



INTERNATIONAL PARTHENIUM NEWS

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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.

Parthenium weed in Korea

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Facts:

- Classified as a naturalized plant
- Identified in 1995 by Dr. Byeung Hoa Kang
- Distributed in Masan City, in the south-eastern part of the Korean peninsula (Figure 1).
- No reports so far concerning human allergy and crop production losses.
- It is the first-introduced and reported *Parthenium* spp. in Korea.
- Normally grows to 30 – 90 cm tall.
- Distributed on the roadside spreading out from Masan harbour.
- Dr. Kang first observed Parthenium weed populations in 1993.
- Parthenium weed may have come from Japan in early 1990s as Masan City was free-exprot-zone at that time, so there was frequent imports made from Japan (*Editors addition: However, it must be remembered that parthenium weed is not found in the regions of Japan where such exports were being made from*).

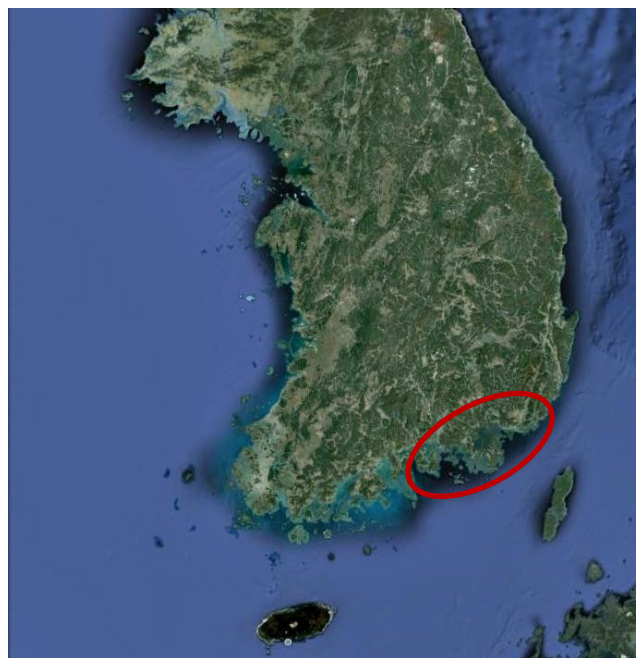


Figure 1 Distribution of parthenium weed in the south-eastern part of Korean peninsula

