



INTERNATIONAL PARTHENIUM NEWS



Number 12, January & July 2016

Editorial team:

Dr. Asad Shabbir (Editor in Chief)
Prof. Steve W Adkins

Produced by:



Tropical & Sub-Tropical Weed
Research Unit, The University of
Queensland, Australia.



In collaboration with IOBC working
group on biological control and
management of parthenium weed.

International collaborators meet in Ethiopia for the biological control of *Parthenium hysterophorus* in East Africa

Lorraine Strathie, Agricultural Research Council –
Plant Protection Research Institute, Private Bag
X6006, Hilton, 3245, South Africa. E-mail:
StrathieL@arc.agric.za

Dr Wondi Mersie Principal Investigator, Integrated
Pest Management Innovation Lab project on Biological
Control of the Invasive Weed *Parthenium
hysterophorus* in East Africa, Agricultural Research
Station, Box 9061, Virginia State University,
Petersburg, VA 23806, USA. E-mail:
WMersie@vsu.edu

Many countries on the African continent, from the south, along the eastern region, to the north eastern parts, are invaded by parthenium weed (*Parthenium hysterophorus* L.), some to a significant extent, with severe impacts on agricultural production, biodiversity conservation, and human and animal health. There is increasing concern over pending or realised threats of invasion as the extent and density of parthenium weed expands on the continent.

Biological control, using selected introduced natural enemies, presents a cost-effective, sustainable method to manage parthenium weed. In Queensland, Australia, the weed has been considerably reduced in severity and extent using 11 introduced biological control agents in a program initiated in the 1970's. Biocontrol programs on parthenium weed have since been undertaken in a few other affected countries. Based on the success in Australia, four biological control agents have been introduced into South Africa after assessment of their suitability, since 2010 onwards, to manage expanding parthenium weed populations. The summer rust fungus *Puccinia xanthii* var. *parthenii-hysterophorae*, the stem-boring weevil *Listronotus setosipennis*, the leaf-feeding beetle *Zygogramma bicolorata*, and the seed-feeding weevil *Smicronyx lutulentus* have established, to varying degrees, and additional biocontrol agents are under consideration.

Due to the extent and severity of parthenium weed infestations in parts of Africa, and the likelihood of increasing impacts, the United States Agency for International Development (USAID) through the Integrated Pest Management Innovation Lab housed at Virginia Tech, USA, awarded Virginia State University a grant in 2005 to initiate a project to facilitate the management of parthenium weed in southern and eastern Africa. Work included (i) the establishment of a weed biological control quarantine facility and initiation of biocontrol research on parthenium weed in Ethiopia, (Fig. 1) (ii) investigation of the weed's distribution in South Africa, Swaziland, Botswana, Ethiopia, (iii) studies on the impacts of parthenium weed on crop production, biodiversity, socio-economics in Ethiopia, and (iv) investigation of other management methods.

From 2009 until 2014, a second phase of the project focused work in East Africa (Ethiopia, Kenya, Uganda and Tanzania). Biological control efforts continued to be developed, with the establishment of a mass-rearing facility and approval and release of the first biocontrol agent *Zygogramma bicolorata* in Ethiopia during this phase. Release of a second agent, *Listronotus setosipennis* in Ethiopia was also approved. Distribution surveys of parthenium weed were conducted in Ethiopia, Uganda, Kenya and Tanzania.

Through the Feed the Future Innovation Lab for Integrated Pest Management program housed at

Virginia Tech, Virginia State University was awarded a competitive grant of \$748,465 for a third phase of work on parthenium weed in East Africa, from 2015 until 2019. The entire focus of this current project is on biological control of parthenium weed in East Africa (Ethiopia, Kenya, Tanzania, and Uganda), due to the recognized benefits of this management method.



Fig. 1: IPM Innovation Lab parthenium project Principal Investigator Dr Wondi Mersie (Virginia State University) with research staff from the Ethiopian Institute of Agricultural Research at the Ambo quarantine facility, during the first importation of *Smicronyx lutulentus* on parthenium weed into Ethiopia in December 2015. (left to right: Mr Tesfaye Hailu, Ms Asmret Teklemariam, Mr Teshale Daba, Mr Teshom Mosisa, Dr Wondi Mersie, Ms Sintu Alemayhu Chala).

