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Feeding potential of *Zygogramma bicolorata* on *Parthenium hysterophorus* during different months at western zone of Tamil Nadu

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Abstract

Field experiments were conducted at non cropped areas of Coimbatore district, Tamil Nadu, India *viz.*, Arasur, Jageenaickenpalayam, Vedapatty, Vadavalli, Mathampalayam and Devarayapuram blocks, during May – December 2010 and 2011 to study the feeding behavior of *Zygogramma bicolorata* beetles on *Parthenium hysterophorus*. *Zygogramma bicolorata* beetles were released during May months of both the years (2010 and 2011) in heavily *Parthenium* infested areas of Arasur, Vadavalli, Jageenaickenpalayam, Vedapatty Devarayapuram and Mathampalayam blocks. Adult beetles were released at 400 to 500 numbers / m² per site in about 120m² areas under non-crop situation. Observations on number of eggs, larvae and adult beetles per plant were made at monthly intervals. There was a better multiplication of beetles during September, October and November months of both the years during that period there was fair distribution of rainfall. From mid-November the beetles started evading from the infested blocks and sites. The *Parthenium* damage ranged between 73.6 to 89.7 percent with an average damage of 81.9 percent during North East Monsoon periods (October to December) than the south west monsoon periods (June to September) wherein damage was in the range of 39.5 to 66.7 percent during first month of observation with an average damage of 48.3 percent.

Keywords: *Parthenium hysterophorus*, *Zygogramma bicolorata* and feeding behavior

Introduction

Parthenium (*Parthenium hysterophorus* L.) has been found growing naturally since centuries in Mexico, North and South America, Australia, China, Pacific islands, East and South Africa and Canada. Till early 70s, the weed did not find any place in the list of world's worst weeds. But, within the decade time, it has become one of the seven most dreaded weeds of the world. *Parthenium* is native to the Gulf of Mexico and central South America and has become invasive in North America, South America, the Caribbean, and many parts of Africa, Asia, and Australia (Navie *et al.*, 1996) [7].

In India, this weed was observed during mid-fifties because it accidentally introduced during the import of wheat grains in Maharashtra during 50s. However, it spread throughout the country has been very rapid with abnormal density. Further, factors such as (i) the absence of natural agents that not restricted the spread of this weed, (ii) high fecundative capacity, (iii) efficient seed dispersal mechanisms, (iv) Allelopathy impact on other plant species and (vi) wide adaptability to varying soil and agro climatic conditions have enabled *Parthenium* to invade a variety of growing environments particularly in situations where the human activities are abundant. Currently, the *Parthenium* has invaded throughout India in about 35 million hectares of land (Sushilkumar and Varshney 2010, Sushilkumar 2014) [9, 10]. It is notorious for causing allergic reactions (Kologi *et al.* 1997) [6] besides a threat to biodiversity and loss of crop productivity (Adkins and Shabbir 2014, Sushilkumar, 2014) [1, 10].

Parthenium is used to manage by several methods in order to minimize the further spread in the environment. Though, manual and chemical methods are very effective management strategies to contain further growth of the *Parthenium* in cropped fields, but these are leads to economically not viable options in waste and range lands and also lead to dermatitis problem when we advocate manual removing. If we manage the *Parthenium* through biological method, it can be economically viable and environmentally and ecologically better options. *Zygogramma bicolorata* is widely used to manage *Parthenium* plants in non cropped areas and it was estimated that this bioagent has checked the spread of *Parthenium* in about eight million hectares of land since its release in India.

Zygotogramma beetles have different feeding behavior on *Parthenium*. The infestation of this beetle and their activity is greatly influenced by the climatic parameter and in particular seasons. There is no information available on the response of the *Z. bicolorata* on *Parthenium* in western agro climatic zone of Tamil Nadu, India. Hence, this study has been formulated to know the feeding behavior of *Zygotogramma bicolorata* on *Parthenium* in different periods and their effectiveness to the defoliation of *Parthenium* weed under non crop situations.