Parthenium hysterothorus in Japan

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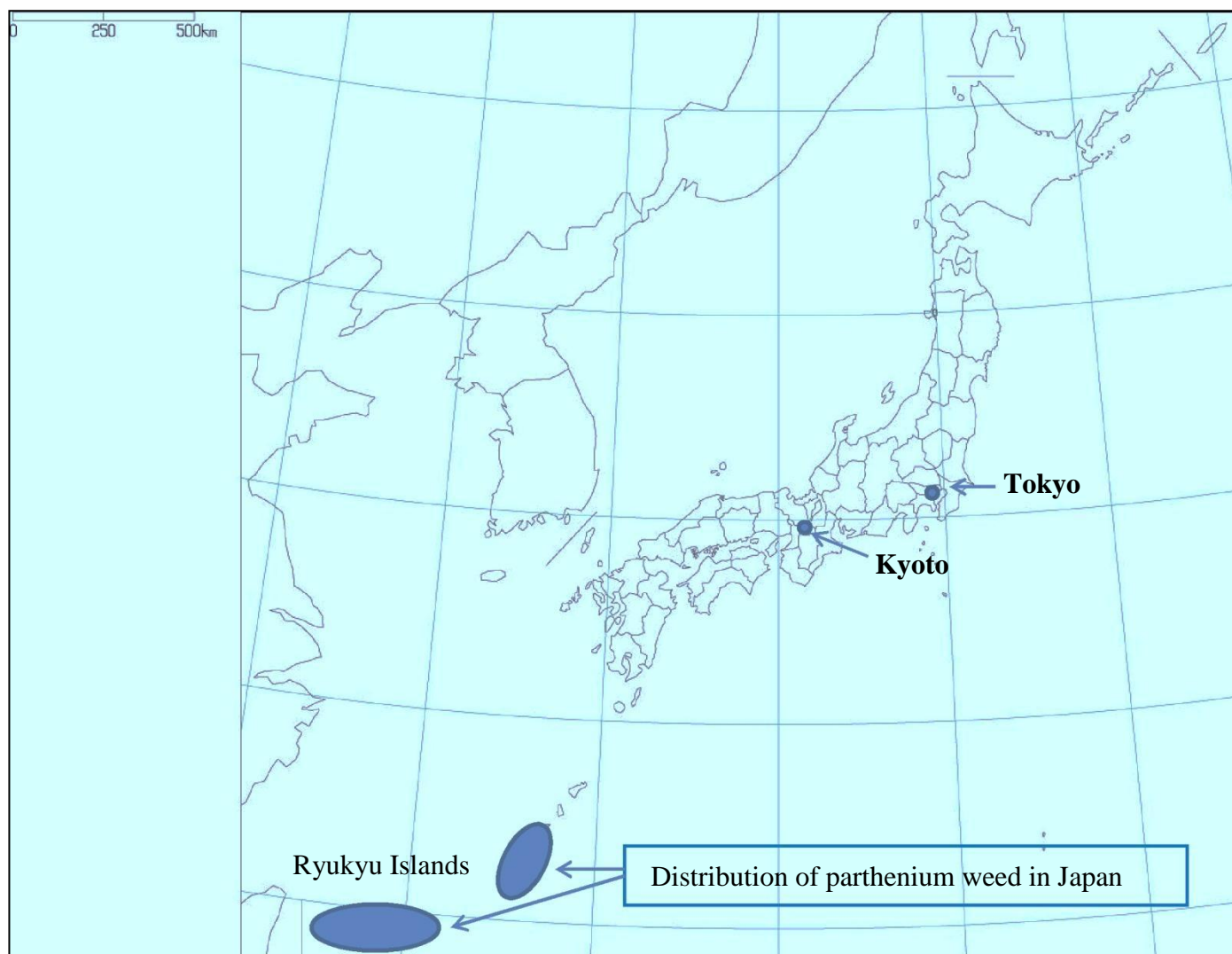
In Japan, the invasion of *Parthenium hysterothorus* is restricted to the Okinawa Islands, located in the most southern parts of Japan, 26 to 27N, 127 30 to 128 30E. The minimum temperature in the Islands is 9°C. It is distributed mainly on road sides and waste lands, but there are no reports on the population size and its rate of spread. It acts as an annual and/or a biennial, flowers in the summer to autumn time (Uemura et al., 2010), and causes pollen allergy. Parthenium weed was firstly found in Okinawa around 1972 (Tachikake and Nakamura, 2007). Recent global warming is likely

to have resulted in range expansion of the weed to other parts of Japan.

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Suppression of parthenium weed by *Tagitus minuta* at Kuni, eastern Ethiopia: implications for the new biological control program

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In Ethiopia, parthenium weed is believed to have been introduced in the 1970's (Berhanu, 1992) and currently

is covering almost all parts of the country causing up to 97 % yield reductions in certain field crops and 100 % reductions in certain forage crops. The weed has become a problem within rangelands, forest regions and cropping lands. It grows in any soil type and in a wide range of habitats and is also known to affect animal and human health. It causes loss of biodiversity and therefore it has been recorded as an invasive alien weed species in Ethiopia (Wakjira et al., 2009). Suggested control measures include hand pulling, mowing and the use of herbicides. Hand pulling and mowing, however, have limited value because of the enormous amount of labour required and the sensitivity

of people to allergens contained within the weed. If herbicides are used, multiple applications are necessary as plant replacement from the seed bank occurs rapidly. In addition, appropriate herbicides are not available in all areas where the weed is a problem (Tamado *et al.*, 2004). Farmers may not be able to invest in management options for parthenium weed especially when the weed is spread over large rangeland areas, within fallow and wasteland, and by the road side. The use of biological control insects, pathogens and other plants, in an integrated parthenium weed management system is one possible solution (Shabbir, 2012; Bekeko *et al.*, 2012; Kahan, 2011; Taye *et al.*, 2004) for future management in Ethiopia.



