

## ABSTRACT

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*Parthenium hysterophorus* L. is an invasive weed with negative impact on agriculture, livestock, human health and plant biodiversity and is dominant at road side, grass lands, national parks, canals and agricultural lands in Nepal. Interestingly, leaf feeding beetle, *Zygoqrama bicolorata* Pallister has naturalized in certain areas as a result of fortuitous biological control. Keeping in view, farmers' survey was conducted in 12 districts of Nepal to assess the impact of *P. hysterophorus* in Nepalese agroecosystem during 2016. Besides, host specificity, biology and efficacy of the beetle was studied in the laboratory and fields at NERC, Khumaltar from 2016 to 2018, and subsequently validated in 2019 at the natural field condition in Lalitpur, Kathmandu and Bhaktapur. According to respondents, the weed was highly associated with crops (60%) and reduced crop production greatly by 30%. *Parthenium* replaced plant species, *Ipomoea fistulosa* Jacq., *Crotalaria juncea* L., *Eleusina indica* (L.) Gaerth and *Casia tora* Roxb. affecting biodiversity. Very few farmers (3.36%) had knowledge of negative effects on livestock, so 27.27% farmers allowed animals to graze on parthenium, 36.36% fed to goat and 30.00% used for bedding material. Only 16.36% of respondents had experienced human health related problems due to parthenium. Hand weeding was practiced by 78.18% of respondents and 64.55% respondents utilized parthenium for compost, mulch, bedding material, biopesticide, fuel, medicines and alcoholic drinks production. The grubs of *Z. bicolorata* passed through four larval instars and average incubation, larval and pupal periods in laboratory were 4.33 days, 12.20 days and 11.00 days, respectively. The average longevity of adult female and male was 91.90 days and 75.00 days, respectively. A female laid 1,837 eggs during 58.80 days oviposition period, pre-oviposition and post-oviposition periods were 10.50 days and 22.60 days, respectively. Hatching percentage was 73.01% and adult emergence 75.50% with sex ratio of 1:1.55 (male: female). Among plant species in host specificity test, *P. hysterophorus* was only a preferred host of *Z. bicolorata* and oviposition, larval development, pupation and adult emergence occurred successfully on this host. Larvae consumed *Helianthus annuus* L. in no-choice test but could not pupate. Both adults and larvae fed on *Xanthium strumarium* L. in no-choice test but adult females could not oviposit. Adult longevity was significantly reduced after feeding on *H. annuus* (19.00 days) and *X. strumarium* (29.33 days) as compared to *P. hysterophorus* (83.33 days). *Z. bicolorata* caused 98.25% defoliation of *P. hysterophorus* in screen house reducing 38.88% plant height, 27.29% plant width, 26.25% root length, 12.33% leaves number, 40.58% shoot biomass, 36.59% root biomass, 50.22% flower and 40.29% seed bank in 90 days period. In natural field conditions, *Z. bicolorata* caused 71.00-85.00% defoliation of *P. hysterophorus* reducing plant height by 12.33-20.91%, leaf production by 39.63-49.2%, plant biomass by 25.16-35.76%, flower production by 36.93-41.97% and soil seed bank by 31.02-51.08% after four months of insect release. More than 90% of parthenium seeds germinated within four days as soon as the moisture was available. It is necessary to educate

people about ill effects of parthenium and its proper management. *Z. bicolorata* can be utilized in management of parthenium weed in Nepal as it is safe, effective and efficient, and mass rearing laboratories need to be developed for timely supply and release of the insect.