
Awareness related survey of an invasive alien weed, *Parthenium hysterophorus* L. in Gautam Budh Nagar district, Uttar Pradesh, India

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Parthenium hysterophorus L. is a weed of global significance causing colossal loss in terms of economic, environmental, animal and human health hazards. A survey on awareness of *Parthenium hysterophorus* L. infestation and its eradication was conducted in Dadri and Jewar blocks of Gautam Budh Nagar district of Uttar Pradesh state, India by selecting five villages in each block. One hundred fifty respondents were interviewed in each block and data were collected through questionnaire. During survey it was observed that most of the villagers (75%) of Dadri block had knowledge about the morphological features of *Parthenium* plant whereas in Jewar block only 60% of the rural people were aware about the morphological features of *Parthenium* weed. The present study revealed that 55.33 and 40.67 % of the respondents in Dadri and Jewar block were aware about the adverse effects of *Parthenium hysterophorus* on the productivity of crop plants but only 10% respondents in Dadri block had an idea about the negative effects of *Parthenium hysterophorus* on environmental biodiversity. It was observed that awareness and knowledge level regarding the ill - effects of *Parthenium* weed was more in the respondents of Dadri block in comparison to Jewar block it may be due to higher level of educational status of the rural people of Dadri block. In Jewar block, respondents had no idea about the negative effects of *Parthenium* weed on environmental sustainability. Unfortunately in both of the blocks, rural people did not know about the biological method to control the weed and other methods of utilization of *Parthenium hysterophorus*. Thus, there is an urgent need that media resources should carried out awareness programmes to enhance the knowledge level to the people for eco - friendly management of *Parthenium* weed.

Key words: Awareness, *Parthenium hysterophorus*, respondents and Survey.

Introduction

Weeds are undesirable and non - economic plants that compete with crops for natural resources like water, nutrients and sunlight. *Parthenium hysterophorus* L. or Peterson's Curse, an obnoxious weed has been reported as a main source of nuisance and health hazard to mankind and animals as well as threat to biodiversity and danger to environment (Knox *et al.* 2011).

Parthenium hysterophorus L. popularly known as Santa-Maria feverfew, broom bush, carrot weed, congress weed, star weed and whitetop. *Parthenium hysterophorus* has got a position among the list of top ten worst weeds of the world and has been listed in the global invasive species database (Callaway and Ridenour, 2004) and it has invaded almost all the states of India encroaching about thirty - five million hectares of land. Invasive alien species are such species whose introduction or spread threatens the environment, economy or society including human health (Sharma *et al.* 2005; Worku, 2010). *Parthenium hysterophorus* is native of Northeast Mexico, probably introduced in India along with wheat grains under the PL 480 scheme and spread alarmingly like a wild blaze to almost all the states in India and established as a naturalized weed. *Parthenium* is commonly seen lavishly growing in vacant sites, rock crevices, city waste - dumped areas, roadsides, railway tracks, orchards and construction sites (Singh *et al.* 2004). This plant belongs to the division : Magnoliophyta, class : Magnoliopsida, order : Asterales and family : Asteraceae (Kumar and Kumar, 2010). *Parthenium hysterophorus* L. has been originated as a result of natural hybridization between *Parthenium confertum* and *Parthenium bipinnatifidum* (Nath, 1988). A successful establishment of *Parthenium* in any ecosystem is attributed to several reasons such as high germination ability throughout the year, an enormous seed bank, rapid spread and colonization, plasticity in physiological behaviour and extreme adaptability in a wide range of habitats (Evans, 1997; Thapar and Singh, 2006; APFISN, 2007). *Parthenium hysterophorus* is very prolific seed producer and produces up to 25,000 seeds/ plant leading to large seed bank in the soil (Navie *et al.* 1996). This exotic invasive species with deep penetrating roots and erect shoot establishes itself rapidly in the alien environment and suppresses the growth of other native species with its allelopathic effect due to this reason *Parthenium* can be seen in all the stages of its growth round the year.

The chemical analysis of *Parthenium hysterophorus* has indicated that all the plant parts including trichomes and pollen contain several secondary metabolites such as alkaloids, parthenin, kaempferol, p - coumaric acid and caffeic acid being high in leaves followed by inflorescence, fruit, root and stem (Narwal, 1994). The sesquiterpene lactones namely parthenin and coronopilin present in the trichomes of leaves and stems of *Parthenium* are responsible for causing various allergies like contact dermatitis, hay fever, asthma and bronchitis in human - beings (Wiesner *et al.* 2007). The weed is known for its allelopathic effects on other plants as well as contact dermatitis and respiratory effects on humans and livestock (Lakshmi and Srinivas, 2007). *Parthenium hysterophorus* interferes with the growth of other species by releasing allelochemicals like phenolic acids and sesquiterpene lactones which seize the