Figure 1: A Photograph showing the dominance of *Tagitus minuta* over parthenium weed at Kuni (in the plot the photograph indicates from right to left, Zelalem and Emiru Assefa, 2010 while collecting data).

Allelopathy is the phenomenon in which living or dead plant material, including decaying litter, releases chemicals that inhibit (rarely stimulate) the growth of associated plants (Rice 1984). Allelopathic interference also has been well-demonstrated in parthenium weed with allelochemicals being produced in almost all plant parts, including pollen and trichomes, (Kohli and Rani 1994; Evans 1997). A number of water-soluble allelochemicals – phenolic acids and sesquiterpene lactones – have been identified from the weed and are implicated in allelopathy (Kanchan 1975; Picman and Picman 1984). However, few studies about allelopathic interference of parthenium weed pertain to the fresh parts or freshly collected dried materials. Little emphasis has been given to the field residues of the weed that can accumulate in large amounts, especially at the end of the growing season or following its removal from the soil through mechanical means. It was observed that the residues of parthenium weed not only hampered the

germination of the other plants by causing a physical barrier, but also caused allelopathic interference. Field surveys were undertaken from 2008 to 2010 at Kuni, eastern Ethiopia to determine the dominant weed species in the area and to study the interaction of parthenium weed with other plants such as a non-native plant, *Tagitus minuta* (Mexican Merry Gold).



Figure 2: Suppressed parthenium weed at flowering stage (the white tips indicates parthenium weed at flowering)

From the field observations it was found that the population of parthenium weed was suppressed by the presence of *Tagitus minuta* which is also known to have an allelopathic effect upon other plant species. At sites where the population of *Tagitus* increased over time, the population of parthenium weed declined. Contrary to this in plots where the population of *Tagitus* was lower, the population of parthenium weed was found to be higher. From these observations it was suggested that *Tagitus* has a strong suppression effect upon the growth of parthenium weed; thus, it may be used as an option for the further management of parthenium weed at different locations. But more studies have to be under taken to better evaluate the interaction effect of this plant and other useful plants species that are not only suppressive to parthenium weed but also have fodder value.

Parthenium weed growth calendar and patterns in the Western Hararghe Zone, Ethiopia

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Parthenium weed may have been first introduced to Ethiopia in the 1970's during the Ethio-Somali war and has become a serious weed both in arable and grazing lands (Berhanu, 1992; Fasil, 1994; Frew *et al.*, 1996; Tamado, 2002). Studying the growth calendar and patterns of morphological development of this weed has helped in the selection of the types of control measures to use, such as the time for herbicide application and the time for the use of biological control agents. The results indicate the following:

- Maximum germination takes place between April to October (after the harvesting of the maize crop when soil moisture is high).
- The first seed set was observed 45 days after germination
- From January to mid-March no parthenium plants were observed in the field but they were present on the road sides and in protected areas (orchards).

Table 2: Morphological growth of parthenium weed in the Western Hararghe Zone, Eastern Ethiopia 90 days after germination, and in fallow, non-cropped land.

Parameters	Average growth
Plant height	114 cm
No of branches /plant	24 pairs
No of leaves/branches	42
Root depth	38 cm
Girth	2.8 cm
Number of seeds/plant	5,874
Population/m ²	34

Conclusions: In Eastern Ethiopia (Chiro) it was observed that parthenium weed produces seed within 45 days after flowering. Larger population of parthenium weed was observed at the beginning of the wet season and after crop harvest in maize fields. This information help in designing management options of parthenium weed in eastern Ethiopia.

