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***ZYGOGRAMMA BICOLORATA*: A GOOD SOURCE OF BIOLOGICAL CONTROL FOR TOXIC WEED (*PARTHENIUM HYSTEROPHORUS* L.)**

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ABSTRACT: Congress weed is a destructive and harmful weed. It has been spreading in all over the country. It has become a serious problem in deserts and crop fields. Among the various causes of its rapid spread there is lack of natural enemies such as fungi, bacteria and insect pest effective to control it. During the surveys of *Parthenium* growing areas of botanical garden and study sites in July-September 2017 and 2018, it found a natural enemy of this weed such as both adults and larvae of a Mexican beetle i.e *Zygothrips bicolorata*. It was frequently observed the feeding on leaves, apical meristem and younger buds buds. However this beetle is good source as biocontrol of *Parthenium* weed effectively. Hence, there is needed to be enough mass population of beetle. Therefore, need to be the application of this beetle as bio-control agent to manage ecofriendly.

Keywords: *Parthenium hysterophorus*, *Zygothrips bicolorata*, biocontrol agent.

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1. INTRODUCTION

Parthenium hysterophorus L. is a herb, upright and yearly plant belonging to the family Asteraceae. It is an exotic weed native of tropical America. It was inadvertently found in India during 1955 and later imported and occupied almost all parts of India and in Pune (Maharashtra) in 1956 [1]. The congress grass has been considered as one of the worst weeds responsible for causing health hazards

in human being and animals besides loss to crop productivity. This weed is of global significance occurring in Asia, Africa, Australia and Pacific. *Z. bicolorata* Pallister, variously referred to as the *Parthenium* beetle or Mexican beetle, is a species of leaf beetle in the subfamily Chrysomelinae, native to Mexico. The pattern on the elytra is greatly variable - in a study of 478 beetles, 29 variations on this pattern were identified. *Z. bicolorata* is innate to Mexico, India and Australia. Adults and larvae are used as a form of biological pest control in India in order to control invasive *Parthenium hysterophorus* [2, 3]. It was reported as bio control of parthenium in Australia in 1977 and found eight species of insects and one fungal pathogen [4,5]. Among them, the leaf-feeding beetle *Zygogramma bicolorata* Pallister (Chrysomelidae: Coleoptera) is the most prominent agent. *Z. bicolorata* was first introduced to Australia from Mexico in 1980 and subsequently was introduced in India [6,7]. Therefore the present study reveals that *Z. bicolorata* can be used as a potential biological agent to control *Parthenium* weed.

2. MATERIALS AND METHODS

The study was carried out in botanical garden Arts, Science and Commerce Naldurg (Latitude- N 17° 49' 7.3" Longitude- E 76° 16' 3.0") Osmanabad districts of Marathwada region of Maharashtra. Naldurg is located at an altitude of 518 m and receives an average annual rainfall of 760 mm. *Parthenium hysterophorus* (L.) as a host and *Zygogramma bicolorata* (Pallister) biological control agent were used for this study. The study was carried out with constant observations during kharif or monsoon season (July-September-2017 and 2018) from botanical garden, Arts, Science and Commerce Naldurg and nearby study sites.

3. RESULTS AND DISCUSSION

Study revealed that, initially *Parthenium* was a problem in waste and vacant land but now it has become a problematic weed in crops fields also. *Parthenium* is a noxious, poisonous, problematic, allergic and aggressive weed posing a serious threat to human beings and their livestock. Field surveys of different *Parthenium* growing locations of study sites were undertaken from 2017-2018. It observed the attacks of a beetle *Z. bicolorata* on *P. hysterophorus* leaves, apical meristem and younger buds. The adult and larvae both feed the apical meristem and newly emerging parthenium leaves (Fig. 1). *Z. bicolorata* was observed the characteristics such as a small main beetle with a brown head, 5–6 mm in length, brown and yellow graduated pronotum and yellow elytra marked with elongated brown stripes. *Z. bicolorata* was classified as Kingdom-Animalia, Phylum-Arthropoda, Class-Insecta, Order- Coleoptera, Family-Chrysomelidae, Genus-*Zygogramma*, Species- *bicolorata*. In India released the beetles in various states such as Manipur, Assam, Meghalaya, Arunachal Pradesh, Madhya Pradesh and Maharashtra (Table 1).

Table 1: *Parthinum* beetles released in different states of India for the management of the Congress grass.

Sr.No.	State	National/State Highway	Date of Release	No.of beetles Released
1	Manipur	NH-39	12/08/2015 and 7/09/2015	16609
2	Assam	NH-31,37A & 52	2/09/2015 to 3/9/2015	14500
3	Meghalya	Nh-31	2/09/2015	3000
4	Arunahal Pradesh	NH-52	05/09/2015	2100
5	Madhay Pradesh		3/9/2015	500
6	MaharashtraVNAU, Parbhani	MH-211	2004-2005	500-1000

(Source: Govt. of India's Twinning R & D Programme on *Parthenium* Management, 2015)

