



**Ecofriendly Control Of Carrot Weed *Parthenium
Hysterophorus* Using Mexican Beetle
Zygogramma Bicolorata Around Rahuri City
(Maharashtra – India)**

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Abstract: *Parthenium hysterophorus L.* is a serious weed in India, covering about 5 million ha of land. *Zygogramma bicolorata* Pallister the leaf beetle, Mexican was considered a safe biocontrol agent. It causes extensive damage to *Parthenium* plants. Its occurrences & distribution was studied around Rahuri city. It is not well established and spread in study area and need its dispersal to control the parthenium. The data on preference of food by adults of *Z. bicolorata* on crop plants along with carrot weed indicates its preference for feeding & oviposition to parthenium. It is found to be a promising, safe biocontrol agent. Its distribution among farmers can help to control the weed.

Keywords: Occurrence, distribution, preference of food, safe biocontrol, planning, awareness programme

Introduction

Ragweed Parthenium (a.k.a. parthenium weed, Santa Maria feverfew, congress grass, carrot weed, white top, etc.), (*Parthenium hysterophorus*), a member of the Asteraceae (Compositae) family, is native to Mexico and Central and South America and is becoming an increasingly troublesome weed around the world. The fast-growing weed is a nuisance in public parks, residential colonies and orchards. It is harmful to health of man & domestic animals. In Queensland, Australia, losses to the cattle industry due to parthenium have been estimated to be Au\$ 16 million per year in terms of control costs and loss of pasture¹. Biocontrol of parthenium was first initiated in Australia in 1977. Australia & India have proved that biological control of parthenium is possible & effective². In India, this weed was first reported from Pune in 1955³, it has spread through the country occupying 5 million hectares of land. *Zygogramma bicolorata* Pallister was introduced from Mexico in 1983 and host-specificity tests were carried out under quarantine conditions with 40 plants belonging to 27 families. After much research, Mexican beetles (*Zygogramma bicolorata* Pallister) were considered a safe biocontrol agent. Field cage studies showed that *Z. bicolorata* is able to breed under Bangalore conditions and cause extensive damage to Parthenium plants. It is proved that this insect is capable of feeding and reproducing only on Parthenium, *Z. bicolorata* cause extensive damage to Parthenium plants. Both the adults and larvae are capable of feeding on the parthenium leaves thus checking the plant growth and flower production. Adults defoliate the plant. Immature flowers are cut by the beetles in an effort to chew the soft tissues beneath the flowers. Completely defoliated plants start to show die-back symptoms and gradually get killed.

As this Beetle is exotic, in India, *Zygogramma* became abundant within three years after introduction, resulting in a significant reduction in Parthenium density in local areas^{4,5}. *Z. bicolorata* is now widely used in India to control Parthenium. It has spread to about 2 million ha in the country with different status of establishment and spread. In some places it is reared in the laboratory & released for the control of the weed. In India, a single adult *Z. bicolorata* per plant caused 85-100% defoliation within six to eight weeks, depending on the stage of plant growth⁴. The present study deals with the observation and recording of Naturally Available biocontrol agent *Zygogramma bicolorata* in study area on Parthenium, its biology & rearing. Its occurrence & distribution near and around Rahuri city, Ahmednagar district of Maharashtra and extent of control of weed

was studied so as to find out its proportion as biocontrol agent of Parthenium, study on feeding on crop plants other than Parthenium by leaf beetle.

Materials & Methods

Collection Of Zygogramma

The Parthenium beetles were collected on Parthenium weed in its natural environmental conditions from villages in the range of 30 km around Rahuri city. The villages selected were Vambori, MPKV, Digrus, Mulanagar, Baragaon nandur, Takimiya, Manori, Rahuri city (college campus), Guha (table1) etc. The adult beetles were collected during the months of June, July, August, September, October & November as the beetles were more active in these months. The beetles were collected in plastic containers of volume 1 liter along with its natural food i.e. leaves of Parthenium. The five samples were collected from selected locality during day time from 10am to 5pm in 1 square meter area. The collected samples counted & then again released in the same habitat.

Rearing In Laboratory

Mated adult females were selected & placed in plastic containers of 1lit.capacity along with fresh parthenium leaves for feeding & egg laying. Females deposited eggs on lower side of parthenium leaves. The leaves of parthenium containing eggs of Zygogramma were placed in separate plastic containers of same size till they hatch at room temp. & 60%-70% humidity. The newly hatched larvae were provided fresh parthenium leaves. The rearing was set to have a mass culture for studying feeding preference of Zygogramma on various crop plants along with parthenium.