The project objectives include: (1) scale-up the rearing and release of approved biocontrol agents, *Z. bicolorata* and *L. setosipennis* in Ethiopia; (2) evaluate the establishment and impact of released agents on parthenium, crops and biodiversity; (3) evaluate new parthenium weed biocontrol agents for their safety to non-target plant species under quarantine and, if suitable, seek approval for their release; and (4) scale-up the release and monitoring of *Z. bicolorata* in Tanzania, obtain the necessary permits for field release of *Zygogramma* in Kenya and Uganda; and release *Listronotus* and other natural enemies (evaluated in Ethiopia) in Kenya, Tanzania and Uganda. Scientists from six countries are collaborating to implement the project. CABI and collaborating partners are involved in project activities in Kenya, Tanzania and Uganda. The ARC-PPRI has been involved since the 2005 inception of this work in East Africa, and is a current partner to share their expertise and provide starter cultures.

In December 2015, a first importation of the seed-feeding weevil *Smicronyx lutulentus* was provided by ARC-PPRI South Africa to the Ethiopian Institute of Agricultural Research's (EIAR) Plant Protection Research Center's quarantine facility at Ambo (Fig. 2).

A supplementary culture of *Listronotus setosipennis* was also supplied, to assist mass-rearing for release. Research staff from the EIAR and Amhara Agricultural Research Institute received training from L. Strathie of ARC-PPRI on the newly imported weevil and other aspects of parthenium biological control (Fig 3).

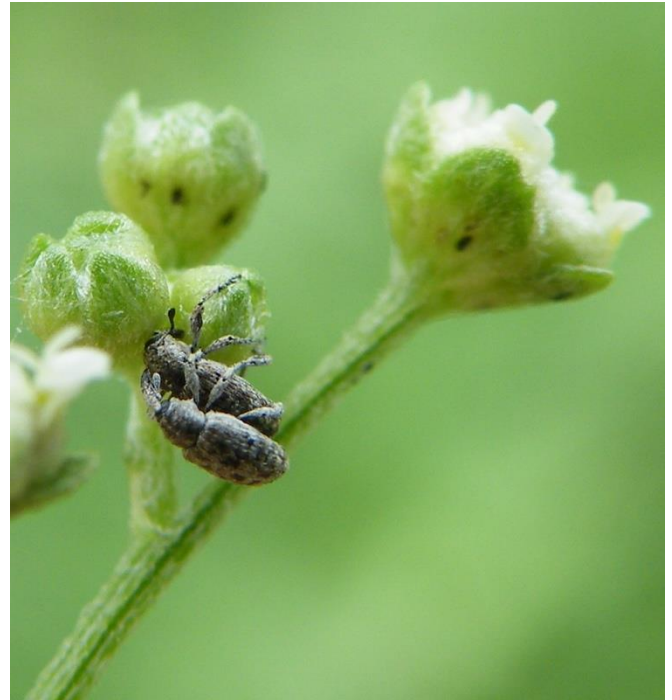


Fig. 2: *Smicronyx lutulentus*, the seed-feeding weevil imported into Ethiopia in December 2015.



Fig. 3: Research staff from the Ethiopian Institute of Agricultural Research receiving training on the newly imported *Smicronyx lutulentus* weevil on parthenium weed from L. Strathie of ARC-PPRI.

Project partners of the IPM Innovation Lab met at an International Workshop on Biological Control of *Parthenium hysterophorus* in East Africa on 17-18

December 2015 at Dire Dawa in eastern Ethiopia. About 25 representatives from the USA, Ethiopia, Kenya, Tanzania, Israel and South Africa, participated in this workshop (Fig. 4).



Fig. 4: Participants of the International Workshop on Biological Control of *Parthenium hysterophorus* in East Africa, held 17-18 December 2015 at Dire Dawa, Ethiopia.

