



INTERNATIONAL PARTHENIUM NEWS

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Parthenium weed problem, its spread and status in Uganda

(From the IPM-CRSP funded Parthenium weed project in Uganda, local coordinator Dr. J. Bisikwa)

Parthenium weed (*Parthenium hysterophorus* L.), an invasive weed threatening biodiversity, human and livestock health, was first sighted in Uganda in 2008. It is now rapidly multiplying in several locations, especially along the sides of highways crossing Uganda from Busia (Kenya-Uganda border) and to Kabale (see Figure 2). Currently, it has been detected in at least 12 districts including Busia, Namutumba, Bugiri, Tororo, Mbale, Jinja, Mbarara, Ibanda, Masaka, Kampala, Kabale, and Kasese.

The Parthenium Weed Project Team in Uganda headed by Dr. Jenipher Bisikwa, a Weed Scientist from the Department of Crop Science, Faculty of Agriculture, Makerere University, are currently carrying out a detailed extensive countrywide survey to establish the exact extent of parthenium weed spread in Uganda. We have been doing some monitoring and containment activities after undertaking initial mechanical control approaches back in December 2008 at the Namalemba and Bugembe sites. These infestations were cleared by first slashing, followed by burning and then by digging and handhoeing. However there are still some parthenium weed seedlings coming up at these sites. We have also sadly noted that Parthenium weed inflorescences are now being used by florists in their floral arrangements used at weddings and at other parties. We are afraid such activities will further spread the parthenium weed problem in Uganda.

We also have plans to hold sensitization seminars targeting florists/decorators countrywide addressing health problems associated with this invasive weed and plans are also underway to organize meetings at affected sites to create awareness within the local

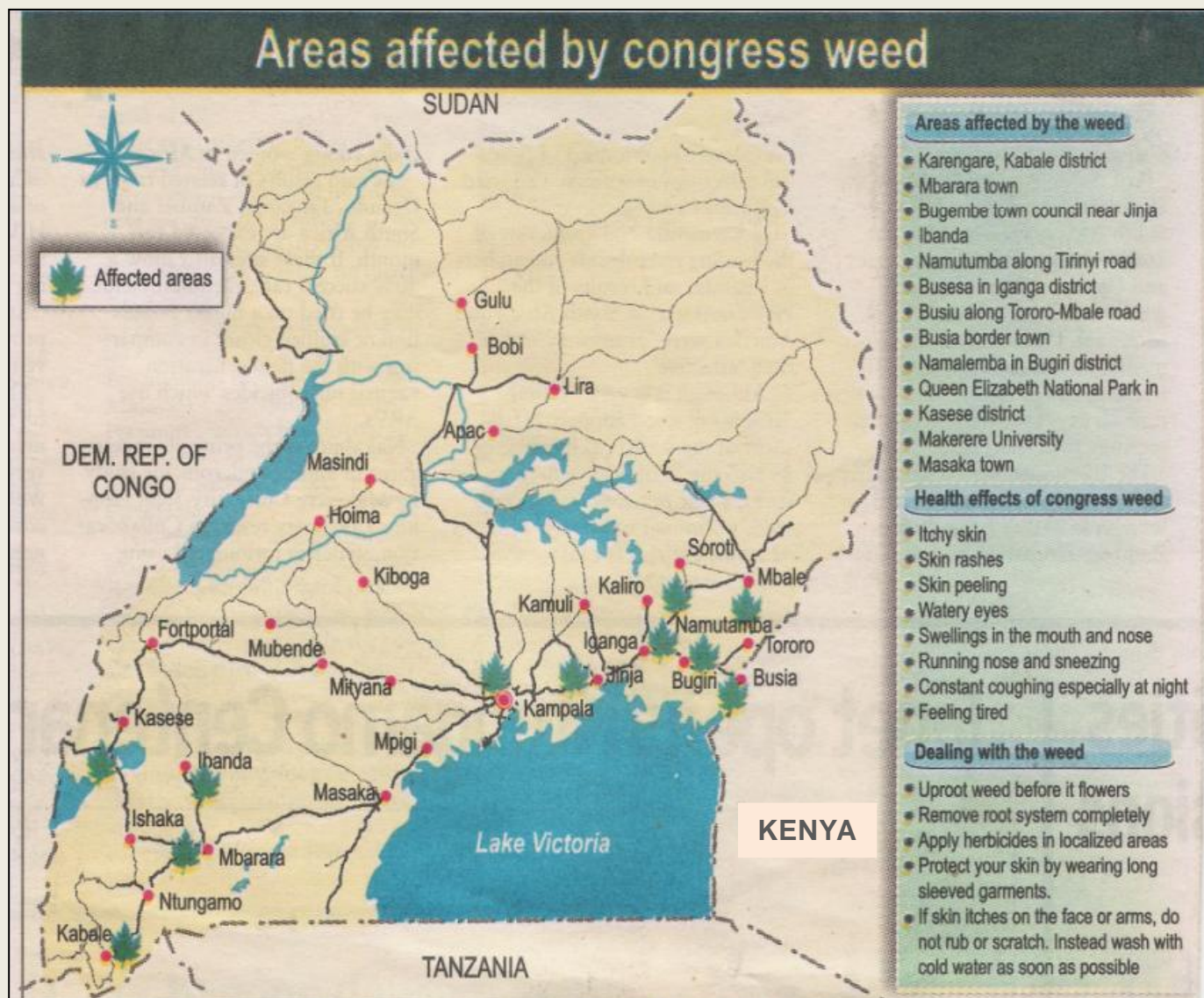
populations concerning the dangers associated with are making use of posters/ID kits distributed by Drs Wondi Mersie and Steve Adkins to make local people aware of the negative effects associated with this weed. To conduct the awareness and monitoring activities in Uganda, we have been working hand in hand with the National Invasive Species management program under the National Agricultural Research Organization (NARO), coordinated by Dr Gadi Gumisiriza. We undertook a monitoring trip in January 2010 to check on the sites in Namutumba and Jinja Districts where we had removed parthenium during December 2008. The density of the weed had decreased where we removed it but unfortunately more seedlings had come up. On a positive note, during this visit in January 2010 to Namutumba one of the farmers had converted the field that was heavily infested by Parthenium weed into a sweet potato field and the tillage practices used had removed all of the seedlings at that site (however, seed is possibly still in the soil seed bank).