Choice & No-Choice Tests (table 2)

For studying preference/selection of plants for feeding & oviposition, choice tests & no-choice tests trays of 6”w x 9”l size were used. For choice tests about 25 leaves of each crop plant were placed in half part of trays & 25 leaves of carrot weed in other half on opposite side in trays were placed. The distance kept betn. Test crop plant & parthenium was about 3”-4”. Five adults were placed on each test crop plant every time & its behaviour in terms of locomotion/ attraction towards its natural food host plant parthenium was observed (table 2). In no choice test only crop plants were provided to adults for feeding & oviposition. Each test replicated five times consisting of five adults in each replica.

Results & Discussion

Morphology

Eggs- 1mm in size, yellowish in color, near hatching change in reddish color.

Larvae- four larval instars, full grown larvae about 6mm in size, become dark yellow in colour.

Adult- female small in size about 5mm, male large in size about 6mm in size, adult are dull white or yellowish in color with black serpentine line on wings.

Life Cycle

The incubation period of eggs is 4 to 5 days. The larvae feeds for 10 to 15 days on the leaves and on maturity enter the soil, larval period 9 to 7 days and pupate below up to 15 cm depth, Pupal period 8 to 11 days. The beetles emerge after eight to 12 days and Total life cycle 23 to 37 days⁶ (egg-adult approximately 6-8 weeks). Adults feed on leaves & flowers, females lays eggs on underside of leaves in cluster of two or three, eggs yellowish in colour, 1mm in size, eggs become red near about to hatch. After 4-6 days from eggs hatches the larva, well grown larva is about 6mm in length, larvae feed on leaves & buds, full grown larvae enter the soil & pupate in earth capsule, chamber, young adults emerge & feed ferociously. Adults reaches up to 6mm in size, they feed on leaves & buds, after two –three days male & female mate in morning & early evening time, mating behaviour simple, mating last for five minutes to hour, a single female lays about 2000 eggs in her life time.

High humidity & available moisture are essential to ensure continuous oviposition by *Z. bicolorata*, otherwise females stop ovipositing & adults go into the soil where they diapause. Continuous oviposition can be achieved by ensuring high humidity (70%).

The data collected are tabulated (table1) & shows occurrence, distribution of *Zygotyphlocyba bicolorata* around Rahuri on *Parthenium hysterophorus* in year 2010.

The sample collected shows the variation in occurrence & distribution. In the month of June to November the adult beetles & larvae feed on leaves of host plant, the beetles also feed on seed of *Parthenium*. Further from December up to June these hibernate in soil and after first rain showers they come out of the soil and starts feeding on carrot grass. They are less in number at Guha & MPKV & higher at Rahuri college campus & Baragaon nandur. However, this population is less, it is not sufficient to control the *Parthenium*. A total of 60,056 adults and 2, 17, 570 grubs of *Z. bicolorata* were released during 1987-1994 around Prawaranagar on *Parthenium*. Complete defoliation of the

weed in released area was noticed from September onwards. Drying of weed started from October onwards. The population of *Z. bicolorata* underwent hibernation pupating below the soil. The recurrence of beetle occurs in July/ August ⁶. In our study we also observed recurrence of beetle in July/ August but we noticed its presence up to the December rather than October. This may be due to the climatic variation of locality and year of study.

The data on preference of food by *Z. bicolorata* (table2) on crop plants along with carrot weed indicate that the adults moved with in about 3-15 minutes from crop plants to parthenium, indicating that they are not polyphagus except sunflower. It was also found to feed on leaves of Sunflower when no choice of its host plant was provided. It can deposit the eggs on brinjal in no choice test.