Presentations were delivered by dignitaries from Virginia Tech, IPM Innovation Lab, Haramaya University, and Oromia Agricultural Bureau, followed by presentations on the social and economic impact, and distribution and management of parthenium weed in Ethiopia, Israel, Kenya, Tanzania, and South Africa, pre- and post-release biological control activities, gender aspects, and project administration. The workshop concluded with a visit to the nearby Haramaya University, which has recently engaged in the mass-rearing of parthenium weed biocontrol agents, enabling project participants to engage on technical aspects, benefitting new project partners (Fig. 5).

In Ethiopia, parthenium biological control activities are now operational at the EIAR Plant Protection Research Center at Ambo (research), as well as the IPM Innovation Lab parthenium weed biocontrol pilot mass-rearing facility at a Farmers' Cooperative Centre at Wollenchiti, which was visited by project partners in December 2015. Through this project, rearing and release efforts expanded during 2015 to the north of Ethiopia at ARARI facilities at Kobo and Sirinka, at Guder campus of Ambo University west of Addis Ababa, and to Haramaya University in the east (Fig. 6). Additional agents are intended for future assessment in Ethiopia.

In Tanzania, the leaf-feeder *Z. bicolorata*, supplied by ARC-PPRI, was released at a few sites around Arusha in 2013 but establishment has not yet been observed. Development of in-country capacity on biological control of parthenium weed is underway through the IPM Innovation Lab project. The introduction of

parthenium weed biocontrol agents into Kenya and Uganda is being addressed during this project in an effort to initiate biological control activities. Some interest has been shown in biological control in Israel due to increasing infestations of parthenium weed.



Fig. 5: Members of the Management Entity of the Feed the Future Innovation Lab for Integrated Pest Management and Virginia Tech with project partners from Ethiopia examine the leaf-feeding beetle *Zygogramma bicolorata* at the mass-rearing facility at Wollenchiti, Ethiopia in December 2015 (left to right: Dr Brhane Gebrekidan, Dr R. Muniappan, Dr Million Abebe, Mr Jemal Mohammed, Mr Dennis Treacy).



Fig. 6: The newly established mass-rearing facility at Haramaya University, Ethiopia for the production of biological control agents on *Parthenium hysterophorus*.

The extension of biological control knowledge on parthenium weed from Australia to South Africa, and subsequently to East Africa and beyond, through international collaborative projects, is enabling greater global coordination of efforts to manage this severe invader. This should ultimately benefit the livelihoods of the millions of people that are affected by this plant.

Acknowledgements

Funding by the Department of Environmental Affairs: Natural Resources Management Programs for the biological control and management of *Parthenium hysterophorus* in South Africa is gratefully acknowledged. Financial support provided by the

United States Agency for International Development under award number AID-OAA-L15-00001 to the IPM Innovation Lab project on biological control of *Parthenium hysterophorus* in East Africa is gratefully acknowledged.

A case to eradicate *Parthenium hysterophorus* L. in Malaysia

NG Kwang Yew Strategic R&D Advisor, Hextar R&D International Sdn. Bhd.
Email: kwangyew.ng@hextar.com

Parthenium hysterophorus L., commonly known as parthenium weed is a native of the tropical and subtropical regions of Central, North and South America but has spread to and naturalized in several countries in Africa, Asia and Australia, including the Middle East, and in several Indian Ocean and Pacific islands with warm climates, indicating its extensive geographical range (Masum *et al.* 2013). The weed was reported to invade pastures, destroy native flora and invading croplands of vegetables, fruits, rice, corn, sugarcane, causing yield losses and even crop failure in some of these countries.

This plant was also reported to produce allelopathic substances that deter or suppress other plants or crops from germinating and growing near it. Chemical compounds (parthenin and other phenolic acids) were also found in all parts of the plant, including hair-like structure (trichomes) on the stems and leaves as well as on pollen, that are highly toxic to human and animals. The toxin causes severe skin and respiratory problems such as dermatitis, hay fever, asthma and bronchitis in human, especially those that are allergy-prone (Sharma *et al.* 2013). The dried plant parts are also carried by wind over long distances to affect people in the surroundings areas. Although the weed is unpalatable to livestock, mixed with fodder, the resultant meat and milk can be tainted. Grazing animals, including cattle and horses, suffer mouth ulcers, intestinal damage, loss of condition, anorexia and death due to rupturing and hemorrhaging of internal organs and tissues.