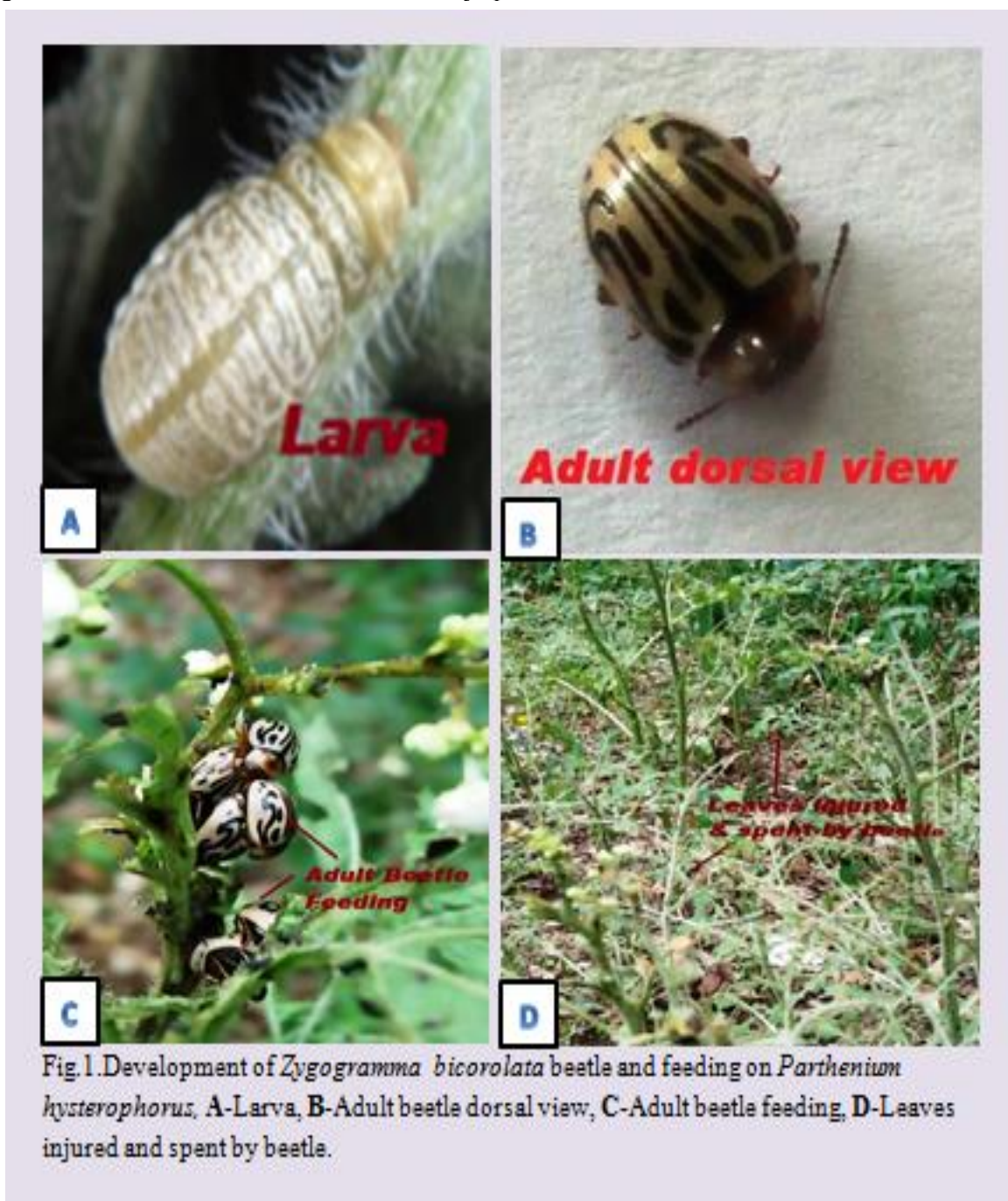


Fig.1. Development of *Zygogramma bicolorata* beetle and feeding on *Parthenium hysterophorus*, A-Larva, B-Adult beetle dorsal view, C-Adult beetle feeding, D-Leaves injured and spent by beetle.

According to previous researchers findings, *Parthenium* was observed the fast growth rate; high reproductive potential, adaptive nature and interference by allelopathy are the major contributing factors for rapid spread and successful establishment of this weed the ecology[8]. It was reported the treating sunflower leaves with parthenium pollen extract induced *Z. bicolorata* to feed on sunflower leaves [9]. It was reported in host-specificity tests conducted on 40 plants belonging to 27 families at the time of introduction, slight nibbling was observed from *Jasminum grandiflorum* and niger (*Guizotia abyssinica*), but no feeding was observed on sunflower [10]. It was reported the feeding by *Z. bicolorata* on *X. strumarium* was reported in 1992 [11]. It was reported biological control of *Parthenium hysterophorus* by *Zygogramma bicolorata* in Pakistan

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first time [12]. It was reported that the defoliation of parthenium by *Z. bicolorata* was found to cause severe reduction in flower production and growth of vegetation suppressed by this weed [13].

Future prospects of biological control to *Parthenium* management

1. The establishment of this insect along with *Z. bicolorata* may be helpful to management.
2. Beetle survives only during July to September in the area where monsoon rains are received. but, *Parthenium* is able to germinate throughout the year.
3. *Z. bicolorata* can be achieved through mass multiplication.
4. Safe and effective mycoherbicides, bioherbicides and herbicides could be integrated with bio agents.
5. The role of marigold should get encouragement in integrated *Parthenium* management using marigold, parthenium suppression can be achieved at one hand while visual value can be maintained on the other hand.
6. The competitive and harmless plants should be used in the integrated management biologically.

4. CONCLUSION

Effectiveness of *Z. bicolorata* on parthenium is more severe when defoliation was initiated at early stages of plant growth and sustained for longer durations. It is expected that the Mexican beetle (*Zygotogramma bicolorata*) Plister, if released in huge quantity, will successfully multiply in the Parthenium growing areas and thereby control biologically further spread of *Parthenium* weed. Hence, there would be urgent need to more production & released of *Z. bicolorata* on large scale then the effect of beetle on field crops and receives economically important.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The author confirms that the data supporting the findings of this research are available within the article.

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CONFLICT OF INTEREST

The authors of this paper do not have any financial relation with any company, agricultural sectors that might lead to a conflict of interest for any of the authors

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