Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 856-859

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 856-859**
Journal homepage: http://www.ijcmas.com

Original Research Article

To Work Out the Food Consumption by Different Life Stages of Mexican Beetle under Laboratory Conditions

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A B S T R A C T

The food consumption of Mexican beetle, *Zygogramma bicolorata* P. was conducted under laboratory conditions at 25-30°C and 60 ± 5% RH, Department of Entomology, IGKV, Raipur District in Chhattisgarh during 2016 and 2017. On the basis of overall two years of data indicated that food consumption of parthenium was maximum (11.03mg) eaten by third instar grubs followed by four instars (7.94mg) and minimum in adults stage (0.74mg). Quantitative food utilization indices were measured in different larval instars and physiological ages of adult *Zygogramma bicolorata* P. Among the grubs and adult stages of the beetle, third instar and fourth instars ingested maximum food. The efficiency of conversion of digested food was maximum in third instar and decreasing trend was observed in second instar larvae.

Keywords

Mexican beetle, food consumption by grubs, different instars, parthenium weeds

Introduction

Parthenium hysterophorus L., (Asteraceae) is a weed of global significance occurring in Asia (Bangladesh, India, Israel, Pakistan, Nepal, southern China, Sri Lanka, Taiwan and Vietnam), Africa (Ethiopia, Kenya, Madagascar, Mozambique, South Africa, average that would occur in the absence of the bio- control agent. Insects, fungi, nematodes, snails, slugs, competitive plants and microorganism may be bio-control agents for Parthenium. So far in the world, insects have received maximum attention in biological control of Parthenium followed by pathogens and competitive plants. Biological control of Parthenium through insects, pathogen and competitive plants gained momentum in India in 1980s with publication of more reports about the indigenous bioagents infesting Parthenium. The weed suppresses growth of local vegetation and has been reported as a health hazard for farm labourers by causing dermatitis, eczema and asthma (Nav Bahar 2000). The classical biological control was started with the introduction of a host-specific leaf-feeding beetle *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae) from Mexico (Jayanth 1987). In spite of good information available on Parthenium about insects, fungi and plants infesting it, countable efforts were made in past to review all such information at one place. This paper gives the current scenario of different group of bioagents and

their present status in controlling Parthenium in India along with the recent important work carried out on this aspect in the world.

Materials and Methods

The food consumption of Mexican beetle, *Zygogramma bicolorata* P. was conducted under laboratory conditions at 25-30°C and 60 ± 5% RH, Department of Entomology, IGKV, Raipur District in Chhattisgarh. Newly hatched different instars of grubs were taken for food utilization studied. A single grub each of different instars maintained separately as stock culture was provided for test. The different stages of beetles i.e. first, second, third, four instars and adults were released on to host plant of different petri dishes. The different treatments likewise grub and adult were introduced into Petri dish (10 cm diameter) of size with filter paper. Premeasured weight of parthenium leaves was provided to the instar wise grubs to allow feed for 24 h.

At the end of each day of the experiment, the filter paper was cleaned with a fine camel hair brush to collect the excrement and remove from tissue paper. After then all consumption of host plant were measured on weight basis that is, the difference in the total weight of the tissue paper contained with leaves of the host plant subtracted by difference in the total weight of the remained leaves containing tissue paper of host plant after leaves consumption. There were three replications. Observations were recorded food eaten by different life stages of *Zygogramma* within 24hrs. These indices were calculated as follows:

$$\text{Food consumption} = \frac{\text{Total food given by grubs \& adult (wt) - total food eaten by grubs \& adult (wt)}}{\text{Total food given by grubs \& adult (wt)}} \times 100$$

Results and Discussion

The all the treatments were sown significantly. In first year, the food consumption of parthenium was maximum (11.01mg) eaten by third instar grubs followed by four instars (8.10mg) and minimum food eaten by adults stage (0.73mg) whereas, during 2017, the highest (11.04mg) food eaten by also third instar grubs. It was followed by four instars (7.77mg) and minimum in adults (0.75mg).

On the basis of overall two years of data indicated that food consumption of parthenium was maximum (11.03mg) eaten by third instar grubs followed by four instars (7.94mg) and minimum in adults stage (0.74mg) are presented in table-1&2 and fig.-1. Not accurate but similar reported by McClay in under laboratory conditions in Mexico which indicated on its biology showed that the eggs were laid in the stems, there were 5 nymphal instars and development from egg to adult lasted 30-56 days. It could only reproduce on *P. hysterophorus* and *Ambrosia confertiflora* of the 11 species of Compositae tested. At high population densities, it caused yellowing of the leaves and spindly growth. Sanghmitra and Basu (2004) also mentioned the insect and fungal infestation in *P. hysterophorus* plants from July to September 2003, it was observed that a large number of insects were feeding on *P. hysterophorus* leaves and flowers. The percentage of damage was very high (up to 90%). The insect was identified as *Listronotus setosipennis*. This is thought to be the first report of *L. setosipennis* from India. Not accurate but similar finding given by to Wald Bauer (1968) according to all consumption and growth parameters were measured on dry weight basis. Utilization efficiencies and rates were determined and modified by Scriber and Slansky (1981).