Figure 1: Parthenium weed field activities held in Uganda.



I talked to the local people to keep monitoring and to continue removing parthenium weed before seed production. Also, the National Agricultural Research Organization launched a national campaign on TV stations and on the local news to make people aware about the health issues to do with this weed. As a follow-up activity, together with NARO staff we plan to hold a workshop to educate decorators and florists

Figure 2: Map showing current the Parthenium sites in Uganda (Graphics by New Vision Uganda, March 2009)



about the dangers of using parthenium weed in their floral arrangements since this seems to be one of the main sources of spread in the country at the moment. We also plan to hold interviews with local radio stations to discuss the effects of parthenium weed on agricultural activities within Uganda. These interviews will be translated to local languages in order to reach local farmers who are likely to be affected by this weed the most.

Acknowledgement: The Parthenium Weed Project in Uganda is part of the USAID funded IPM-CRSP Parthenium Weed Projects in Eastern Africa regionally coordinated by Dr Wondi Mersie from Virginia State University, USA and involving scientists from a number of countries.

Status of parthenium weed in Papua New Guinea

By Annastasia Kawi and Warea Orapa

The first incursion of parthenium weed, *Parthenium hysterophorus* L. (Asteraceae), a serious agricultural and rangeland weed, was first recorded in Lae, Morobe Province of Papua New Guinea (PNG) in 2001. The weed was detected at two locations, one within an industrial area leading from a vehicle bond yard in Lae city and a second site at Buambub Plantation, 10 km along the Highlands Highway from Lae. The highway is the gateway to the agriculturally rich five Highlands provinces and Madang Province on the northern coast of PNG. The climate of PNG is generally hot and

humid but there is a distinct wet-dry season in most parts of the country with some areas such as the Morobe Province and Central Province experiencing local dry conditions which are all suitable conditions for Parthenium weed. The infestation in Lae City was found in a major vehicle import company's yard where new and used vehicles were stored pending customs clearance. Some of the used vehicles were from Australia so it was suspected that the tiny seeds of parthenium weed were accidentally introduced on these used vehicle imports from Australia, where the weed has been a serious problem for about 50 years. The weed established and spread along a drainage area running through the Industrial area and onto the roads and property perimeters near the drains.