Materials and Methods

Field experiments were conducted at non cropped areas of Coimbatore district, (Western agro climatic zone) Tamil Nadu, India viz., Arasur, Jageenaickenpalayam, Vedapatty, Vadavalli, Mathampalayam and Devarayapuram blocks, during May – December 2010 and 2011 to study the feeding behavior of *Zygotogramma bicolorata* beetles on *Parthenium hysterophorus*. *Zygotogramma bicolorata* beetles were released during May months of both the years (2010 and 2011) in heavily *Parthenium* infested areas of Arasur, Vadavalli, Jageenaickenpalayam, Vedapatty Devarayapuram and Mathampalayam blocks. Adult beetles were released at 400 to 500 numbers / m² per site in about 120m² areas under non-crop situation. Observations on number of eggs, larvae and adult beetles per plant were recorded at monthly intervals (August, September and October, 2010 and 2011). Observations on number of eggs, larvae and adult beetles per plant were made at monthly intervals and presented. Mean of infestation of the beetle, percentage of damage caused by the insects and standard errors were estimated.

Results and Discussion

Biological control through insects is an environmentally sound and effective means of reducing *Parthenium* plants in

the environment. *Zygotogramma bicolorata*, an effective leaf eater and both the adults and larvae feed on leaves. The early stage of larvae feed on the terminal and auxiliary buds and move on to the leaf blades as they grow. An insect density of one adult per plant caused skeletonization of leaves within 4–8 weeks. But, the plants are alive and when sufficient moisture is available (Jayanth, 1987) [5].

After a month of release, there were 20.2 to 34.5 eggs / plant with 14.6 to 30.7 larvae and 16.4 to 28.1 adults / plant in the three sites. *Parthenium* damage was in the range of 48.3 to 66.7 percent during first month of observation with an average damage of 48.3 percent. There was quite lot of variation in the beetle population in the bombarded sites. However, with higher *Parthenium* damage ranging from 50.3 to 80.6 percent with an average of 69.0 percent at second month after beetle release, where, 16.8 to 32.7 eggs / plant with 19.3 to 23.6 larvae and 17.0 to 20.4 adults / plant in the three sites. Enhanced *Parthenium* damage was observed at 3rd month of observation with a damage range of 73.6 to 89.7 percent with an average damage of 81.9 percent based on biomass reduction in comparison with *Parthenium* from beetle free areas. Whereas, 24.4 to 29.4 eggs / plant with 21.8 to 24.1 larvae and 17 to 21.6 adults / plant in the three sites during third months after release of beetles (Table 1,2 and 3). This might be due to favourable environment created because of monsoon rains at Tamil Nadu. (Shabbir A Dhileepan K and Adkins SW. 2012) [8].

The active period of *Zygotogramma bicolorata* was from October to December than other months. Further, it has been observed that *Parthenium* weed emerges earlier and present well in advance stages of its growth before *Z. bicolorata* appears during April and May (Table 4). This was observed by Javaid A and Shabbir A. 2007 [4].

Table 1: *Zygotogramma bicolorata* infestation (No.) and intensity of *Parthenium* damage (Mean of August, 2010 and 2011)

