



FIRST INTERNATIONAL CONFERENCE ON BIOLOGICAL CONTROL

APPROACHES & APPLICATION

27 - 29 SEPTEMBER, 2018

BENGALURU, INDIA

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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: Incidence of *Parthenium hysterophorus* and its Eco-friendly control by *Zygotogramma bicolorata* in Chitrakoot, MP, India

DESCRIPTION: *Parthenium hysterophorus* L. is an invasive and environmental pollutant weed. In India, it has been spreading very fast, causing multiple problems to the inhabitants. People were affected with allergic reactions including reddening of skin, swelling of hands, arms and face, itching, and eczema on hands and palms. It has become one of the main weeds in almost all types of agricultural lands besides infesting wasteland, community land, road and railway track sides, and forests. *Parthenium hysterophorus* had dispersed over 50000 km² by 1992. The beetle appears to have potential in reducing weed density in those parts of India with moderate weather conditions.

In the present observation, the incidence, density and distribution of *P. hysterophorus* was carried out along with the biocontrol by *Zygotogramma bicolorata*. Its distribution was studied around the local areas of Chitrakoot. *P. hysterophorus* infected the fallow agricultural field. *Z. bicolorata* defoliate *P. hysterophorus* caused up to approximately 99.5% decline in weed density without disturbing soil ecosystem. The studies also indicated that the rate of decline of *Parthenium* and the degree of diversity of succeeding plant species in fallow lands, after defoliation by *Zygotogramma bicolorata*, vary depending on the duration of weed occupation and the history of land utilization. It is found to be a promising, safe, eco-friendly biocontrol agent. *Parthenium* is a weed of global concern affecting human and animal health, crop production and biodiversity. The reduction in density of *P. hysterophorus* by *Zygotogramma bicolorata* is highly significant.

KEY WORDS: Biological control, carrot grass, Mexican beetle.



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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: Incidence of *Parthenium hysterophorus* and its ecofriendly control by *Zygogramma bicolorata* in Chitrakoot MP India.

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BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: Host plant mediated effects of elevated CO₂ and temperature on growth performance of *Zygogramma bicolorata* (Coleoptera: Chrysomelidae)

DESCRIPTION: *Parthenium* has been categorized as one of the worst weeds in India and has spread in almost all of her states. It is estimated to have invaded about 35 million hectares of land in India. Increased carbon dioxide and temperature directly and indirectly affect the distribution of species, ecosystem structure and function. Leaf defoliator *Zygogramma bicolorata* has emerged as one of the most important bioagents to suppress *Parthenium* in India. Therefore, in view of expected increase in CO₂ and temperature by 2050, a study was done to find the effect of elevated CO₂ and temperature on food consumption and utilization of the bioagent and its impact to suppress the weed compared to ambient conditions. The experiment was conducted in six circular type open top chambers (OTCs) having an area of 5.55 m². The study revealed that grubs and adults had a significant influence on food consumption. The other parameters of ecological efficiencies, such as efficiency of conversion of ingested food (E.C.I.) were highest in the fourth instar grubs and in adult females. The Consumption Index (C.I.) was higher in elevated CO₂ with elevated temperature and only elevated CO₂ compared to ambient conditions in both grubs and adult stages. Developmental and growth rates were relatively higher in the first and second instar grubs. The fourth instar grubs and adults were the most efficient consumers and converters of food. Food intake by females was an important determinant of the number of eggs laid.



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BENGALURU, INDIA

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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: Current Status of Biological control of *Parthenium hysterophorus* with Mycoherbicide

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DESCRIPTION: Weed management through chemical herbicides creates spray drift hazards and adversely affects the environment. Besides, herbicide residues in food commodities, directly or indirectly, affect human health. These lead to the search for an alternate method of weed management, which is eco-friendly. In this regard, the biological approach is gaining momentum. They include a high degree of specificity to target weed, with no effect on non-target and beneficial plants or man, absence of weed resistance development, and absence of residue build-up in the environment. Currently, fungal weed control is rapidly developing natural phenomena in research areas with implications for plant yield and food production. Fungal weed control may help to maintain the quality of crops and reduce the uses of chemical pesticides and other toxic chemicals and offer important natural mortality factors in weed population control under natural environmental condition. The application of the fungal spores, fermented broth, and their crude metabolite or purified metabolites are very good source for natural herbicide in *Parthenium* management. Fungal weed pathogens can produce a wide array of toxins, bioactive metabolites with different biological activities, chemical structures, mechanisms of action, specificity with respect to plants, and environmental impact and stability. This present paper will discuss the current research progresses of fungi and their secondary metabolite application for *Parthenium* management.