Figure 3: Ela Motors bond yard, PNG where parthenium weed first appeared, the site is regularly sprayed with herbicides by the company.



The National Agricultural Quarantine & Inspection Authority (NAQIA) was involved in the monitoring and eradication of the weed from the start with support from the Secretariat of the Pacific Community in 2000 to 2005. The incursion at Buambub Plantation, 10 km from Lae City along the Highlands Highway was found under an open cocoa plantation areas near the road. It appears that this probably resulted from spread from the Lae City infestation. There are no further reports or evidence of the weeds spread from both the Lae City and the Buambub Plantation outbreak sites.

An eradication programme for parthenium weed was initiated and funded by the South Pacific Commission (SPC)'s Plant Protection Service and implemented by NAQIA and the National Agricultural Research Institute personnel based in Lae City. The parthenium weed eradication programme lasted for 5 years with the regular spraying of paraquat and glyphosate at the affected sites. NAQIA and SPC have yet to declare parthenium weed as having been eradicated in PNG as seedbanks at the Lae City industrial sites may still give

rise to further infestations. The sites are still being monitored for possible regrowth from seeds. A recent quarantine survey in November 2009 indicated that no parthenium weed was sighted at the same sites or elsewhere in Lae City. If the area remains parthenium weed-free for another year, it will be officially declared as eradicated from PNG.

A note added by the Editor

During a four day visit to PNG in April 2010, Dr Steve Adkins undertook a visual inspection of the road margins and wasteland areas of the city of Madang, and also along the road margins of the main highway leading north out of the city for 50 km. The conditions for growth of parthenium weed at that time of the year were ideal however, no plants were found in any of the locations inspected. A similar roadside inspection was also made on the Island of New Britain around the cities of Rabaul and Keravat. Copies of the parthenium weed identification kit were left with agricultural advisors for further distribution in these regions.

Parthenium weed: Spread and Status in China

The first herbarium specimen of parthenium weed was collected in Yunnan Province in 1926, which is adjacent to north Vietnam where this species was first recorded in 1924 (Li & Xie 2002). Currently, parthenium weed is broadly distributed across southern China, including Yunnan, Guizhou, Guangxi Guangdong, Hainan, Hong Kong, Fujian and Taiwan. In 2004, however, parthenium weed was also reported in Junan County of Shandong Province in northern China. It seems that this weed is still expanding its geographic distribution in China (Figure 5).

Figure 4: Parthenium weed in Shandong province.



(Photos taken by Dr SQ Tang)

Figure 5: Current distribution of parthenium weed in China (By Dr. SQ Tang, 2010)



A previous study showed that parthenium weed in Shandong is genetically different from those in southern China, which suggests that it may be an independent introduction either from its native range or from other introduced areas around the world (Tang et al. 2009. *Weed Research* 49,373–380).

Research Projects:

1. Phylogeographic and genetic structure

This is a collaborative project currently underway to broadly characterize the phylogeographic structure of parthenium weed in the Americas, determine the native-range origin of invasive populations and, in a preliminary way, to reconstruct its invasion history globally. We are currently collecting parthenium weed samples from native and introduced areas, with the aid of members of IPaWN across the world.

2. Local adaptation in distinct climate areas

In a preliminary experiment, we found that the plants in Shandong had significantly different performance from those in southern China under common garden conditions, suggesting possible local adaptation. This is consistent with our previous finding using molecular marker analysis. However, a more rigorous examination using multiple common gardens is needed.

Call for international collaborations

As parthenium weed is broadly distributed, we hope more members of IPaWN can join these projects, for example through providing samples from your country for inclusion in our global study. Anyone who is interested in these projects can contact Dr Yupeng Geng (gengyupeng@gmail.com), Dr Rieks van Klinken (Rieks.vanklinken@csiro.au) or Dr Steve Adkins (s.adkins@uq.edu.au).

