the beetle is specific to *P. hysterophorus* and therefore might not constitute a threat to other related economically important crops in India². However, seven years later, fears were expressed, on the host specificity of the beetle claiming that it was found feeding on an important oilseed crop, sunflower (*Helianthus annuus* L., Asteraceae)³. But the evidences supporting the claim were strongly contested^{4,5} (see box). Here I report the evidence suggesting that the beetle has extended its host range.

During a recent field trip to Sira Taluk of Tumkur District, Karnataka (19 July 1992), I noticed extensive defoliation of an Asteraceae weed, *Xanthium strumarium* L. by the adults of Mexican beetle in three locations, namely Chikkanahalli, Kallambella and Sira. Later, on 24 July 1992, I also observed these beetles and their larvae defoliating *X. strumarium* in several places within Bangalore. At Chikkanahalli, all the beetles found on *X. strumarium* plants ($n=12$) were removed and three days later they were found to harbour 24 new beetles, indicating their migration from elsewhere. The beetles collected from *X. strumarium* were found to be identical to those found on *P. hysterophorus*, based

on their male genitalia. A few preliminary feeding experiments were conducted in the laboratory to confirm the field observations.

The beetles ($n=42$) collected from *X. strumarium* fed readily on the cut twigs of *X. strumarium* through 15 days of the experiment with 69 per cent of them surviving. Five of the eight larvae similarly fed on the leaves of cut twigs of *X. strumarium* pupated. The beetles collected from *X. strumarium* fed relatively more on *X. strumarium* than *P. hysterophorus* when their leaves were offered separately (Table 1), while the beetles preferred *P. hysterophorus* when both the hosts were provided together. On the other hand, beetles collected

The beetle battle

The Mexican beetle, *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae) was introduced to India during 1983 to combat the noxious weed, *Parthenium hysterophorus* L. (Asteraceae). The beetle was mass released in the field during 1984 after extensive laboratory trials on its host specificity at the Indian Institute of Horticultural Research, Bangalore^{1,2}. At a conference in 1990, Jayanth and Bali³ reported a reduction in the density and the rates of reproduction of *P. hysterophorus* at the sites of release of the beetle. It is estimated that the beetle has now spread over 20,000 km² in southern India^{3,4}.

An alarm was recently raised that the beetle might become a potential pest of one of the major oilseed crops of the country, sunflower, which also belongs to the family Asteraceae^{5,6}. The claim was, however, only supported by photographic evidence and damage estimates obtained through interviews with farmers, but not with any information using controlled feeding trials. Further, doubts were also cast over the photographic evidence, since the pattern of damage shown was not typical of the beetle^{4,7}. Though a few other workers, testing the host range of the beetles have observed the beetles nibbling sunflower leaves, these were certainly not large enough to indicate it as a potential threat to sunflower⁴. However, since the claim, if true, is of considerable significance to the National Economy, the Institute of Agricultural Technologists (IAT), Bangalore convened a group discussion among the experts and scientists concerned on 12 February, 1992 at the IAT under the chairmanship of Prof. G. K. Veeresh, University of Agricultural Sciences, Bangalore.

The proponents of the Mexican beetle as a safe biological control agent, allayed the fears using the

following arguments. First, in controlled feeding trials, the Mexican beetle was observed to nibble and not to feed extensively on sunflower leaves^{4,8}. Secondly, the larvae were not found to feed on the leaves in the field; neither did they do so in control feeding experiments⁴. Thirdly, surveys carried out to assess the host range of the beetle in Mexico did not reveal the beetles feeding on sunflower, even when *P. hysterophorus* and sunflower were growing in close vicinity⁹. Finally, all the five species of *Zygogramma* Chevrollet which have been extensively studied, indicate strong host specificity, including *Z. exclamatoris*, a pest of sunflower in the US^{4,8-10}.

However, these arguments, though temporarily seemed to settle the issue, were not convincing enough to allay the potential threat of the beetle as a pest of sunflower. This is especially true in the face of the fact that *Z. bicolorata* is already known to feed on *Ambrosia* L. species, belonging to the same tribe as that of sunflower and *Parthenium* and that a related species of the beetle, *Z. exclamatoris* is a pest of sunflower in the US. But the acuteness of the problem stems from the experience in the then USSR *Z. tortuosa* Rogers, a related species of the Mexican beetle which was introduced to USSR to control the weed *Ambrosia* species was observed to feed on sunflower. The introduced culture was destroyed immediately to safeguard the economic oilseed crop¹².

In other words, there appeared to be no sufficient evidence with either camp and therefore it was decided to have a state level seminar at a later time when more empirical data are generated. A committee under the chairmanship of Mr N. Sampangi, Special Secretary to the Government, Department of Science and Technology, Ecology and Environment, Government of Karnataka was constituted to oversee the matter.