Keywords: *Parthenium hysterophorus*/ Biological Control/Mycoherbicide/Secondary Metabolites



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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: Phytotoxic Effect of *Abutilon indicum*, *Tephrosia purpurea*, *Prosopis juliflora* and *Cassia occidentalis* – Ethanolic Extracts on Germination and Seedling Growth of global invasive weed *Parthenium hysterophorus*

DESCRIPTION: A study was conducted with aim to evaluate the bio-herbicidal potential of *Abutilon indicum*, *Tephrosia purpurea*, *Prosopis juliflora*, *Cassia occidentalis* ethanolic extracts on growth and germination of invasive weed *Parthenium hysterophorus*. The effect on seed germination and seedling growth was assayed by using Agar germination media. Preparation of plant extract was done by using ethanol. Ethanolic Extract of each plant and with all plant mixture was tested separately for germination of *Parthenium* seed.

All four plant extracts at 25% concentration with distilled water reduced significantly the total germination percent (GP), germination index (GI), germination energy (GE), speed of emergence (SE), seedling vigour index (SVI), and coefficient of the rate of germination (CRG) of *Parthenium hysterophorus*. Inhibition of seed germination of weed plant was observed more sensitive to extract of all plants mixture compared to single plant extract. Results revealed that the *Abutilon indicum*, *Tephrosia purpurea*, *Prosopis juliflora*, *Cassia occidentalis* plant extracts have phytotoxic properties and thus contain phytotoxic substances. Isolation and characterization of those phytotoxic substances from these plants may act as a tool for new, natural, biodegradable herbicide development to manage invasive weeds like *Parthenium* seed.



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PRESENTATION TYPE: Oral

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TITLE: Age, mating status and sex influence food consumption and utilization efficiency of *Parthenium* beetle, *Zygogramma bicolorata* Pallister

DESCRIPTION: Present study was designed to evaluate combined effects of age, mating status and sex on the feeding attributes of chrysomelid beetle, *Zygogramma bicolorata* Pallister when fed on *Parthenium hysterophorus* L., a serious weed of wastelands, pastures and agricultural fields. The newly emerged adults were placed in two groups. Adults of first group were kept unmated and their daily predation attributes were assessed for next 20 days. However, males and females of the second group were allowed to mate on the 11th day (attainment of sexual maturity), and mating pairs were kept individually to assess their daily predation attributes for the next 10 days. Results revealed higher consumption and growth rates of *Zygogramma bicolorata* females over the males. In contrast, males exhibited higher food conversion efficiencies than the females. However, food consumption and growth rates of unmated adults were higher than the mated ones. Age-based regression graphs revealed decreased consumption rates, conversion efficiencies and growth rates of *Z. bicolorata* adults with increase in age. However, the mean body biomass of adults increased with increase in age. This further suggested compensatory feeding in *Z. bicolorata* adults as they age. The present findings may, therefore, be helpful to mass-multiply *Z. bicolorata* in laboratories for biocontrol of *Parthenium* weed in agricultural farms on the Indian subcontinent.



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TITLE: Predicting establishment of the leaf-feeding beetle *Zygogramma bicolorata* (Coleoptera: Chrysomelidae) for the management of *Parthenium hysterophorus* (Asteraceae: Heliantheae) in India: A Machine Learning Approach