Origin, distribution and importance in Malaysia

Parthenium weed was first reported in Malaysia in 2013 (the New Straits Times, page 18, Friday, 23 October, 2013; Rezaul Karim, 2014). It is found in many parts of the country but it has not been recorded so far in the east coast states of Kelantan, and Terengganu in Peninsular Malaysia and Sarawak in East Malaysia. Locally it is named as Rumpai Miang Mexico. This herbaceous, dicotyledonous plant is a

member of Asteraceae (Compositae) family. It can grow up to 150 cm tall in loaming soil. The different growth stages of parthenium weed are usually found in a particular locality. Of importance are the presence of trichomes on stems and leaves and the well-developed taproot system for firm establishment as shown in Fig. 1.



Fig 1: Different growth stages of parthenium weed (a) trichomes on stem and leaf (b) well-developed tap-root system (c).

Parthenium weed suppression by natural vegetation

Although the weed was reported to produce allelochemicals that suppressed germination and growth of a wide range of crops and plants in other countries, in Malaysia it was observed that several local plant species found in its vicinity were able to compete and co-exist well with it. In most cases, the growth and spread of the weed were confined or suppressed by the natural vegetation. It was observed that the parthenium weed was found in open areas in small discreet, patches, co-existing with the natural vegetation.

Several local plants co-existing with parthenium weed has been identified. A few parthenium weed plants were observed to venture outside the observation plot but appeared to be restricted or contained by the natural vegetation. (Fig. 2).

Urban development and parthenium weed

Parthenium weed was also commonly found along roadsides and housing premises especially in open barren areas where it appeared to be the dominant

species. This indicated its highly competitive ability under the right conditions. (Fig. 3).



Fig. 2: Parthenium weed confined by natural vegetation.

Spread of parthenium weed

The transportation of soil, gravel and sand, contaminated with parthenium weed seeds, for construction purposes could also have helped spread the weed. Small-holdings of coconut, oil palm and orchards along these roadsides were often invaded by parthenium weed but the weed did not appear to spread widely into the farm. It is suspected that the vigorous growing natural vegetation played a major role in restricting the spread and growth of the weed (Fig. 4).



Fig. 4: Parthenium weed in small-holding confined by natural vegetation.

One oil palm estate in Selangor reported the presence of parthenium weed but the management had promptly eradicated it. Overall, it is surmised that the parthenium weed is still not yet a major crop weed in the country, but in areas where it is found, steps should be taken early to control it. Over-grazing encourages establishment of parthenium weed. Parthenium weed is also commonly found in some cattle-grazing areas, especially where large numbers of cattle are kept in stockyards. It is believed that overgrazing could have depleted the vegetation and allowed the parthenium

weed to establish. In such situations, over-grazing should be avoided. (Fig. 5).



Fig. 3: Parthenium weed growing along roadside and adjacent small holding (top) parthenium weed growing in garden of housing premises (bottom).

These human activities viz. urban development, agriculture, over-grazing, etc., create a conducive environment for parthenium weed to establish. In all such areas, the natural vegetation is either destroyed or not present and the surface left bare for some time. In the absence of competitive plants, parthenium weed is able to establish unhindered. The natural vegetation would eventually establish itself and stem the spread of this weed. For management no single method of control alone is adequate to control this weed and there is a need to integrate various management options (Kaur *et al.*, 2014). As the parthenium weed has already spread to different parts of the country, the following measures have been taken or should be taken to minimize the spread

Import regulation

Grains/seeds from exporting countries should be regulated to certify that they are free of parthenium weed seeds.

Legislation

Parthenium weed was gazetted as a noxious weed on February 26, 2015 under the Plant Quarantine Act

1976 of Malaysia. Under this Act, the Minister of Agriculture or the Inspecting Officer of the Department of Agriculture can compel land/property owners who have this weed growing in their land to remove it within 14 days or cause it to be removed. The owner will have to bear all costs and expenses for carrying out the removal. Additionally, in the event of a prosecution in the court of law, a person, if found guilty of the offence, will be fined not exceeding RM10,000 or imprisonment not exceeding 2 years or both.



Fig. 5: Over-grazing by cattle may encourage parthenium weed establishment.