Its moving to the South: The Cotton Industry is at risk in Pakistan

By Asad Shabbir

During extensive survey work, data was collected on the distribution of parthenium weed throughout the Province of the Punjab and Islamabad Capital Territory (ICT), Pakistan. This data set was needed for the current and future distribution and mapping of this weed in Pakistan as well as further climate suitability studies (CLIMEX modelling) for the biological control agents that present in Pakistan to manage parthenium weed.

In Pakistan, parthenium weed is rapidly spreading throughout the Punjab Province, Islamabad, the Islamabad Capital Territory (ICT) and parts of the North West Frontier Province (NWFP). The current survey to record parthenium weed in the Punjab showed that parthenium weed is now much more widespread than was first believed. The survey work revealed that the core infestation of this noxious weed is centred upon the Central and Northern divisions of the Punjab including the ICT. Interestingly, parthenium weed has now moved from the northern to the southern districts of this Province (see map below). The southern districts now infested include *Okara, Pakpattan, Sahiwal, Kanewal, Multan* and *Bahawalpur*. The presence of parthenium weed is a potential threat to agriculture and the dairy industry in the *Sahiwal* and *Okara* districts which are also known as the livestock hub for the country. Similarly, occurrence of parthenium weed in *Multan, Sahiwal* and *Bahawalpur* indicate a potential threat to the cotton industry of Pakistan. These districts are part of the cotton belt of the South Punjab and the cotton industry is also recognized as the backbone of the Pakistan's economy.

During the survey work it was also found that parthenium weed had invaded the *Pattoki* region near the *Lahore* district. The town is the centre for the cut flower, fruit and decorative plant industries in Pakistan and supplies plants to major districts in the Punjab and NWFP. The nurseries' sale points are stretched across both sides of the National Highway between *Lahore* and *Sahiwal* with over 5 km of lush greenery but also contaminated with a huge infestations of parthenium weed. Parthenium weed was also found growing in almost all of the nursery sale points in distant districts (such as *Bahawalpur* and *Multan*) where this weed is not reported elsewhere, and suggest that these plants along with soil or potting mix coming from the *Pattoki* district are infested with parthenium weed seed and hence are acting as a method of spread of the weed to these new areas (Figure 7).

Parthenium weed in Pakistan is reported to harbour mealy bug species and is thought to carry the Tobacco Streak Virus (TSV) both are considered to be major pests of cotton; hence the presence of the weed in the south Punjab is a real threat to the Cotton Industry.

Figure 6: Mealy bug attack on parthenium weed growing in Lahore and Sahiwal districts of Pakistan.