DESCRIPTION: *Parthenium hysterophorus* L. is one of the most troublesome weeds of the world, which has invaded non-cropped as well as cropped lands in many tropical and sub-tropical countries including India. Various approaches, like cultural, mechanical, chemical and biological have been attempted for its control. Among these, biological control using the Mexican beetle (*Zygogramma bicolorata* Pallister) has been considered the most cost-effective and environmentally safe method in India. Initially, it was presumed that *Z. bicolorata* will be the most suitable biocontrol agent for a moderate climate and will not establish well in areas experiencing temperatures below 15°C and above 35°C in India. However, during past field surveys, the beetle was found to cause wide spread defoliation of *Parthenium* even under such extremes. Therefore, in order to forecast the establishment of *Z. bicolorata*, models were developed using climatic indices as independent variables. Machine learning approaches (decision tree) were used for model building. Decision tree using J48 algorithm classified 81.7% instances correctly, and developed rules to predict the establishment of *Z. bicolorata*. Minimum temperature (MMIN) was found to be most important in explaining the degree of establishment of *Z. bicolorata*. It was inferred from the results that although rainfall and relative humidity do not play significant roles if taken individually, their interaction with minimum temperature play significant roles to predicting the establishment of *Z. bicolorata*. Several rules were developed using the decision tree model to categorize the establishment of *Z. bicolorata* in three classes i.e. negligible, moderate and high. Based on the rules obtain from our study, it was concluded that a site experiencing climate with indices values of average minimum temperature 24.2 - 26.2°C and rainfall 191.2- 257.3 mm during July to October would be highly suitable for setting up the *Z. bicolorata* population in the region. These models might be useful to decide the most suitable sites for release and establishment of *Z. bicolorata* in India as well as in other parts of the world with similar climatic conditions for the control of *Parthenium hysterophorus* using biological approach.



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PRESENTATION TYPE: Oral

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TITLE: Host range evaluation of the leaf-feeding beetle, *Zygogramma bicolorata* and the stem-boring weevil, *Listronotus setosipennis* demonstrates their suitability for biological control of the invasive weed, *Parthenium hysterophorus* in Ethiopia

DESCRIPTION: The invasive annual shrub, *Parthenium* (*Parthenium hysterophorus*), damages agriculture, adversely impacts biodiversity and is hazardous to human and animal health in Ethiopia. This invader has been successfully managed in Australia and India using selected host-specific natural enemies. The host range of two natural enemies, a leaf-feeding beetle, *Zygogramma bicolorata* and a stem-boring weevil, *Listronotus setosipennis* was evaluated for biological control of the weed in Ethiopia. The specificity of *Z. bicolorata* and *L. setosipennis* was assessed against 29 non-target plant species. The host range of *Z. bicolorata* and *L. setosipennis* was first assessed using no-choice tests to examine their oviposition and feeding response on non-target plants, relative to *Parthenium*. *Zygogramma bicolorata* was further evaluated on selected economically important plant species in choice tests. Both agents were unable to complete development on any test plants offered in no-choice or choice tests. In no-choice tests, oviposition nor feeding by *L. setosipennis* occurred on any non-target species assessed. Mean oviposition on *Parthenium* was 38.96 ± 3.37 eggs per plant whereas no eggs were laid on any of the 29 species tested. Based on these results, in combination with host range data from Australia and South Africa, permission for the release of *Z. bicolorata* and *L. setosipennis* in Ethiopia was granted in 2013. Releases were made shortly thereafter and are currently ongoing to assist with management of this serious invader in Ethiopia.



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PRESENTATION TYPE: Oral

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TITLE: Current spread and integrated management to contain *Parthenium* weed in India

DESCRIPTION: Currently, *Parthenium* has spread in almost all the states of India but in varying density. It has severely spread in North and South India except Kerala, where it has occupied limited areas in certain pockets. In extreme arid and cold areas of India, its spread is inadequate. In the North-East region, it has wide spread in Assam, but its presence is negligible in Meghalaya, Sikkim and Tripura and Mizoram. Its occurrence is more in Itanagar and Imphal of Arunachal Pradesh and Manipur state, respectively, but in other areas of state, its presence is trivial. In Nagaland, it is prevalent in lower areas up to Dimapur but does not occur towards hilly areas. In Gujrat and Odisha, its spread is limited towards coastal areas. Various management approaches are being used to minimize the losses caused by this weed. The use of exotic bioagents *Zygogramma bicolorata* has contributed effectively to suppress *Parthenium* in India, nevertheless, the weed remains a substantial problem. The bioagent, *Z. bicolorata* has been established widely in North, Central and South India and contributing significantly to control *Parthenium* during rainy season. In North-East India, efforts are being made to establish this bioagent but chances seem to be meager for its good establishment. Integrated *Parthenium* management approaches including awareness programmes through *Parthenium* awareness week since 2004 has begun to yield good results. People are coming forward to make their premises and village *Parthenium* free. The declaration of two *Parthenium* free villages in Punjab is an indicator of the success of awareness programs.