growth phenomenon of the co - existent species. Infestation of *Parthenium* weed can be seen in cereals, vegetables and horticultural crops and it is a menace to agricultural productivity due to its potent allelopathic effect (Kanchan, 1975; Patil and Hegde, 1988; Oudhia *et al.* 1997; Mulatu *et al.* 2009). *Parthenium* completes its life - cycle within 3 - 4 months and it shows three to four generations in a year which helps in quick spreading and generation of adverse impacts on the surrounding vegetation (Srivastava *et al.* 1985; Knox *et al.* 2010). The rationale behind the selection of the Dadri and Jewar blocks of Gautam Budh Nagar district, Uttar Pradesh was due to the presence of dense colonies of *Parthenium hysterophorus* in these regions. Unfortunately, till today no functional large scale survey was conducted in the Dadri and Jewar blocks of Gautam Budh Nagar district to study the awareness and knowledge level of the rural people about this hazardous weed. Creating public awareness is important to avert the ill - effects of *Parthenium hysterophorus* on human - beings, livestock and crops and also for the management of this obnoxious weed. In view of this fact, the present investigation was carried out to study the awareness and knowledge level of the rural people of the district in identification of *Parthenium* weed, its adverse effects on the environment and preventive measures taken so far in the area. This study may provide baseline information for the development of future strategies for the eco - friendly and safe management of *Parthenium* weed.

Materials and methods

The systematic and extensive survey was conducted in Gautam Budh Nagar district, Uttar Pradesh, India during July 2010 - March 2011 to assess the occurrence and distribution pattern of *Parthenium hysterophorus* in the district.

Geographical position of the study site

Gautam Budh Nagar (latitude 28° 32' N and longitude 77° 28' E, 200 m above the sea level) is an administrative district of Uttar Pradesh state in northern India. The district is bounded by Ghaziabad district in the north, Bulandshahr district in the east and Aligarh district in the south. Gautam Budh Nagar occupies an area of about 1442 sq km and the total population of the region is approximately 1,674,714 as per the 2011 census. The Gautam Budh Nagar district comprises of three tehsils and four blocks. Two blocks of Gautam Budh Nagar district namely Dadri and Jewar were selected for the present study because of the presence of dense colonies of *Parthenium hysterophorus* in these regions.

Climate conditions of study area

Gautam Budh Nagar experiences three seasons in a year i.e. summer (March - June), rainy (July - September) and winter (October - February). Sporadic winter rains are common in December and January months while dew fall continues up to February. The annual mean temperature is 25 - 31⁰C, the mean maximum temperature is 44.4⁰C recorded in May - June and the mean minimum temperature is 2.2⁰C recorded in January - February.

Selection criteria of respondents

The entire survey study was based on the interview with the local people of the two blocks viz. Dadri and Jewar of Gautam Budh Nagar district of Uttar Pradesh about their knowledge of *Parthenium hysterophorus* plants available in the area and surroundings. Due to large number of villages and huge rural population in the blocks of Gautam Budh Nagar district, this district constitutes a suitable and significant area for the awareness related studies. Five villages were selected from each block and from each identified village thirty respondents comprising of 18 male and 12 female were randomly selected between the age of 32 - 65 years for the study. One hundred fifty rural people were selected as respondents from each block for the study. During the survey, people were identified mainly on the basis of the following criteria : (1). a person who was resident of a block (2). willingness of the local inhabitants for participation in the study.

Interview and group discussion with the local people

A brief group discussion and interview were made with the respondents in their local language prior to data collection to get their consent and to explain them that their cooperation is a valuable contribution to the documentation of their knowledge about the awareness of *Parthenium* weed and development of future strategies for weed control. Respondents were asked to come to the field and other wasteland area and show the presence of *Parthenium* plants. Questionnaire was used during the survey for collection of the information about the habit and habitat of *Parthenium hysterophorus* plant, occurrence in the area and surroundings, morphological features and their adverse impacts on the environment, domestic animals and inhabitants itself (Appendix - 1). To measure the level of the awareness and knowledge of the rural people a 'knowledge index' was prepared by taking different dimensions such as morphological features, life - cycle and adverse impacts of *Parthenium* weed on human - beings and animals (Verma *et al.* 2010). For each of the knowledge

dimension different scores were given for the respondents who had knowledge of *Parthenium hysterophorus* plant. A low level score was assigned when the rural people have no knowledge or very less knowledge, a medium score was assigned when the rural people expressed their awareness and a high level score was assigned when the respondents expressed their complete knowledge about the hazardous weed *Parthenium hysterophorus*. Finally, the questionnaires were collected, observed and summarized in form of percentage as given in the Tables 3 - 8.