Early Detection and Response

Any new weed infestation must be detected early and destroyed to prevent them from establishing and spreading. Controlling the weed before it seeds is necessary to prevent it spreading. Regular follow-up inspection is required for sustained control.

Manual weeding

This method of control is applicable in newly invaded areas where the weed occurs in isolation and in small numbers. The weeds should be pulled out before flowering with its entire root system intact, to avoid re-growth. (Fig. 6).

Use light, long-sleeved garments and half-leather or cotton gloves to avoid contact with the skin. Place the plants in plastic bags and leave them in the sun for later disposal/burning. Mechanical method of control such as slashing is not recommended as it promotes seed dispersal as well as rapid re-generation from the basal stumps. It was observed that stumps of 6 cm or more high would produce new shoots within 30 days (Fig. 7).



Fig. 6: Manual removal of parthenium weed.



Fig. 7: Parthenium stems produce new shoots after slashing.

Chemical Control

Chemical control using herbicides is a useful method for managing small populations of parthenium weed. Timing is critical so that the weed is sprayed when the plants are small and have not produced seeds. A close watch should be kept on treated areas for several years as seed can remain in the seedbank for many years. Chemical control will involve a quick knockdown herbicide that kill the weeds present and a suitable residual herbicide to control future seed germination. Repeated spraying may be required to prevent seed production/germination. In Malaysia several herbicides were evaluated in 2014-2015 for the control of parthenium weed. The most suitable candidates, based on effectiveness and speed of action, together with their rates of application, are listed below:

Active ingredient (% w/w)	Rate of application (450 liter/ha)	
	mL, g/10litre	mL, kg/ha
Glyphosate sodium (60.0) + metsulfuron methyl (1.5)	70.0 g	3.15 kg
Glyphosate IPA (41.0)	67.0 mL	3.0 mL
Glufosinate ammonium (13.1)	73.0 mL	3.30 mL
Diuron (80.0)	45.0 g	2.0 kg

Any of the above post-emergence herbicide can be applied by themselves to control parthenium weed. A pre-emergence herbicide diuron, applied at 2 kg ha⁻¹ can be used together with the selected post-emergence herbicides to control germinating weed seedlings. Use of a good hand-operated, pneumatic sprayer, fitted with a cone nozzle for spraying is recommended. Selective spot spraying should be carried out on individual weeds. Direct spray jet on the top of the target weed to avoid or minimize spraying the natural vegetation. A monthly inspection up to a year on the treated area has to be carried out to evaluate the progress of the spray program. Follow-up application is necessary to treat any remaining parthenium weed and/new germinations that may occur until the seed bank in the soil is exhausted. (Fig. 8). Once the weed is eradicated, it is essential to allow succession of natural vegetation to take place.



Fig. 8: Parthenium weed germination occurs within 30 days after herbicide application

Recommendations

Parthenium weed has been established in Malaysia for a number of years but the spread is still confined in small patches in open-areas, around homes and along roadsides and in some agricultural small-holdings beside these roads. It is still not considered a major crop weed and any medical problems it could cause to the general population and livestock are not serious and manageable. It is, nevertheless, timely to immediately organize an eradication program on a state-by-state basis to eradicate the weed completely, if possible. Further delays or inaction, may allow the weed to spread further, and hastened by the rapid urban development taking place in the country. Various effective methods of control are now available. They are easy and economical to use. The most appropriate method or combination of methods of control can be utilized in any particular situation. Judicious use of herbicide should be observed for safety reasons and to avoid unnecessary destruction of natural vegetation as their presence would discourage and prevent the re-establishment of parthenium weed.

CHUNG, G.F. 2014. Brief notes on recognition and management of deadly noxious weed – parthenium hysterochorus L. (Asteraceae). The Planter 90 (1065): 869-875.

MASUM, S. M., M. HASANUZZAM and M.H. ALI. 2013. Threats of parthenium hysterochorus on agro-ecosystems and its management: a review IJACS ([www.ijagcs.com/IJACS/2013/6-11\(84-697\)](http://www.ijagcs.com/IJACS/2013/6-11(84-697)))

REZAUL KARIM S.M. 2014. Malaysia invaded: Weed it out before too late. International parthenium News, Number 9, January 2014.