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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: Importation and quarantining of the seed-feeding weevil, *Smicronyx lutulentus*, for prospective control of *Parthenium hysterophorus* in India

DESCRIPTION: The asteraceous plant, *Parthenium hysterophorus*, commonly called *Parthenium* weed, has been causing enormous losses to agriculture and animal husbandry as well as to the environment and human health in India. Though *Zygogramma bicolorata*, the only biocontrol agent released against this weed, has been fairly successful in keeping it under control in certain situations, the enormity of the problem requires additional biocontrol agents to completely manage it. *Smicronyx lutulentus*, the seed-feeding weevil, was chosen as an additional agent for import as it has already shown good results against *Parthenium* weed in Australia (Queensland), and very recently, in South Africa. The 90 adult weevils received from Biosecurity Queensland on 24 April 2018 underwent quarantining in the QC-2 facility at the ICAR–National Bureau of Agricultural Insect Resources, Bengaluru. The preliminary biology of *S. lutulentus* in the Indian context and details of the proposed host-specificity studies within the quarantine are explained. Once host-specificity studies confirm the safety of the weevil, a field-release permit will be obtained for limited releases in suitable areas for classical biological control of *Parthenium* weed.



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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: “BioKill” – an effective bioherbicide for *Parthenium* weed control

DESCRIPTION: “Bio-Kill” is an effective bioherbicide derived from fungal isolate, *Rhizoctonia solani* UMKRSPL1 and can be used to control *Parthenium* weed. Biochemically, it is a mycotoxin extracted from culture filtrate of the fungus isolate UMKRSPL1. To develop this “BioKill,” first the fungus isolate was cultured in a PDA medium in the laboratory, and then the homogeneous media broth was transferred to the fermenter along with Richard media. After fermentation for a week, the culture filtrate from the fermenter was collected. The culture filtrate was methanol extracted and then was purified first by activated charcoal. The partially purified filtrate was then partitioned by ethyl acetate and finally purified by Sephadex G-75 column in the herbicide production chain. The purified mycotoxin was evaluated on the 15 days old *Parthenium* seedling and found effective in killing the *Parthenium* plants. The purified mycotoxin was granular formulated by mixing with oat flour and maltose (ratio 4:1). The pasta dough was then cut into granular form by a screw conveyor, dried properly in a fluid bed drying and finally, the product was packed in airtight packets for marketing. The liquid formulation can also be prepared by collecting the purified culture filtrate as the stock active ingredient, which could be diluted with water for spraying as per dose specification.



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BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: Initiation of a classical biological control programme against *Parthenium hysterophorus* in Pakistan

DESCRIPTION: Invasive alien plants can pose a serious threat to food security, biodiversity, human and animal health and economic development. *Parthenium* weed, *Parthenium hysterophorus*, is no exception in Pakistan and steps to reduce its impact and prevent further spread need to be taken. In Pakistan, the plant was first reported from the Gujarat district of Punjab Province in 1980 and since then, it has rapidly spread throughout the region. It was identified as a priority for control in Pakistan and an integrated control programme has been launched against this invasive weed. Preliminary surveys in 2009 documented the presence of the biological control agent, *Zygogramma bicolorata*, which naturally dispersed into Pakistan. In Australia and South Africa, more than one biological control agent was required to reach desirable levels of control, so we propose the stem boring weevil, *Listronotus setosipennis* for release into Pakistan to complement *Z. bicolorata*. The CABI Action on Invasives Programme is working with Pakistan in developing the biological control programme and host range testing in a Pakistani context, including a test plant list important to Pakistan. The host range testing will be conducted in the quarantine facility on the CABI-Rawalpindi campus in Pakistan. The addition of *L. setosipennis* to the biological control of *Parthenium* weed will be an invaluable asset to the integrated control of this weed in Pakistan. Ultimately, the development of the biological control programme should result in the sustainable control of *Parthenium* weed and a reduction in the amount of manual and chemical control required.



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PRESENTATION TYPE: Oral

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TITLE: Distribution and Current Efforts on Biological Control of *Parthenium* in Uganda

DESCRIPTION: Early detection of *Parthenium* did not occur until 2009 when it was first reported in Uganda. In 2013, high infestations in agricultural and grazing land caused concern, which stimulated actions by government and other stakeholders. This paper provides highlights on assessment made of distribution of the weed and approach to integrate biological control in the *Parthenium* management. Countrywide surveys were conducted and reports from affected communities were verified to map the occurrence. The findings indicated that *Parthenium* is widespread in 52 surveyed out 121 districts of Uganda with hot spots in northern, followed by eastern, central and western Uganda. Two species of biocontrol agents, *Zygogramma bicolorata* (a leaf feeding beetle) and *Listronotus setosipennis* (a stem boring weevil) were imported in January 2018 to control the weed and cultures were established in the screen house for mass rearing. Mass rearing of the biological control agents has been successful in the screen house with average percentage emergence of adults from soil ranging from 45-67%. A total of 200 insects of each species have so far been released at a pilot site in central Uganda.