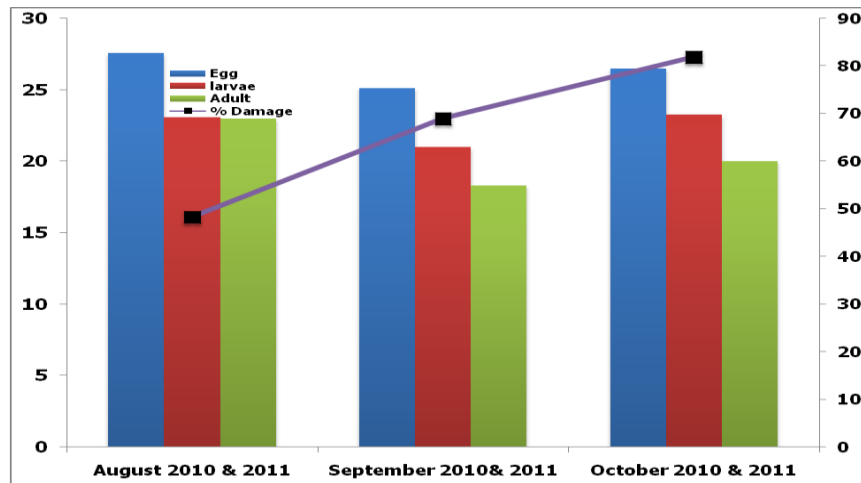
Plant No.	Jageenaickenpalayam			Vedapatty			Devarayapuram			% damage of <i>Parthenium</i>
	Egg	Larvae	Adult	Egg	Larvae	Adult	Egg	Larvae	Adult	
1	25	23	26	24	20	22	20	18	20	47.9
2	38	34	38	31	26	24	18	15	14	52.4
3	34	30	29	30	24	20	15	10	12	40.7
4	42	38	35	36	31	26	26	21	20	54.3
5	55	50	54	30	25	24	31	26	24	66.7
6	28	25	20	20	18	18	20	19	16	44.5
7	10	9	12	34	30	28	14	13	12	41.7
8	32	30	25	19	15	14	18	15	14	40.8
9	36	31	27	25	21	19	20	18	15	39.5
10	45	43	41	32	26	23	20	19	17	54.6
Average	34.5	31.3	30.7	28.1	23.5	21.8	20.2	14.6	16.4	48.3
Overall <i>Parthenium</i> Damage = 48.3 %										

Table 2: *Zygotogramma bicolorata* infestation (No.) and intensity of *Parthenium* damage (Mean of September, 2010 and 2011)

Plant No.	Jageenaickenpalayam			Vedapatty			Devarayapuram			% damage of <i>Parthenium</i>
	Egg	Larvae	Adult	Egg	Larvae	Adult	Egg	Larvae	Adult	
1	35	23	32	29	18	16	20	16	20	79.8
2	32	24	18	24	20	24	14	10	14	66.4
3	46	39	14	20	6	21	16	12	10	80.6
4	24	20	36	43	28	20	18	15	18	69.2
5	32	25	10	26	23	30	34	30	20	76.5
6	15	10	15	18	12	10	64	34	32	64.3
7	56	36	12	15	14	14	21	20	15	72.6
8	31	21	20	32	28	16	36	31	25	60.5
9	29	18	31	23	20	15	20	15	10	69.4
10	27	20	16	15	12	10	14	10	6	50.3
Average	32.7	23.6	20.4	16.8	20.1	17.6	25.7	19.3	17.0	69.0
Overall <i>Parthenium</i> Damage = 69.0%										

Table 3: *Zygogramma bicolorata* infestation (No.) and intensity of *Parthenium* damage (Mean of October, 2010 and 2011)

Plant No.	Jageenaickenpalayam			Vedapatty			Devarayapuram			% damage of <i>Parthenium</i>
	Egg	Larvae	Adult	Egg	Larvae	Adult	Egg	Larvae	Adult	
1	30	26	30	26	21	20	36	33	30	76.8
2	24	20	24	31	29	25	41	30	24	86.5
3	36	30	10	24	20	18	31	24	28	85.4
4	43	36	16	29	25	24	24	19	23	80.9
5	18	15	10	36	34	32	52	42	32	86.9
6	20	18	21	34	31	30	31	28	24	77.8
7	16	10	8	51	42	35	15	14	12	85.5
8	24	21	15	16	15	12	19	15	10	75.7
9	32	30	21	17	12	10	25	21	18	89.7
10	14	12	15	10	10	9	20	16	15	73.6
Average	25.7	21.8	17.0	24.4	23.9	21.5	29.4	24.1	21.6	81.9
Overall <i>Parthenium</i> Damage = 81.9%										