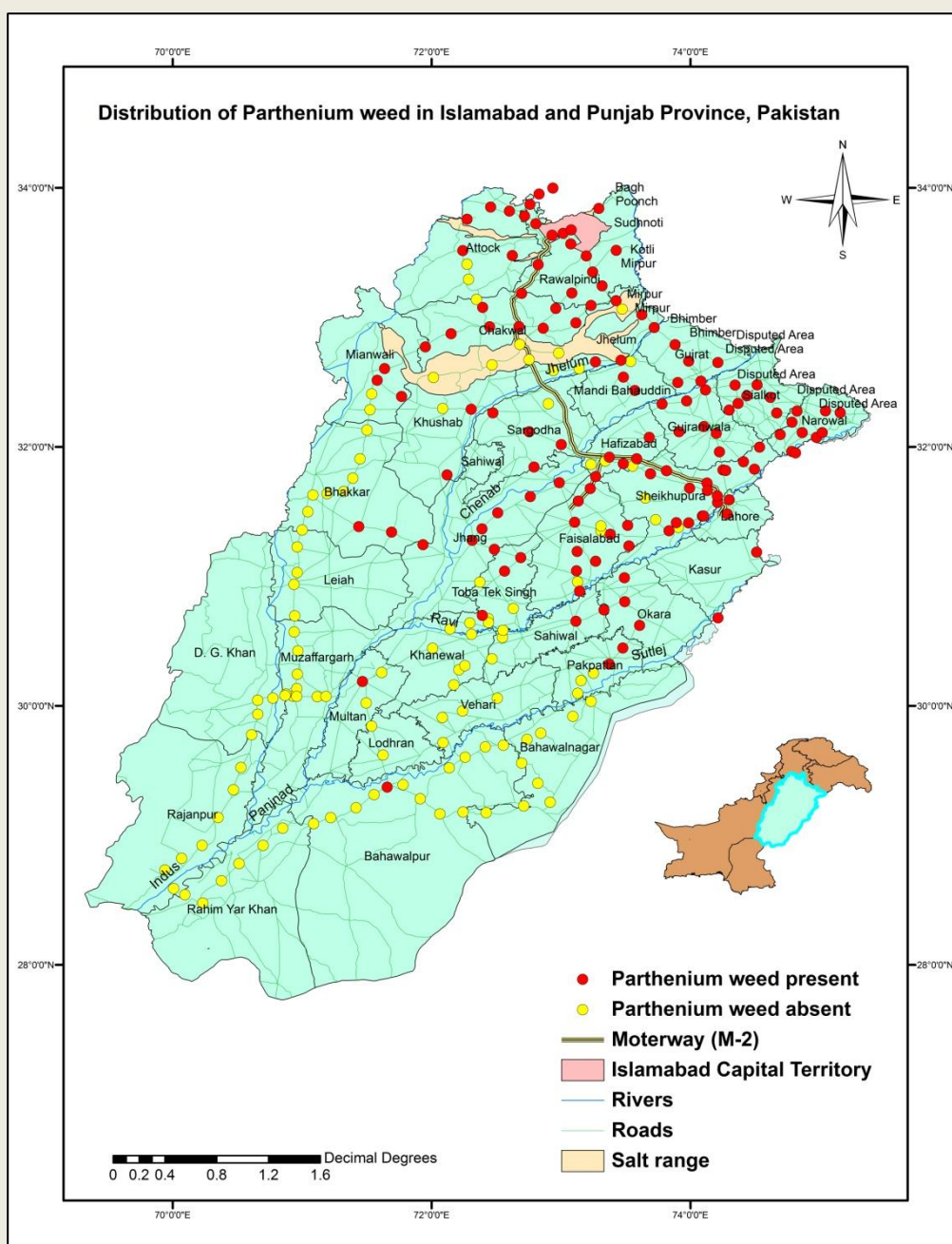


The distribution data sets collected will be used to help predict the future distribution of the weed and its biocontrol agent (*Zygogramma*) in Pakistan under the present and a changed climate scenario using CLIMEX. Once a CLIMEX models have been developed, this will help target areas for effective redistribution of the beetle and other forms of management in Pakistan. This research project (supported with an University of Queensland, International travel grant) will further help predict how climate change may affect parthenium weed distribution and that of one of its biological control agents in Australia.

Figure 7: Parthenium weed growing inside the plant nursery area in Multan, Pakistan.



Figure 8: Parthenium weed distribution map in Punjab Province and Islamabad, Pakistan.



(Map developed by Mr Asad Shabbir)

Parthenium weed in Israel – a status report for 2010

Y. Giladi¹, B. Rubin², G. Achdari³ and H. Eizenberg³

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The species *Parthenium hysterophorus* L. is a recent invasive and troublesome weed that causes severe damage to field crops in Israel. *P. hysterophorus* infestation was first reported in Israel in 1980, in the Jordan Valley (Eastern Israel), next to fish ponds, presumably after imported from the US with the feed grains. Since 1980, *P. hysterophorus* is slowly migrating and is now established in other locations in Israel from the Jordan Valley, to the Esdraelon Valley.

Parthenium hysterophorus is an annual summer invasive weed that grows in the field margins, road

sides, and orchards. The weed germinates during the winter, in February, and few weeks later produces seeds, throughout the summer and autumn. Its efficient growth and seed production, under Mediterranean climate conditions, allows its rapid dissemination and establishment, in particular, when the winter is mild. For example, in the winter of 2010 that was warmer than the perennial average, *P. hysterothorus* did not enter dormancy, and behaves as a perennial weed. The weed was found in alfalfa and clover fields that were grown for hay. Interestingly, the time required for *P. hysterothorus* seed production was synchronized with the hay harvest cycle (2-3 weeks). It was found that the Israeli *P. hysterothorus* seeds contain phytotoxic compounds that may cause damage to livestock, as reported also in the literature.