Key words: Parthenium, Biocontrol, Rearing, Distribution



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BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: Techniques to rear three insect agents for the biological control of *Parthenium hysterophorus* in South Africa

DESCRIPTION: Releases of the stem-borer *Listronotus setosipennis* (Coleoptera: Curculionidae) and defoliator *Zygogramma bicolorata* (Coleoptera: Chrysomelidae) on *Parthenium hysterophorus* began in 2013 in South Africa, followed by the seed-feeder *Smicronyx lutulentus* (Coleoptera: Curculionidae) in 2015, and are ongoing. Rearing techniques were developed. Critical to insect production is the continuous supply of suitable plants. Frequent seedling propagation and transplanting, nutrient application, selective removal of floral material to enhance vegetative production, and timely pest management, are necessary. Tunnel facilities maintained at 18°C to 30 °C, and artificial lighting during winter, enhanced plant growth. Various plant growth forms are required for the differing oviposition and developmental needs of each agent. Breeding cages in temperature-controlled glasshouses (22 °C to 28 °C) contained adult insects which were exposed to potted *Parthenium* for one to four weeks, agent dependent. Oviposition, larval development, and pupation stages were separated. Insect production was enhanced by increasing the plant replacement frequency in breeding cages and manipulated by moisture application during pupation. Some agents, by their nature, were more readily reared than others. Challenges included fertigation systems, planting frequency, pest outbreaks, and timeously supplying suitable plants to meet the needs of insect cultures. Capacity, space, and plant quantity and quality limited agent production. Temperature-controlled facilities enabled year-round production of plants and insect agents, increased timeously for seasonal releases. More than 35,000 *L. setosipennis*, 50,000 *Z. bicolorata* and 35,000 *S. lutulentus* have been released in South Africa. Training and starter cultures were provided to initiate biocontrol programmes in Ethiopia, Tanzania and Uganda.



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TITLE: Spread of the leaf-feeding beetle, *Zygogramma bicolorata* for the biological control of the invasive weed, *Parthenium hysterophorus* in Ethiopia

DESCRIPTION: Spread of the leaf-feeding beetle, *Zygogramma bicolorata* for the biological control of the invasive weed, *Parthenium hysterophorus* in Ethiopia

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Abstract

The invasive weed, *Parthenium* (*Parthenium hysterophorus*), reduces yield of major crops, invades pasture lands and adversely affects human health in Ethiopia. *Zygogramma bicolorata* has been released in Ethiopia for biological control of this weed. The spread and abundance of *Z. bicolorata* was monitored at these release sites. The distance traveled by the biocontrol agent from the spot of release as well as its abundance was measured at different times. In 2017, *Z. bicolorata* moved 20 m within six weeks from the location of its release. At other sites the spread was limited and it took several weeks to spread out of the release spot. It appears there is a need to increase the number of release sites and number of the biological control agents to increase its spread and eventually its establishment.



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TITLE: Establishment and early impact of introduced natural enemies to control *Parthenium hysterophorus* in South Africa

DESCRIPTION: *Parthenium hysterophorus* (Asteraceae: Heliantheae) has spread aggressively and is a serious invader in South Africa and on the African continent, aided by its invasive attributes and local land use habits. In South Africa, biological control is recognized as critical to efforts to curb the spread and impact of the weed. Following host range evaluation, the summer rust fungus (*Puccinia xanthii* var. *parthenii-hysterophorae* (Pucciniales: Pucciniaceae) and three insect agents (defoliating *Zygogramma bicolorata* (Coleoptera: Chrysomelidae), stem-boring *Listronotus setosipennis* (Coleoptera: Curculionidae) and seed-feeding *Smicronyx lutulentus* (Coleoptera: Curculionidae)) have been released since 2010, 2013 and 2015, respectively. Releases have been undertaken at more than 330 sites in densely invaded KwaZulu-Natal (KZN) and Mpumalanga provinces. All four agents have established, although drought conditions interfered. *Listronotus* has established readily, while *P. xanthii* has spread widely, largely unaided. *Zygogramma* is restricted in distribution. A chemical exclusion field study is underway to assess agent impact on *Parthenium* within four treatments in 5m² plots in northern KZN province. The dynamics of *Parthenium*, other vegetation, and biocontrol agents are assessed. Although still relatively early in the field establishment programme, it is apparent that additional agents are required for broader control. The root-crown borer *Carmenta* sp. nr. *ithacae* (Lepidoptera: Sesiidae) and stem-galler *Epiblema strenuana* (Lepidoptera: Tortricidae) are under evaluation. Despite concerns from laboratory host range results for *E. strenuana*, further investigation is desirable due to considerable impact by this agent. Scope exists for broader use of the approved agents, both locally and internationally, to intensify biological control efforts.