**Fig 1:** Average of *Zygogramma bicolorata* growth stages and its effect on *Parthenium***Table 4:** Impact of *Zygogramma bicolorata* on its feeding potential on *Parthenium*

Location	August 2010 and 2011				September 2010 and 2011				October 2010 and 2011			
	<i>Zygogramma bicolorata</i> (Nos.)			% damage of <i>Parthenium</i>	<i>Zygogramma bicolorata</i> (Nos.)			% damage of <i>Parthenium</i>	<i>Zygogramma bicolorata</i> (Nos.)			% damage of <i>Parthenium</i>
	Egg	Larvae	Adult		Egg	Larvae	Adult		Egg	Larvae	Adult	
Jageenaickenpalayam	34.5 ± 1.22	31.3 ± 1.13	30.7 ± 1.18	48.3 ± 0.87	32.7 ± 1.41	23.6 ± 0.86	20.4 ± 1.55	69 ± 0.93	25.7 ± 0.94	21.8 ± 1.18	17 ± 1.13	81.9 ± 0.56
Vedapatty	28.1 ± 0.58	23.5 ± 0.51	21.8 ± 0.41		16.8 ± 0.84	20.1 ± 0.62	17.6 ± 0.91		24.4 ± 0.85	23.9 ± 1.02	21.5 ± 0.90	
Devarayapuram	20.2 ± 0.50	14.6 ± 0.45	16.4 ± 0.36		25.7 ± 0.92	19.3 ± 0.63	17 ± 0.77		29.4 ± 0.70	24.1 ± 0.93	21.6 ± 0.76	

Conclusion

From the present study, it is clear that the fecundative activities of the *Zygogramma bicolorata* beetles were more predominant during monsoon periods viz., October to December. Hence, biological control of *Parthenium* through *Zygogramma bicolorata* beetle can be intensified during these periods in order to have good control over other methods.

References

- Adkins S and Shabbir A. Biology, ecology and management of the invasive *Parthenium* weed (*Parthenium hysterophorus* L.). Pest Management Science. 2014; 70:1023-1029.
- Dhileepan K, Setter SD, McFadyen RE. Response of the weed *Parthenium hysterophorus* (Asteraceae) to defoliation by the introduced biocontrol agent *Zygogramma bicolorata* (Coleoptera: Chrysomelidae). Biological Control. 2000; 19:9-16.
- Dhileepan, K. Effectiveness of introduced biocontrol insects on the weed *Parthenium hysterophorus* (Asteraceae) in Australia. Bulletin of Entomological Research. 2001; 91:167-176.
- Javaid A and Shabbir A. First report of biological control of *Parthenium hysterophorus* by *Zygogramma bicolorata* in Pakistan. Pakistan Journal of Phytopathology. 2007; 18:99-200.
- Jayanth K.P., Introduction and establishment of *Zygogramma bicolorata* on *Parthenium hysterophorus* at Bangalore, India, Current Science. 1987; 40:568-569.
- Kolgi PD, Kolgi SD, Kolgi NP. Dermatologic hazards of *Parthenium* in human beings. In: Mahadevappa M, Patil VC, eds. Proceedings of the First International Conference on *Parthenium* Management, Dharwad, India, 6-9 October 1997. Dharwad, India: University of Agricultural Sciences, 1997, 18-19.
- Navie SC, McFadyen REC, Panetta FD, Adkins SW. The biology of Australian weeds 27. *Parthenium hysterophorus* L. Plant Prot. Q. 1996; 11:76-88.
- Shabbir A, Dhileepan K, Adkins SW. Spread of *Parthenium* weed and its biological control agent in the Punjab, Pakistan. Pakistan Journal Weed Science Research. 2012; 18:581-588.
- Sushilkumar, Varshney Jay G. *Parthenium* infestation and its estimated cost management in India. Indian Journal of Weed Science. 2010; 42(1-2):73-77.
- Sushilkumar. Spread, menace and management of *Parthenium*. Indian Journal of Weed Science. 2014; 46(3):205-219.