

Evaluation Of Feeding Potential Of Mexican Beetle (*ZYGROGAMMA BICOLORATA*) On Carrot Grass (*PARTHENIUM HYSTEROPHORUS*) In Dehradun District, Uttarakhand

Abstract:

Zygogrammabicolorata is an efficient natural control agent which can be used against *Parthenium hysterophorus*, a widespread very common and allergic weed found in the Dehradun belt of Uttarakhand region. It is responsible for asthma, bronchitis, skin lesions, rashes, contact dermatitis, hay fever, and various respiratory ailments. *Z.bicolorata* is a natural predator of this vicious weed. *Z.bicolorata* is a natural predator to this vicious weed. The feeding capacity of Mexican beetle, *Zygogrammabicolorata* was studied under controlled conditions, Department of Zoology, S.G.R.R. University, Dehradun, Uttarakhand 2023. Ten different sites were chosen from the Dehradun district, considering the region's widespread availability of *Parthenium* weed in the region. It was detected that the feeding capacity of adult stage of the beetle was maximum in site 3 and lowest in site 6. The result showed in site 3 that he adult consumed 3.7 gm leaves of *Parthenium* at 20 °C whereas, the similar relevant statistics were 2.3 mg. The detriment caused by *Z. bicolorata* was more visible when it was used at higher density and at initial growing stages of *Parthenium*. The fully mature stages were preferred less in comparison to the younger ones. This technique can be highly useful if implemented wisely in the management of *Parthenium* weed and contributes towards achieving the goal of sustainable development.

Keywords: Mexican beetle, parthenium, feeding potential, defoliation, sustainable development

Introduction:

Zygogrammabicolorata is typically named as the Mexican Beetle or the *Parthenium* Beetle (Dhurgude, 2022). This insect belongs to the order Coleoptera and family Chrysomelidae. It is a small beetle comprising of a brown colored head, yellow colored graduated pronotum and has yellow-colored elytra marks along with special long brown stripes which also happen to be its characteristic feature. This beetle has been named as *Zygogrammabicolorata* by Pallister in 1953. This beetle was of Mexican origin and was introduced in Bengaluru state of India in 1984 (Chakravarthy and Bhat, 1997). It was first observed in the Pune region of India around the 1950s by Professor Paranjape as a wild plant growing on garbage dumping sites, and later Rao reported it as a new species that evolved in India. With the widespread of this weed all across the globe, special efforts have been made by all the countries to get rid of this harmful weed through

various methods, including biological, chemical, mechanical, allelopathy and manual control methodologies. Despite ~~of~~ so many efforts, it has been difficult to eliminate this weed as every method employed has several disadvantages attached to it. Keeping in mind the concept of environment protection and sustainable development, people are more inclined toward ~~seco-~~ friendly biological control methods such as

~~the~~ use of natural enemies, bioherbicides, insects, nematodes, snails and some competitive plants, which could outcast this dangerous weed completely without deteriorating the quality of the natural environment. It is important to implement an integrated approach along with biological methods to improve the management of this weed. Control of *Parthenium* cannot be achieved by one single method, keeping in mind the various agricultural, environmental and medical hazards of *Parthenium* (Jayanth (1996)).

This beetle has around ~~a~~ 100 days of life cycle with four instar stages leading to larval and pupa stages. They mostly lay their eggs on the ventral side of the leaves, stem and flowers of the grass. Their eggs are elongated, cylindrical or oblong in appearance, with color varying from yellow to orange. They are initially yellow ~~in color~~ and slowly turn pale with progressive growth. After feeding on leaves for 10 to 15 days, mature larva is formed, which pupates into the soil for about 15 cm. This entire life cycle process takes around 100 days, and this beetle ~~too~~ has enemies. Two bugs act as predators for this beetle named *Andrallus spinidens* and *Eocanthecona furcellata*, which feed on both the larva and adult stages of the beetle. *Parthenium hysterophorous* is a common weed found in different parts of India (Dhurgude.2022). This plant is American ~~in origin~~ and grows as an invasive species in parts of India, Australia and Africa (King, 2008). This plant belongs to ~~the~~ family Asteraceae and can be seen easily growing along roadsides. It is responsible for affecting farmlands, causing massive loss of crop yield. In many places, it has been termed as “famine weed”. It not only affects crop productivity and livestock but also has a hazardous effect on human health. This plant is responsible for the production of biochemicals which affect germination, growth, survival and reproduction of other organisms. Hence, they are also called “allelo-chemicals”. It is frequently responsible for pollen allergy. All this happens because of the toxin named “parthenin” ~~found~~ in the grass.