FIRST INTERNATIONAL CONFERENCE ON BIOLOGICAL CONTROL

APPROACHES & APPLICATION

27 - 29 SEPTEMBER, 2018

BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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ADDRESS: Australia

TITLE: Biological control of *Parthenium* (*Parthenium hysterophorus* L.): Australian experience

DESCRIPTION: *Parthenium* is a Weed of National Significance in Australia. Biological control of *Parthenium* in Australia commenced in 1977 and since then nine insect species and two rust fungi have been introduced. All agents have established at several localities and seven of them are widespread. However, the time taken for field establishment varied widely between various agents, ranging from one to 15 years. Among them, the stem-galling *Epiblema* moth, the stem-boring *Listronotus* weevil, the seed-feeding *Smicronyx* weevil and the root-feeding *Carmenta* moth occur in all *Parthenium*-infested areas at high population levels. The leaf-feeding *Zygogramma* beetle occurs only in the central and southern Queensland, and not in northern Queensland. The *Parthenium* summer rust occurs seasonally in central and northern Queensland; while the *Parthenium* winter rust is more widespread in southern Queensland than in central Queensland, but not in northern Queensland. The sap-feeding *Stobaera* planthopper and the leaf-mining *Bucculatrix* moth become established and are widespread, but their damage levels remains very low. The stem-galling *Conotrachelus* weevil and the stem-boring *Platphalonidia* moth are believed to be established, at very low levels. Biological control has resulted in significant reductions in the abundance and impact of *Parthenium* in Australia. As a result, the area infested with *Parthenium* in central Queensland declined since mid-1990s. Due to the absence of many of the effective agents in southern Queensland, agents from central Queensland are being redistributed to southern Queensland. Additionally, based on Australian success, many of these agents have also been introduced into other countries around the world.



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27 - 29 SEPTEMBER, 2018

BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: NATIONWIDE SURVEY OF PARTHENIUM WEEDS INFESTATION; RISKY AND THREAT FOR FOOD SECURITY

DESCRIPTION: ABSTRACT

A three years survey study was carried out during 2014-15, 2015-16 and 2016-17 at thirty-five districts of Bangladesh to observe the abundance, habitat and spread of *Parthenium* and to identify how many crops were affected by this weed. Maximum *Parthenium* weed was found on roadsides, fallow and grassland and some different crop fields. We identify only one species of *Parthenium* weed which affected maximum crops grown in our country, including cereal crops like wheat and maize, pulse crops like mungbean, black gram, field pea, cowpea, lentil, vegetables crops like tomato, pointed gourd, brinjal, country bean and okra, spices crops like onion, garlic, turmeric, chilli and zinger. Tuber crops like potato, horticultural crops like banana, and sugar crops like sugarcane were affected by this invasive weed. Maximum abundance of *Parthenium* weed was very high at border areas due to Indian way from these locations. In a preliminary survey in thirty-five districts of Bangladesh, this weed has presumably invaded in greater Jessore, Rajshahi and Mymensingh region, which comes from India and is present on roadsides and some crop fields. Now it is the most alarming weed overall in Bangladesh, which has affected some crop fields. *Parthenium* grows all year round but its abundance is maximum in summer season. It reduces the pollination of brinjal, tomato, chili etc. through its poisonous chemicals. This severity of *Parthenium* weed infestation is suspected to cause heavy toll on food security in our country. However, proper management is needed before being established in an unmanageable form in crop fields of Bangladesh.