Figure 8: A close up of parthenium weed in Israel.



Table 1. Efficacy of post-emergence applied herbicides for *P. hysterothorus* control in alfalfa. Alfalfa height was 15 cm in application time. Control efficacy was evaluated by *P. hysterothorus* vigor (0-100).

Herbicide rate (g a.i. ha ⁻¹)	<i>P. hysterothorus</i> Infestation (% of untreated control)		
	5 DAT	13 DAT	25 DAT
Metribuzin 350	58a	20ab	60a
Metribuzin 700	60a	0b	3b
Diuron 1600 + fluroxypyr 100	53a	36ab	55a
Diuron 1600+ fluroxypyr 200	35a	6b	5b
Untreated control	73a	56a	65a

Today, our approach to eradicate *P. hysterothorus* in Israel includes sanitation and chemical control. The herbicide treatments were applied pre emergence (in respect to *P. hysterothorus*), between alfalfa harvest cycles, when the alfalfa shoots are low and the stand is thin. In field studies that were conducted between the years of 2008 and 2010, several selective and non-

selective herbicides were examined for their efficacy against the weed. The non-selective herbicides paraquat and glufosinate were used mainly for local eradication of *P. hysterothorus* in heavily infested sites.

Figure 9: Parthenium weed infesting tomato field, Bet Shean Valley, Israel.



The herbicide metribuzin (350 g a.i. ha⁻¹) is effective as a pre-emergence treatment against *P. hysterothorus* in alfalfa when applied on February when the crop starts its spring growth. The initial alfalfa growth was inhibited but recovered before the summer harvest. A tank mixture of diuron and fluroxypyr (1600 g a.i.ha⁻¹ and 200 g a.i. ha⁻¹), respectively, also effectively controlled *P. hysterothorus*. This tank mix also increases the range of the controlled weeds. A field trial for validation of this observation will be conducted in 2011. In summary, the fast dissemination and the risks associated with *P. hysterothorus* to the irrigated crops and orchards are now recognized by the local farmers and the Extension Services and more measures are planned to limit the distribution to other fields.

Progress on Parthenium Research in Ethiopia

By Wondi Mersie

Parthenium (*Parthenium hysterophorus* L.) is believed to have been introduced to Ethiopia in the 1970's through the eastern part of the country, has now spread to all regions of the country with the greatest infestations in eastern and northeastern Ethiopia. In Ethiopia, parthenium reduces the yield of major crops such as sorghum and competes with preferred pasture species. When consumed by domestic animals, taints their milk and meat, thereby reducing their value. In addition, because it releases toxic chemicals, parthenium is replacing natural vegetation and

threatens eastern Africa, one of the world's richest regions of biodiversity. The mountain ranges and the rift valley passing through Ethiopia are storehouses of plant diversity which are now threatened by parthenium weed.

Parthenium in Ethiopia's small scale, subsistence farming is currently controlled by hand weeding. Other weed control methods including chemical and mechanical techniques are cost prohibitive. Presently, this hand weeding is primarily conducted by women as well as school-age children. Weeding is a time-consuming activity and the reported detrimental health effects of parthenium weed are cause for concern.

Figure 10: Ethiopian villagers clearing a dense stand of parthenium weed.



Photo by Kassahun Zewdie

A project entitled, 'Management of the Weed Parthenium (*Parthenium hysterophorus* L.) in Eastern and Southern Africa Using Integrated Cultural and Biological Measures,' was funded by the United States Agency for International Development (USAID) through the Integrated Pest Management Collaborative Research Support Program (IPM-CRSP) for four years starting in 2005. This international collaborative project has been led by Virginia State University (VSU) in the U.S. with partners in Ethiopia, Uganda, Botswana, Swaziland, and South Africa. Scientists from the University of Queensland in Australia, CABI, IITA, CIMMYT, and the Indian Agricultural Research Institute also participated in the project. The goal of the project was to develop an integrated weed management system that reduces the adverse impact of parthenium weed on humans, crops, livestock and plant biodiversity the eastern and southern Africa.