Materials and methods

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Study Area:

The area of Dehradun ~~basically~~ lies in Doon Valley and has a variation in height from 410m in Clement Town to above 600 m at Jakhan, which is about 4 km from the region. However, the overall ascent is 450 m above the sea level. A place named Jakhan is at the starting point of the Lesser Himalayan Range, which extends up to Mussoorie and other areas ~~A place named Jakhan is at the starting point of Lesser Himalayan Range that extends upto Mussoorie and areas beyond.~~ in Dehradun District at 3700m above the sea level are the . The hilly region of Mussoorie goes up to a height of 1870–2007 metres above sea level. These selected sites for my research work are: Garhi Cantt, Kaulagarh, Raipur, Rajpur, Doiwala, Sahastradhara, Prem Nagar, Jamunwala, Anarwala, and Jhajra.

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Choice Test Experiment:

The food consumption of parthenium beetle for choice and ~~the~~ non-choice test is conducted in biocontrol laboratory conditions ~~at temperature range of~~ 25 to 30 degree Celsius and 60 ±5% RH ~~on the basis of~~ based on Jaiswal *et al.*, 2020 with little modifications. Samples of parthenium beetle will be collected from parthenium leaves, and a few will be collected from flowers. A study bowl (500 ml) will be used to select plant feeding. For experiment 5, beetles will be placed in a study bowl with 5 gm of parthenium leaves, and each test will be replicated three times (n-3) with control. Parthenium leaves will be placed after 0, 24-, 48-, 72-, 96-, 120-, and 144, 168-hour total weight will be measured for the choice test. ~~For selection of plant feeding study bowl (500 ml) will be used. For experiment 5 beetles will be placed in study bowl with 5 gm of parthenium leaves and each test replicated three times (n-3) with control. For choice test parthenium leaves will be placed after 0, 24-, 48-, 72-, 96-, 120-, 144-, 168 hour's total weight of parthenium leaves will be measured.~~

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Result And Discussion:

The feeding potential of the adult stage of the insect was highest in site three and lowest in site 6. The result showed in site three that the adult consumed 3.7gm parthenium leaves at 20 °C, whereas the corresponding figures were 2.3 mg. The damage inflicted by *Z. bicolorata* was more pronounced when applied in higher density and at early growth stages of the weed. The work will help us curb the growth of parthenium using eco-friendly bio-control methods via Mexican beetle and promote sustainable development in our region with minimum environmental degradation.

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Adult males consumed less than females, which may be attributed to the larger size and life span of the females. The males fed to the tune of 3.5-4.5 mg, whereas the females were found to consume more than the males and recorded 4-5mg. Our study agreed with Chandravanshi's (2018) study that the food consumption of the Mexican beetle, *Z. bicolorata*, was conducted under laboratory conditions at 25- 30°C and 60 ± 5% RH.

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The parthenium leaves consumed by the first instar larvae at 25 0C ranged from 2-3 mg. The second instar consumed at a higher rate and recorded 2-3mg. The third instar larvae consumed more voraciously and at a faster rate, and the recorded consumed leaves by them were 3-4mg. In the fourth instar, 4-5mg. This may be due to the approaching stoppage in the feeding as the larvae entered the pre-pupal stage. Adult males consume less than females, which may be attributed to the larger size and life span of the females. The males were observed feeding to the tune of 3-4mg, whereas the females were consuming more than the males and recorded 4-5mg. Our finding corroborate with Swamiappan (1997) for the feeding behavior of *Z. bicolorata*. Adult males consumed less than females, which may be attributed to the larger size and life span of the females.

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Conclusion:

It will help in minimizing asthmatic disorders, bronchitis, dermatitis and various kinds of allergies, which are highly prevalent. The need of the hour is to serve humanity without causing any harm to our surroundings at a minimum cost. This study can aid in examining the potential of the relevant subject. Increased usage of chemical control agents contributes to the deterioration of the environmental quality and poses a hazardous impact on human health. Using biocontrol agents can be a great initiative towards our ultimate goal of environmental conservation.
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