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BENGALURU, INDIA

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THEME NAME: IOBC Parthenium Working Group Workshop

PRESENTATION TYPE: Oral

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TITLE: *Parthenium* weed in Pakistan: Problems caused and Management Options

DESCRIPTION: *Parthenium* weed (*Parthenium hysterophorus* L.) is a serious alien invasive weed in Pakistan and in many other parts of the world. Within the last 15-20 years, this weed has emerged as the most devastating invasive weed in the country. It has invaded most parts of the Punjab, Khyber Pakhtunkhwa and FATA and threatens to invade more areas in future. It has become a serious threat to agricultural production, biodiversity and human and animal health. The plant species richness and diversity in the aboveground vegetation and within the soil seed bank significantly decreased following the invasion of *Parthenium* weed in three protected forest areas in the Punjab. *Zygogramma bicolorata* Pallister, initially released in India as a classical biological control agent for *Parthenium* weed, was first reported in Pakistan in 2006. Our studies have indicated that the efficacy of *Z. bicolorata* in managing *Parthenium* weed was more pronounced in the earlier growth stage (rosette). At the rosette stage, the defoliation caused by three-pairs of *Z. bicolorata* resulted in 100% defoliation and a reduction of 90% of biomass and 63% in height. Climatic modelling using CLIMEX and incorporating a 3oC temperature increase, has predicted that more areas of Pakistan and southern Asia will be suitable for this weed. The agricultural departments in consultation with the ministry of plant protection are considering the option to test and release more suitable biological control agents against *Parthenium* weed in Pakistan. A coordinated national strategy and regional efforts are required to manage the problem of *Parthenium* weed.



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27 - 29 SEPTEMBER, 2018

BENGALURU, INDIA

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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: Impact of *Zygogramma bicolorata* on growth of *Parthenium hysterophorus* in Nepal

DESCRIPTION: *Zygogramma bicolorata* Pallister, a leaf feeding beetle released as a biocontrol agent against *Parthenium hysterophorus* L. in India and Australia, was first reported in Nepal in 2009. The beetle is spreading naturally and has established its populations at several locations but the damage incurred by this beetle on *P. hysterophorus* has not been studied. We evaluated the impact of the beetle population on *P. hysterophorus* at two different altitudes of Nepal. The experiment was carried out in two different altitudes (500 and 1300 m asl) of Nepal during May to September 2017 in 1X1m² randomized plots. *Z. bicolorata* was released in two different proportions per plant (single and two beetle) during vegetative and early flowering period. Individual plants were harvested when the signs of senescence were seen. Their plant height and total biomass were measured after the harvest. Plant height and total biomass were found variable across the different altitudes of Nepal. Plant height and biomass of *P. hysterophorus* declined with increasing density of beetles in lower altitude but the impact was not significant in higher altitude. The decrease in plant height and total biomass was greater in lower altitudes (35% and 55% respectively) as compared to upper altitudes (9% and 39% respectively). The impact of the beetle on *P. hysterophorus* was lower in high altitude than in low altitude.



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BENGALURU, INDIA

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THEME NAME: Biological Control of Invasive Pests and Weeds

PRESENTATION TYPE: Oral

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TITLE: The ecophysiological implications of *Zygogramma bicolorata* leaf-feeding for *Parthenium hysterophorus* biocontrol

DESCRIPTION: The annual shrub, *Parthenium hysterophorus* L. (Asteraceae), is a severe noxious weed of global significance, and has been targeted for numerous control programs. Recent biological control efforts in South Africa have seen a total of four agents released to date, the most promising of which has been the leaf-feeding beetle, *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae), in 2013. Studies surrounding the ecophysiological interactions of insect herbivores and their target weeds remain under-represented in the biological control literature. Leaf-feeding by *Z. bicolorata* metabolically impaired *P. hysterophorus* leaves, resulting in a ~36% reduction to photosynthesis. Photosynthetic reduction was attributed to the removal of leaf tissue as well as the introduction of deleterious microbes by *Z. bicolorata*. Both adult beetles and their larvae were found to carry high abundances of bacterial and fungal microbes. However, in response to *Z. bicolorata* herbivory, adjacent undamaged leaves showed an up-regulation in photosynthesis of ~11%. Despite the ability to photosynthetically up-regulate in response to herbivory, *P. hysterophorus* is unlikely to overcome the physiological implications associated with continued *Z. bicolorata* feeding as well as the ingress of microbes. Given the effectiveness of *Z. bicolorata* as a biological control agent, efforts should be made to maximize the beetles' incidences in the field.