Note added in proof The second workshop on 'Management of parthenium — A critical appraisal' was held on 22 October 1992 at IAT, Bangalore. The workshop covered various aspects of management of *P. hysterophorus*. During the meeting, it was noted that in the seed production plots, the beetles were found feeding on the foliage of young sunflower plants, at times causing heavy damage to certain plants. K. P. Jayanth informed that experiments conducted at the Indian Institute of Horticultural Research indicated that the *P. hysterophorus* pollen grains deposited on sunflower are responsible for attracting *Z. bicolorata* adults and inducing their feeding on sunflower leaves. However, several doubted the pollen theory and it was suggested that the pollen grains may be only one of the factors inducing feeding.

- 1 Jayanth, K. P., *Curr Sci*, 1987, **56**, 310–311
- 2 Jayanth K. P. and Nagarkatti, S., *Entomon*, 1987, **12**, 215–223
- 3 Jayanth, K. P. and Bali, G., Evaluation of the efficacy of *Zygogramma bicolorata* and *Parthenium hysterophorus* at a field release site in Bangalore. Paper presented at the National Symposium on Conservation and Management of Living Resources Univ Agric Sciences, Bangalore, January, 1990
- 4 Jayanth, K. P., On the reported feeding by the Mexican beetle,

- Zygogramma bicolorata* on sunflower in Bangalore, Status paper, Mimeographed report, IHR, Bangalore, 1992, pp 10
- 5 Sridhar, S., *Frontline*, 9–22 November, 1991, Madras, India p 100
- 6 Sridhar, S., *Frontline*, 28 February, 1992, Madras, India, p 127
- 7 Pandey, R. M., *Frontline*, 28 February, 1992, p 127
- 8 Maclay, A. S., in Proceedings of the VI International Symposium on Biological Control of Weeds, (ed Del Fosse, E. S.), Ottawa, Canada, Agriculture Canada, 1985, pp 771–778
- 9 McFayden, R. E., Report on additional host-specificity tests with *Zygogramma* sp. nr *malvae* Stal. Mimeographed report Alan Fletcher Res. Stn., Sherwood, 1981, pp 3
- 10 McFayden, R. E., in Proceedings of the VI International Symposium on Biological Control of Weeds (ed Del Fosse, E. S.), Ottawa, Canada, Agriculture Canada, 1985, pp 789–796
- 11 Rogers, C. E., *Environ Entomol*, 1977, **6**, 466–468
- 12 All-India Co-ordinated Research Project (AICRP) on Bio-control, *Zygogramma* and *Parthenium* control, Mimeographed report, Bangalore, 1992, pp 5

A. R. V. KUMAR

Table 1. Extent of feeding by *Zygogramma bicolorata* collected on *X. strumarium* and *P. hysterophorus* under choice and enforced conditions (area of leaf fed in cm² per beetle per day)

Condition/leaves	Source plant for the beetles			
	<i>X. strumarium</i> (Xs) on		<i>P. hysterophorus</i> (Ph) on	
	Xs	Ph	Xs	Ph
Choice	0.04 ± 0.018	0.124 ± 0.006	0.0 ± 0.00	0.059 ± 0.025
Enforced	0.634 ± 0.58	0.109 ± 0.051	0.054 ± 0.001	0.204 ± 0.188

from *P. hysterophorus* preferred *P. hysterophorus* irrespective of whether *X. strumarium* was offered with it or not.

These results indicate an innate preference of the beetles to *P. hysterophorus* but also suggest the possibility that under scarcity of the preferred host, they would switch over to an alternate host, *X. strumarium*. This is corroborated by the observation that at locations where considerable feeding on *X. strumarium* was recorded, *P. hysterophorus* stands were devoid of any foliage. Though these results suggest that *Z. bicolorata* beetles have extended their host range, it is not clear whether they would become a threat to sunflower production. Nevertheless con-

sidering that *Xanthium*, *Parthenium* and sunflower belong to the same tribe in Asteraceae and as insects in general have a great ability to develop biotypes, it is indeed essential that these beetles are continuously monitored and measures taken for an early alert in case of any eventuality.

1. Jayanth, K. P., *Curr Sci*, 1987, **56**, 310–311.
2. Jayanth, K. P., and Nagarakatti, S., *Entomon*, 1987, **12**, 215–223
3. Sridhar, S., *Frontline*, 1991, November 9–22, 1991, p 100.
4. Jayanth, K. P., Status paper on the reported feeding by the Mexican beetle, *Zygogramma bicolorata* on sunflower in

Bangalore, Mimeographed report, IHR, Bangalore, 1992, p 10

5. Pandey, R. M., *Frontline*, 1992, 28 February 1992, p 127.

ACKNOWLEDGEMENTS I thank Dr G. K. Veeresh and Dr C. A. Viraktamath for reading earlier drafts of the manuscript and Mr T. M. Musthak Ali for examining the beetles.

A. R. V. KUMAR

Department of Agricultural Entomology
University of Agricultural Sciences
GKVK Campus
Bangalore 560 065, India