Sr. No	Location	Average no. of Adult Beetles collected/m2 area						
		June	July	Augst	Sept.	Octo	Nov.	Ave.
1	Baragaon nandur	09	10	10	09	08	08	9.0
2	Digrus	06	06	07	06	07	07	6.5
3	Guha	06	07	07	04	03	03	5.0
4	Manori	05	06	07	07	06	05	6.0
5	MPKV	03	03	04	04	03	04	3.5
6	Mulanagar	06	07	08	07	08	07	7.16
7	Rahuri college campus	08	09	11	10	09	08	9.16
8	Vambori	04	06	05	06	05	05	5.16

table 1: Occurrences & distribution of *Zygogramma bicolorata* on *Parthenium hysterophorus* around Rahuri

Sr. no.	Common name of plant	No-choice Tests		Choice Tests	
		feeding	oviposition	feeding	oviposition
1	Parthenium	++	++	++	++
2	Sunflower	+	0	0	0
3	Brinjal	0	+	0	0
4	Maize	0	0	0	0
5	Tomato	0	0	0	0
6	Potato	0	0	0	0
7	Spinach	0	0	0	0
8	Garlic	0	0	0	0
9	Onion	0	0	0	0
10	Sugarcane	0	0	0	0
11	Wheat	0	0	0	0
12	Ghass	0	0	0	0
13	Cabbage	0	0	0	0
14	Sorghum	0	0	0	0
15	Pigeon pea	0	0	0	0
16	Chickpea	0	0	0	0
17	Field peas	0	0	0	0
18	Baricot bean	0	0	0	0
19	Lentil	0	0	0	0
20	Green bean (shevaga)	0	0	0	0
21	Cotton	0	0	0	0
22	Methi	0	0	0	0
23	Radish	0	0	0	0
24	Coriander	0	0	0	0
25	Pumpkin	0	0	0	0
26	Ladies finger	0	0	0	0

Table 2: Preference of plant by adults of *Z. Bicolorata* for feeding & oviposition in no-choice tests & choice test.

Future Planning

Parthenium Awareness Programmes (PAP)

Control of Parthenium is not only the need of farmers but also of general public because it is spreading everywhere, occupying the land. Without creating pollution or disturbing the nature it has become necessary to eradicate it & Mexican beetle may prove a promising tool.

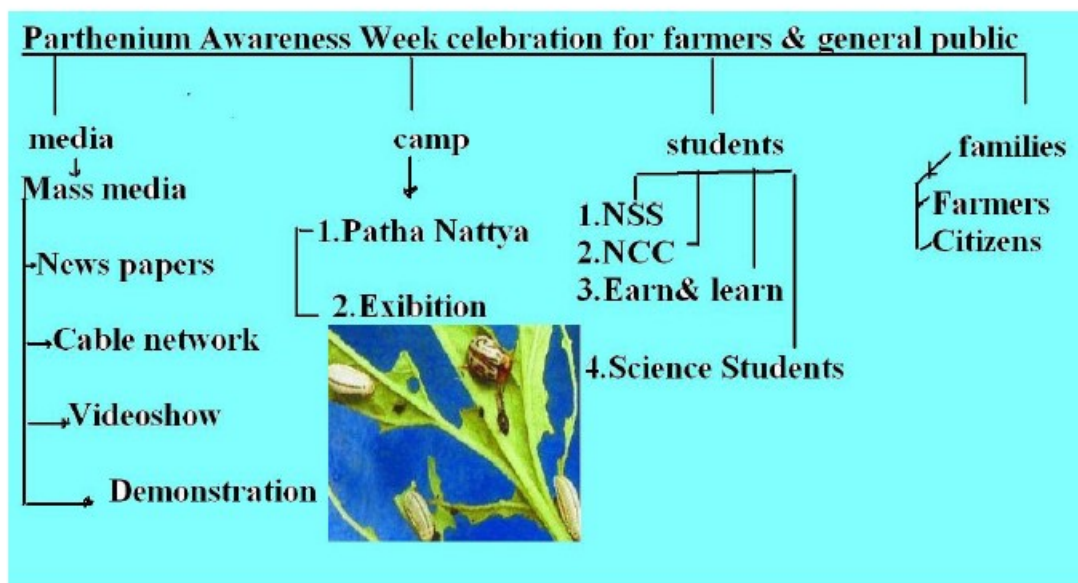


Figure 1: Modified from Gonjari et al 2007 and Tanmbade and Gonjari 2007

Conclusion

They being less in number on Parthenium weed, it is not controlled. For controlling this weed the number of beetle should be increased in proper proportion. Hence there is need of rearing & release on Parthenium. It can be reared in laboratory & after sufficient amount they can be released on its host plant. The Mexican beetle adult & larvae showed choice on Parthenium except sunflower as its preferred food. There is need of awareness & campaign^{5,6} about the Mexican beetle, *Zygogramma bicolorata* among farmers as a safe biocontrol agent for carrot weed.

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