As a result of this project, maps showing the distribution of parthenium in Ethiopia and South Africa were produced after a detailed survey. Host range testing done in South Africa and Ethiopia on a number

of native and economically important crop species and varieties, and indigenous non-crop species, established that the leaf-feeding beetle, *Zygogramma bicolorata* is safe for release against parthenium weed. This bioagent will be released in Ethiopia for the control of parthenium weed once all the necessary permits are received. The stem-boring weevil, *Listronotus setosipennis* was imported to Ethiopia in September 2009 and is being evaluated under quarantine conditions.

South African scientists who were collaborators in the project helped to establish the first quarantine facility in Ethiopia to evaluate the safety and efficacy of biological control agents. The project supported four students to study for their M.S. degree while working on parthenium weed and provided hands-on training to several researchers on biological control techniques. A similar project was recently funded by the USAID to continue the work in Ethiopia, Kenya, Uganda and Tanzania with the participation of scientists from South Africa and Australia.

1st IOBC International Workshop on Biological Control and Management of *Parthenium hysterophorus*

In 2009 a Working Group on Parthenium weed biological control was formed under the auspices of the IOBC, currently under the convenorship of Drs R. Muniappan, K. Dhileepan and W. Mersie. The 1st IOBC International Workshop on Biological Control and Management of *Parthenium hysterophorus* is to be held in conjunction with the 8th IOBC International Workshop on Biological Control and Management of *Chromolaena odorata* and Other Eupatorieae, in Nairobi, Kenya from the 1st – 5th November 2010. It will include the USAID-funded IPM-CRSP Partners Planning Workshop for the project 'Abating the weed (*Parthenium hysterophorus* L.) damage in eastern Africa using integrated, cultural and biological control measures'.

Parthenium weed is spreading in Africa and Asia, causing similar problems to those already experienced in Australia and India, by impacting on agriculture (crops and grazing), biodiversity conservation, and human and animal health. Research on parthenium weed and its management has been conducted over several decades in Australia and India. In Africa, awareness of parthenium weed is limited, but currently some research efforts on the impacts and management of this weed are being undertaken in South Africa,

Ethiopia and Uganda, through various nationally-supported programmes and/or international initiatives such as USAID IPM CRSP and GEF/UNEP. Research on the weed is also being undertaken in Pakistan, Bangladesh, Nepal, China, Sri Lanka and Vietnam, and research in Australia and India is still ongoing. In 2009 an International Parthenium Weed Network (IPaWN) was initiated, coordinated by the University of Queensland, Australia.

The intended purpose of the upcoming workshop in Kenya is to bring together international researchers working on parthenium, to disseminate information on the weed and its management, to increase collaboration amongst researchers regionally and globally, to optimise resources for the control of this weed, and for technology transfer (e.g. supply of biocontrol agents to other countries). Additionally, it is hoped that this workshop will raise awareness of parthenium weed for countries that are at risk, or that are in the early stages, of invasion by this weed.

This workshop will be held in conjunction with the **8th IOBC International Workshop on Biological Control and Management of *Chromolaena odorata* and Other Eupatorieae**, which is organized under the auspices of the IOBC, and will be hosted by CABI. These workshops were initiated in 1988 to facilitate the management and biological control of *Chromolaena odorata* in resource-poor tropical and subtropical countries. In 2003 the scope of the workshop was expanded to include closely related species such as *Mikania micrantha*, while retaining an emphasis on the tropics. Kenya has been selected as the host country for this 8th workshop, the third held in Africa, because *C. odorata* has recently been recorded there and in other countries in East Africa for the first time. This region has been shown to be highly climatically suitable for *chromolaena* as well as for parthenium. Other species of invasive alien Eupatorieae which could be included in this workshop include *M. micrantha* and *Ageratina adenophora*. Suggestions for discussion on further species (tribe Eupatorieae) are welcome.

For further details of the 1st IOBC International Workshop on Biological Control and Management of *Parthenium hysterophorus*, the Second Announcement and Expression of Interest, please refer to <http://www.arc.agric.za/home.asp?pid=5229>. Abstracts are due to be submitted by the end of July 2010.

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

IPaWN Discussion Series

During current half of the year, two discussion questions have been placed to the network. The following is a summary of those discussion points and responses from you.

Topic I – Is Parthenium weed found in your area?