Table 1: Growth Calendar of parthenium weed in Western Hararghe Zone, Eastern Ethiopia 2008 – 2011

Growth Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Germination	*	**						*	*			
Seedling	-	*	*	*	-	-	-	-	-			
Sapling	-	-	*	*				-	-			
Booting			*			*						
Flowering			*	*			*		*	*		
Seed setting					*	*	*	*	*	*		

Parthenium weed awareness campaigns and people's initiative

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In India, *Parthenium hysterophorus* L. is already present in all parts of the country. In the state of Uttarakhand, which is a hill state comprising of 13 districts (see map below), this weed is found in all districts in the plains, as well as most roadsides even at high altitude districts. If the various control measures available, whether chemical, mechanical, biological or integrated, are to be

effective, the public need to understand that their participation will be necessary. Moreover, the extent to which people are familiar with this weed does vary among localities. The use of different local names adds to the confusion. With parthenium weed growing so close to their homes, it was felt that people must be made aware of its ill health and environmental impacts and the management options available to control it. With this purpose in mind, a **Parthenium Weed Awareness Week** was organized during **August 16-22, 2012** by the scientists working in the All India Coordinated Research Program on Weed Control, Pantnagar Centre, in collaboration with the Directorate of Weed Science Research (ICAR), India. The Weed Control group at the Pantnagar Centre coordinated the program with the support from staff, students and residents of the G.B. Pant University. Awareness campaigns were organized throughout the week at various places including schools, colleges and villages and involved students, farmers and local residents. At all these locations, school

children, college students and members of staff actively participated in the awareness programs. Lectures and live demonstrations on parthenium weed and its management were conducted.



Map showing the location of awareness of campaign in India.

Preparations for the week

Mexican beetles (*Zygogramma bicolorata*, the biological control agent) were collected and reared by the Pantnagar Centre for their release in various places during the week. A technical extension bulletin (in Hindi, the local language) describing the ill health and environmental impacts of parthenium weed and its control measures was also prepared by the Centre for distribution to the public. Banners prepared for the purpose were displayed at the various colleges and at various institutional entry gates as well as at various places where awareness campaigns were being held.

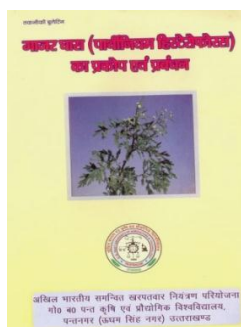
Radio talks

During the week, three radio talks were delivered by Dr. S. K. Guru, SRO and Dr. Rohitashav Singh, Professor, on the Pantnagar Community Radio Service “PantnagarJanvani” (90.8 FM) covering various aspects of the ill health and environmental hazards caused by parthenium weed, its management options and the prospects of utilization.

Using the print media

As the print media reaches almost every locality, this media form was used to disseminate the news on the awareness campaign during the week. This helped to spread the message far and wide throughout the state.

The Technical Extension Bulletin (in Hindi)



Poster competition among students

A poster competition was organized among the National Service Scheme volunteers, the undergraduate students of the Faculty of Agriculture. Students participated in the event and made impressive posters with new slogans. These new ideas will be translated into leaflets/bulletins/posters to spread the campaign further.



Figure 1 Poster competition among students

Awareness campaigns during the week

Posters on parthenium weed were displayed which contained images of the weed, its effect on human and animal health and control, management measures. Tools such as documentaries on parthenium weed, demonstrations of live samples of the plant were used during the campaign to make them aware of this weed. Particular emphasis was given on the biological control of the weed by the Mexican beetle, *Zygogramma bicolorata*. It was interesting for them to see an insect feeding on this highly unpalatable plant. People were also taught how to take precautions while removing the

weed manually or mechanically. The beetles were released in the parthenium weed infested areas near these campaign sites. The bulletin prepared by the centre was distributed among the students and the public.



Figure 2 Articles on parthenium weed in print media on the eve of the awareness week

Impact of the awareness campaign: initiative by villagers

Every year, effort is made to disseminate the message as far as possible. It seems to have been very effective in creating its impact this year. For the first time, , broadcast of talks on parthenium weed over the Community Radio Centre of Pantnagar, “Pantnagar Janvani” attracted the attention of numerous listeners. Consequently, this year, a group of villagers in the Udham Singh Nagar district in the state of Uttarakhand came forward and organized an awareness campaign in their village. On their request, one of us (S.K. Guru) and Dr. Shivendra Kashyap, Programme Coordinator, Pantnagar Janvani participated in the campaign and highlighted the importance of community participation in eradicating such problems.