Table.1 To work out the food consumption by different life stages of Mexican beetle under laboratory conditions during 2016&2017

S. No.	Life stage	Food consumption by adult & grubs within 24hrs (in mg)		
		2016	2017	Mean
1	I-instar	2.50 (1.73)	2.47 (1.72)	**2.48**
2	II-Instar	5.20 (2.39)	5.23 (2.39)	**5.22**
3	III-Instar	11.01 (3.39)	11.04 (3.40)	**11.03**
4	IV-Instar	8.10 (2.93)	7.77 (2.88)	**7.94**
5	Adults	0.73 (1.11)	0.75 (1.12)	**0.74**
Total		**27.54**	**27.26**	**27.40**
SEM		**0.078**	**0.147**	
CD @ 5%		**0.138**	**0.260**	
CV (%)		**2.452**	**4.678**	

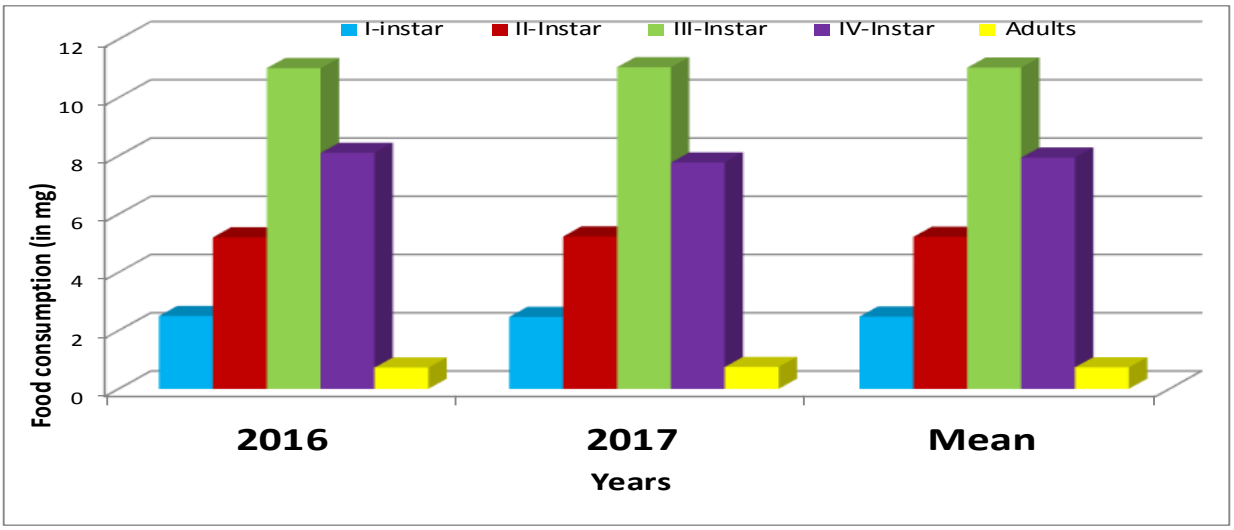
*Data shows Av of three times replicated

Table.2 The pooled data of the the food consumption by different life stages of Mexican beetle under laboratory conditions during 2016&2017

Treatments No.	Insect life stage	Mean (days)
1	1st instar grub	**3.00**
2	2nd instar grub	**4.67**
3	3rd instar grub	**5.17**
4	4th instar grub	**6.00**
5	grub period	**18.83**
6	pupal period	**8.67**
7	Adult longevity	**81.7**

*Data shows Av of three times replicated

Fig.1 The data sowing food consumption by Mexican beetle, *Zygogramma bicolorata* P. within 24hrs (in mg) under laboratory conditions during 2016 & 2017



The indices used were: Relative Consumption Rate (RCR), Relative Growth Rate (RGR), Approximate Digestibility (AD), Efficiency of Conversion of Ingested Food (ECl) and Efficiency of Conversion of Digested Food (ECD) to Biomass. The weight of male and female beetles was highest in Parthenium fed beetles followed by Xanthium and sunflower. Preference tests of grubs and adults also proved Parthenium as most suitable host.

Maximum newly hatched larvae preferred Parthenium followed by Xanthium and sunflower (Sushil kumar 1998a). Further, it was established that *Xanthium strumarium*, acts as alternate host for *Z. bicolorata* (Sushil kumar and Bhan 1996) which confirmed the earlier report of Mexican beetle feeding on *X. strumarium* (Kumar 1992). On the FFC recommendations, Government of India lifted the ban imposed on the Mexican beetle in 1999. Now Mexican beetle can be multiplied and release anywhere in India for Parthenium suppression.

Quantitative food utilization indices were measured in different larval instars and physiological ages of adult *Zygogramma bicolorata* P. Among the grubs and adult stages of the beetle, third instar and fourth instars grubs ingested maximum food. The efficiency of conversion of digested food (ECD) was maximum in third instar and decreasing trend was observed in second instar larvae.

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