SHARMA V.K., P. VERMA and K. MOHARAJA. parthenium dermatitis. Photochem. Photobio. Sci., 2013 12, 85-94

Eco-physiological drivers of parthenium weed invasion: an overview

Poster Presented at the International Weed Science Congress at Prague (19-25 June 2016)

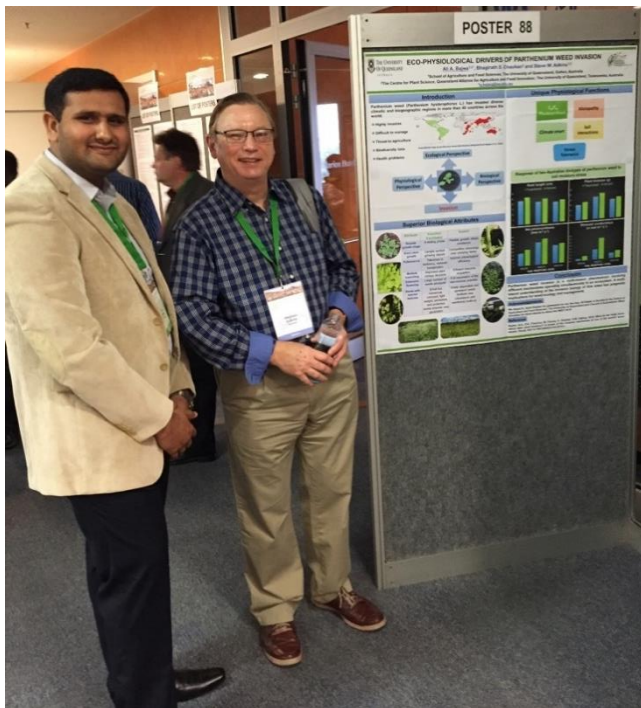
Ali A. Bajwa^{1,2}, Bhagirath S. Chauhan² and Steve W. Adkins^{1,2}

¹School of Agriculture and Food Sciences, The University of Queensland, Gatton, QLD 4343, Australia
²The Centre for Plant Science, Queensland Alliance for Agriculture and Food Innovation, The University of Queensland, Toowoomba, QLD 4350, Australia
(a.bajwa@uq.edu.au)

Parthenium weed (*Parthenium hysterophorus* L.), a well-known noxious weed species, has invaded diverse climatic and biogeographic regimes in more than 50 countries across six continents. Efforts are under way to minimize the parthenium-induced environmental, agricultural, social, and economic issues. However, meager information regarding its invasion mechanisms and interference with ecosystem stability is available. It is hard to devise effective management strategies without understanding the invasion process. There are certain ecological and physiological cues which play important role in parthenium weed invasiveness. Strong morphological traits like vigorous growth habit, pubescent leaves, luxurious flowering, flexible rosette formation, tap root system, and abundant seed production contribute towards its invasiveness. In the meantime, the C₃/C₄ photosynthesis, thermal and photo insensitivity, enzymatic regulation, and antioxidant feedback are some key physiological interventions making parthenium a problematic weed.

The morphological and physiological adaptations to a wide range of abiotic stresses also add up to its invasive power under diverse range of climatic conditions. The allelopathic potential of parthenium weed has also been well explored and declared as a possible mechanism for invasion. The importance of superior morphological and basic physiological traits in parthenium weed invasiveness is certain and well established. However, the comprehensive research is needed to determine the relative contribution of such factors towards overall invasion. The invasiveness of parthenium weed might be due to complex interactions of multiple mechanisms being operated simultaneously. Future research must be oriented to characterize and quantify the ecological, physiological, and biochemical drivers in order to draw a clear picture of parthenium weed invasion.

Ali A. Bajwa^{1,2}, Bhagirath S. Chauhan² and Steve W. Adkins^{1,2}



Mr Ali Bajwa and Steve Adkins at the International Weed Science Congress in Prague, 2016.

Morpho-physiological responses of two Australian biotypes of parthenium weed (*Parthenium hysterophorus* L.) to soil moisture stress

(Presented at the 20th Australasian Weeds Conference-2016 at Perth (11-15 Sep 2016))

Growth response of two Australian biotypes of parthenium weed grown under three different water regimes.