Acknowledgement: The program was sponsored by the Indian Council of Agricultural Research, India through Directorate of Weed Science Research, Jabalpur. Scientists working in the project at Pantnagar include V. P. Singh, D. Singh, R Singh, T. P. Singh, S. K. Guru, S. Tandon and S P Singh.



Figure 3 Awareness campaign held at University farm and local residential areas



Figure 4 Awareness campaign in the village Majra Anand Singh in Chakkimod. Tribal villagers in rapt attention.



Figure 5 Students in a procession during the awareness campaigns



Figure 6 Dr.V. Pratap Singh, Dr. S. P. Singh, Dr. S. K. Guru and the Principal and staff members of the Govt. Girls Inter College at Pantnagar



Figure 7 Media report of the people's initiative

Distribution and management of parthenium weed in the Peshawar Valley, northwest- Pakistan

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Parthenium hysterophorus L. was probably introduced into Pakistan in the 1980s through India where it has been present since the 1950's. An exploratory survey of four districts of the Peshawar Valley, Khyber Pakhtunkhwa (viz. Swabi, Mardan, Charsadda and Peshawar) was carried out during 2009-2011 to find out the distribution, socio-economic and ill health impacts of parthenium weed. The survey found that the weed was the most frequent and dominant species along road sides, in waste lands, rangelands, crop field margins and crop lands to the extent of 41, 18, 15, 14 and 12 % respectively. Parthenium weed is well established in Swabi, Mardan and Charsadda districts while present in Peshawar district, with little and isolated infestation at the present time. Prominent ways of parthenium weed spread are by water (37 %) and vehicles including agricultural machinery (26 %).

Results showed that all of the farmers were aware of the losses caused by parthenium weed to agricultural productivity. These losses were yield reductions (40 %), extra labour costs for weeding (21 %) and quality reductions 16 %. Of the total respondents, 10 % noted that this weed had infested grazing lands, thus causing forage scarcity. Parthenium weed was not reported to be causing serious health problems, however 6 % of farmers were aware that parthenium weed can cause allergy and dermatitis. According to the respondents, field crops infested by parthenium weed were sorghum (35 %), maize (29 %), vegetables (27 %) and tobacco (6 %). Due to the parthenium weed in sorghum (30 %) yield losses were communicated by (45 %) of the respondents, while in maize crops 20 % yield losses were narrated by (42 %) respondents. Parthenium weed in the Peshawar Valley was mostly controlled through hand weeding (64 %) and tillage (17 %), which are

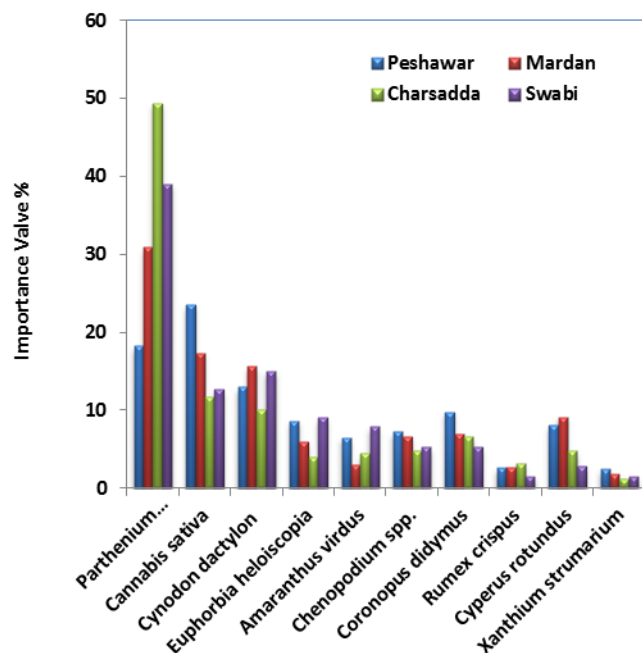


Figure 1. Importance Value % of various weed species in four districts of the Peshawar Valley