A parthenium weed distribution map of the world showing where we believe parthenium weed is found in was posted to the network to confirm the status of the weed in their country. The map was developed using both confirmed (using herbarium specimens) and unconfirmed (personal observations of experienced scientists) observations and the whole area of the country was shaded. Members were requested to confirm the status of the weed in their country. Firstly, if the weed is known to be present, by providing information on the papers, reports, herbaria records etc. that have been produced about their countries infestations, or secondly, if the weed is not there were surveys have been undertaken that confirm its absence. We had a fruitful discussion on the topic and map and heard valuable information on how the weed entered different countries, how it was spread and whether it is now regarded to be invasive.

In Nepal, parthenium weed was suggested to enter through an open border with India. The first specimen of this plant was collected in 1967, the weed become dominant in urban areas after 1990. Transportation appears to be the major mean of dispersal of parthenium weed in different parts of the Nepal. An initiative was taken by the editor, Mr Asad Shabbir from University of Queensland and Dr Bharat Babu Shreshtha from Nepal to prepare a distribution map of PW in Nepal based on GPS points of sites where partheium weed is found in. A preliminary map has been developed based on the current data.

In Bangladesh, Parthenium weed was first reported in an Annual Convention of Bangladesh Botanical Society in late eighties of the 20th century. It is assumed that Parthenium entered in Bangladesh from India most probably through transport vehicles which came from India. The South western part of Bangladesh adjacent to India is the area from where Parthenium was first reported. There has not been enough survey been made to prepare a reliable map at present. The weed has been found to grow even in our capital city Dhaka.

We received a detailed map of parthenium weed distribution in Mexico (see below). Thanks to Dr Alec McClay who send this map to network.

Figure 11: Distribution of parthenium weed in Mexico.



The status of parthenium weed in Uruguay as a native species was also discussed and it was suggested that there are a number of published literature showing parthenium weed as a native species. It was further suggested to search for more herbaria records from Uruguay.

It was informed that parthenium weed is an invasive weed in Sri Lanka and brought to the country with the goats used for food by the Peace keeping Military Mission of India.

Parthenium weed is present in eastern African countries such as Kenya, Ethiopia, Tanzania, Uganda but its presence in Zambia was not confirmed.

A question was asked about the presence of parthenium weed in Bhutan, Yemen and Jordan. A record of its occurrence in Punakha District of Bhutan and from Yemen (Southwest Asia) and Jordan are present on Global Biodiversity Information Network website (<http://data.gbif.org/occurrences/144882714/>), The source and history of the weed spread in these countries would be very interesting but no comments received in this regard.

Topic II – What is an impact of hammer milling on parthenium weed seeds?

A question was posted regarding the impact of hammer-milling on parthenium weed seed in contaminated grain (e.g. sorghum) on the survival of

the parthenium seed. We haven't heard much about the topic from our network but the question was discussed in weed biology group at Tropical & Sub-Tropical Weed Research Unit at The University of Queensland. It was suggested that there should be some practical studies done to ascertain the impact and status of parthenium seed in grain lots used for feed production.

Upcoming Conferences on Weed Science and Invasive Species

17th Australasian Weeds Conference.

Date: 26-30 September, 2010.
Theme: New Frontiers in New Zealand.
Website: <http://www.17awc.org>.
Venue: Christchurch, New Zealand.

First IOBC International Workshop on Biological control and Management of *Parthenium hysterophorus*.

Date: November 3-5, 2010.
Venue: Nairobi, Kenya.
Contact: Costas Zachariades
E-mail: zachariadesC@arc.agric.za

Third International Conference on Parthenium

Date: Dec 8-10, 2010
Venue: New Delhi India
Contact: Professor R.D. Gautam
E-mail: profgautam@gmail.com

23rd Asian Pacific Weed Science Conference

Date: 25-23rd September 2011
Venue: Sebel Cairns, Australia
Website: www.apwss2011.com

Recent Parthenium Weed Publications

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Parthenium. *Annals of Plant Protection Sciences* 18(1) 184-187.

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Parthenium weed season in Queensland, 2010



Figure 12: Some glimpses of parthenium weed in 2010 at Injune region, Central Queensland, Australia. Dark colour vegetation (above and below) are dried parthenium weed stands in open grass lands.