A pot study was conducted to evaluate the morpho-physiological responses of two Australian biotypes (Clermont and Toogoolawah) of parthenium weed to 50, 75 and 100% of the soil water holding capacity (WHC). Moisture stress affected growth of both biotypes significantly ($P < 0.05$); however, the growth of Clermont was less affected than Toogoolawah across all soil moisture regimes. Significantly greater numbers of branches, leaves, longer shoots, higher fresh weight, and dry weight were observed for plants growing at 75% of WHC as compared with those growing at 100% of WHC. However, root length was increased in response to the 50% reduction in soil moisture. Physiological attributes including, net photosynthesis and stomatal conductance were also higher for Clermont than Toogoolawah and were at a maximum at 75% of WHC. Parthenium weed maintains good growth under sub-optimal soil moisture and therefore, is able to invade a wider range of environments than expected.

The invasive potential of parthenium weed: a role for allelopathy

(A book chapter published In: Julia E. Price (Eds.), *New Developments in Allelopathy Research* (pp. 135-173). New York, NY: Nova Science Publisher)

Boyang Shi*, Zubair Aslam and Steve Adkins*
*School of Agriculture and Food Sciences, The University of Queensland, Australian Department of Agronomy, University of Agriculture, Faisalabad, Pakistan

Parthenium weed (*Parthenium hysterophorus* L.) is an herbaceous plant that has now invaded over 44 countries worldwide having an impact upon crop and pasture production, natural community biodiversity and human and animal health. Allelopathy is a well-defined physiological trail that is possessed by some crops and native plant species, but especially by invasive weeds. It is a biological phenomenon involving the release of chemicals that may cause a stimulatory, but more often an inhibitory effect upon another plant's growth, reproduction and survival. Numerous studies have associated the invasive success of parthenium weed with a proficient allelopathic attribute, able to cause an inhibition of either germination, seedling or plant growth, phenological development and/or flowering in a range of agriculturally important species, in other weeds and some native species. The presumed allelochemicals are produced by a number of plant parts including the stem, leaves, roots, pollen and other floral parts. The two major allelochemical groups that are thought to be involved are the sesquiterpene lactones and the phenolics acids, and both have been found to be released by living plants and decomposing plant residues as well as being present in rhizosphere soil under a parthenium weed population. Different bioassay approaches have been used to gain an understanding of this weed's allelopathic character. These include laboratory assays using aqueous extracts applied directly to germinating seeds, or those evaluating the impact of parthenium weed seedlings on the growth of neighbouring seedlings, both using a liquid medium (relay seeding bioassay) or in an agar medium (plant box bioassay). Other laboratory bioassays have looked at the impact of parthenium weed litter upon germination and seedling growth (sandwich bioassay) while some glasshouse pot tests carrying sand or soil have also been undertaken looking at the impact of aqueous extracts, leaf litter or rhizosphere soil. Each approach has its own advantages and disadvantages. This chapter will evaluate the evidence and decide if

allelopathy makes a major or a minor contribution to the invasiveness of this weed.

Biological control or parthenium weed

(A new project initiated to redistribute priority agents from central Queensland into southern Queensland, Australia)

Kunjithapatham Dhileepan Steve Adkins Olusegun Osunkoya, Sathyamurthy Raghu and Asad Shabbir

Institutions: Queensland Government, University of Queensland, University of the Punjab, Lahore.

Parthenium weed (*Parthenium hysterophorus*), is a noxious weed of grazing areas in central Queensland. Eleven agents, nine insect species and two rust pathogens, have been released against this Class 2 weed, in Australia. While the majority of these agents have become established and have proven effective against the weed in the core infested areas, parthenium weed is spreading into southern Queensland at an alarming rate. To stop the spread of this weed further south, in collaboration with Meat and Livestock Australia and the Australian Federal Government, a new project has been initiated to redistribute priority agents from central Queensland into southern Queensland, in partnership with catchment groups, regional councils, Landcare groups and local councils.