labour-intensive practices. Field surveys in the same four districts of the Peshawar Valley, Khyber Pakhtunkhwa (was carried out during May-June, 2009-2010 to study the distribution and invasion of parthenium weed. Data regarding the absolute and relative density, frequency, relative frequency, importance value and importance value constancy index of parthenium weed and other weeds of the area were recorded within 1 m² quadrates. The mean data across the surveyed districts revealed that the flora in the Peshawar Valley is dominated by parthenium weed with highest high relative density of (42.7 %), the highest of all species. This was followed by *Cannabis sativa*, *Cynodon dactylon* and *Cyperus rotundus* with relative densities of 15.2, 13.5 and 6.0, respectively. At different locations, it was observed that parthenium weed was replacing *Cannabis sativa* which is a not so aggressive and problematic weed. While in other areas parthenium weed has already replaced *Cannabis sativa*. *Rumex crispus* and *Xanthium strumarium* possessed the smallest relative frequency at most of the locations studied thereby indicating them as insignificant among the weed flora of the study area. Importance value data revealed that *P. hysterophorus*, *Cannabis sativa*, *Cynodon dactylon* and *Coronopus didymus* having 34.4, 16.3 13.4 and 7.1 % respectively. Looking at the overall distribution of flora in Peshawar Valley, parthenium weed was spreading rapidly alongside the roads, into agricultural crops and onto wastelands.



Figure 2. Parthenium weed infestation in Charsadda District



Figure 3. Parthenium weed infestation in Peshawar District

Field trials were conducted to assess the efficacy of different herbicides against parthenium weed at different growth stages in a non-cropped area. Statistical analysis shows different herbicidal treatments to have different effects upon parthenium weed mortality. At the rosette stage of parthenium weed development, herbicides treatments provided up to 89 % mortality 2 weeks after treatment (WAT) and up to 96 % mortality at 4 WAT. Maximum mortality at the rosette stage of development was recorded for glyphosate and metribuzin treatments (96 and 87 %, respectively?). While 2, 4-D, Logran Extra 750 WG (triasulfuron + terbutryn), Buctril Super 60 EC (bromoxynil + MCPA) and Primextra Gold 720 SC (atrazine + S-metolachlor) gave a not 75 % control at the rosette stage of development. The most effective treatments for parthenium weed control were glyphosate and metribuzin having up to 95 % mortality at 4 WAT. While Logran Extra 750 WG, Buctril Super 60 EC and Primextra Gold 720 SC (atrazine + S - metolachlor) give (50-62 %) control at 4 WAT. Weed mortality with Atrazine, S-metolachlor and 2, 4-D was 37, 41 and 43 % respectively.



Figure 4 Parthenium weed infestation in Swabi District

The findings of this PhD research project revealed parthenium weed to cause significant agricultural and environmental losses, such as those to crop productivity, fodder, biodiversity, animal production as well as causing ill health problems. The weed has the potential to spread all over the Khyber Pakhtunkhwa State very soon. It is a serious menace to social, economic returns and the food security of Pakistan. It is further concluded that the efficiency of herbicides was promising on rosette stage of parthenium plants than bolted stage. The most effective herbicides for parthenium weed control in non-cropped area were glyphosate and metribuzin while in maize crop the efficacy of Primextra Gold 720 SC was promising and hence it is recommended for parthenium weed control and obtaining higher grain yield of maize.



Figure 5 Maize crop, in Mardan district, infested with Parthenium weed

Upcoming Conferences on Weed Science and Invasive Species

18th International Conference on Aquatic Invasive Species

Dates: 21-25th April 2013

Venue: Niagara Falls, Ontario, Canada

<http://www.icaais.org/>

16th European Weed Research Society Symposium

Dates: 24-27th June 2013

Venue: Samsun, Turkey

<http://www.ewrs2013.org/default.aspx>

The 24th Asian-Pacific Weed Science Society Conference

Dates: October 22-25, 2013.

Venue: Bandung, Indonesia

<http://apwss2013.com/>

Recent Publications

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Parthenium weed is becoming a problem in upland rice in India (Photo by curtsey of Dr R K Ghosh)



Parthenium weed growing inside the rice fields near Lahore, Pakistan (Photo by Dr Asad Shabbir)