Upcoming Conferences on Weed Science and Invasive Species

The 2nd Global Herbicide Resistance Challenge; "Challenge Accepted"

Dates: 14–18 May 2017

Venue: Denver, Colorado, USA

<http://www.ghrc2017.org>

26th Asian Pacific Weed Science Society Conference - Weed Science for People, Agriculture, and Nature

Dates: 19–22 September 2017

Venue: Kyoto, Japan

<http://www.c-linkage.co.jp/apwss2017/index.html>

14th World Congress on Parasitic Plants

Dates: 25–30 June 2017

Venue: Pacific Grove, California, USA

<http://www.parasiticplants.org>

International Conference on Biodiversity, Climate Change Assessment and Impacts on Livelihood

Dates: 10-12 January 2017

Venue: Kathmandu

<http://icbcl17.org/>

Recent Publications

- Bajwa, A. A., Chauhan, B. S., Farooq, M., Shabbir, A., & Adkins, S. W. (2016). What do we really know about alien plant invasion? A review of the invasion mechanism of one of the world's worst weeds. *Planta*, 244, 39-57.
- Safdar, M. E., Tanveer, A., Khaliq, A., & Maqbool, R. (2016). Critical competition period of parthenium weed (*Parthenium hysterophorus* L.) in maize. *Crop Protection*, 80, 101-107.
- Terblanche, C., Nänni, I., Kaplan, H., Strathie, L.W., McConnachie, A.J., Goodall, J., Van Wilgen, B.W., (2016) An approach to the development of a national strategy for controlling invasive alien plant species: The case of *Parthenium hysterophorus* in South Africa, *Bothalia* 46(1) 1-11.
- Hasan, F., & Shafiq Ansari, M. (2016). Temperature-dependent development and demography of *Zygogramma bicolorata* (Coleoptera: Chrysomelidae) on *Parthenium hysterophorus*. *Annals of Applied Biology*, 168(1), 81-92.
- Tavva, S. M. D., Deshpande, A., Durbha, S. R., Palakollu, V. A. R., Goparaju, A. U., Yechuri, V. R., & Muktinutalapati, V. S. R. (2016). Bioethanol production through separate hydrolysis and fermentation of *Parthenium hysterophorus* biomass. *Renewable Energy*, 86, 1317-1323.
- Qurat-ul-Ain, Firdaus-e-Bareen and Shafiq, M. (2016). Management of the *Parthenium hysterophorus* through biochar formation and its application to rice-wheat cultivation in Pakistan. *Agriculture, Ecosystems & Environment*, 235, 265-276.
- Kaur, M., & Aggarwal, N. K. (2016). Biocontrol potential of *Alternaria* sp. PMK2, against a devastating weed: *Parthenium hysterophorus* L. *International Journal of Pest Management*, DOI: 10.1080/09670874.2016.1217364
- Nguyen, T. L., Bajwa, A. A., Navie, S. C., O'Donnell, C., & Adkins, S. W. (2016). The Soil Seedbank of Pasture Communities in Central Queensland Invaded by *Parthenium hysterophorus* L. *Rangeland Ecology & Management*.
- Kumar, S., Srivastava, A., Jaidi, M., Chauhan, P. S., & Raj, S. K. (2016). Molecular Characterization of a Begomovirus, α -Satellite, and β -Satellite Associated with Leaf Curl Disease of *Parthenium hysterophorus* in India. *Plant Disease*, 100(11), 2299-2305.
- Hussain, N., Abbasi, T., & Abbasi, S. A. (2016). Vermicomposting transforms allelopathic parthenium into a benign organic fertilizer. *Journal of Environmental Management*, 180, 180-189.
- Verma, K. K., Singh, S., Kumar, P., & Pandey, R. M. (2016). Seasonal variation in contact hypersensitivity to *Parthenium* in patients of *Parthenium dermatitis*. *Indian Journal of Dermatology*, 61(1), 53.
- Day, M. D., & Bule, S. (2016). The status of weed biological control in Vanuatu. *NeoBiota*, 30, 151.

For contributions, please send your news items/articles to the following address;

Dr. Asad Shabbir

Department of Botany University of the Punjab, Lahore Pakistan. Email: assadshabbir@yahoo.com or asad.iags@pu.edu.pk