Results and discussions

The systematic survey was conducted to assess the awareness and knowledge level of the rural people of Dadri and Jewar block of Gautam Budh Nagar district of Uttar Pradesh, India about the *Parthenium* weed. During the survey of different villages, it was observed that agriculture was the main occupation of the rural people of Gautam Budh Nagar. The information about the *Parthenium hysterophorus* was collected by conducting interview and group discussion with the local people including both male and female participants between the age of 32 - 65 years. The majority of the respondents approximately 18% in Dadri and 27.33% in Jewar block had no formal education and they were illiterate. In Dadri block, 23.33 % had primary school level education up to 5th standard, 22 % had secondary school level education and only 16.67% of the respondents had university level education whereas in Jewar block, 14.67 % had primary school level education up to 5th standard, 11.33 % and 8% had secondary and higher secondary level education and only 5.33 % of the respondents had university level education. It was observed that literacy ratio was more in rural people of Dadri block in comparison to Jewar block (Table 1). Similar findings were also reported by Neelima *et al.* (2010) during their survey related with mass awareness of *Parthenium hysterophorus* in different districts of Andhra Pradesh, India.

Table 1. Educational status of the rural people in different blocks of Gautam Budh Nagar district, Uttar Pradesh, India

S. No.	Educational level of the respondents	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Illiterates	27 (18)	41 (27.33)
2.	Primary level	35 (23.33)	22 (14.67)
3.	Secondary level	33 (22)	17 (11.33)
4.	Higher secondary level	29 (19.33)	12 (8)
5.	Graduation	25 (16.67)	8 (5.33)

Figures in parentheses indicate the percentage over the total.

In Dadri block, most of the respondents (51.33%) had small - land holdings while in Jewar block, maximum number of the rural people (64%) had large land - holdings. Approximately 6%, 9.33% and 57.33% of the respondents in Dadri block informed that *Parthenium* has been invading the area for the last 16 - 20, 11 - 15 and 6 - 10 years, respectively while in Jewar block, 58% of the respondents told that *Parthenium* has been invading the area for the last 1 - 5 years. In both of the blocks, majority of the respondents said that growth of *Parthenium* weed was profusely increased during last 3 - 5 years. Some of the old villagers told that *Parthenium* weed is observed in the district from the last 20 years but its rapid spread was noticed from the last 5 years (Table 3).

Table 2. Land - holdings of the rural people in different blocks of Gautam Budh Nagar district

S. No.	Land holdings of the rural people	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Small	77 (51.33)	26 (17.33)
2.	Medium	38 (25.33)	28 (18.67)
3.	Large	35 (23.33)	96 (64)

Figures in parentheses indicate the percentage of the total.

Table 3. Knowledge of the rural people regarding the invasion period of *Parthenium hysterophorus* L. in Dadri and Jewar blocks

S. No.	Time-period (Years)	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	1 - 5 years	44 (29.33)	87 (58)
2.	6 - 10 years	86 (57.33)	40 (26.67)
3.	11 - 15 years	14 (9.33)	12 (8)
4.	16 - 20 years	9 (6)	7 (4.67)

Figures in parentheses indicate the percentage of the total.

Knowledge of the rural people about the morphological - features of Parthenium hysterophorus L.

Knowledge of the rural people of Dadri and Jewar blocks about the morphological features of *Parthenium hysterophorus* weed was analyzed by seven characteristics of *Parthenium* plant viz. habitat, shape and size of the plant, height of the plant, shape of the leaves, colour of the flower and life - cycle of the plant etc. 70 - 80% of the villagers of Dadri block knew the characteristics of the *Parthenium* plant and they could identify the plant properly by its morphological features but most of the villagers of Jewar block

could not identify the hazardous weed by its morphological features. Only 50 - 65% of the rural people were aware about the characteristic features of *Parthenium* (Table 4).

Table 4. Knowledge of the rural people regarding the morphological - features of *Parthenium hysterophorus* L.

S. No.	Morphological characters	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Habitat	120 (80)	98 (65.33)
2.	Shape and size of plant	115 (76.67)	92 (61.33)
3.	Height of the plant	106 (70.67)	86 (57.33)
4.	Shape of the leaves	98 (65.33)	82 (54.67)
5.	Colour of the flower	92 (61.33)	76 (50.67)
6.	Life cycle of the plant	64 (42.67)	24 (16)

Figures in parentheses indicate the percentage of the total.

Knowledge of the rural people about the dispersion method of Parthenium hysterophorus L.

Parthenium seeds are light, small and black in colour and they can spread with air, water and animals from one place to other. Majority of the respondents of Jewar blocks had no knowledge regarding the dispersion methods of *Parthenium hysterophorus*. Only 64%, 48% and 20% of the respondents of Dadri block reported that *Parthenium* has been introduced in their fields through canal water, wind and animals (Singh *et al.*, 2003). However, most of the respondents 54.67% and 42.67% of Jewar block reported that canal water and wind is responsible for the spread of the *Parthenium* weed in their fields (Table 5). But respondents of both of the blocks accepted that *Parthenium hysterophorus* grows profusely in monsoon season i.e. from June - August and in the soils having high moisture content. Most of the respondents of the Dadri (88.67%) and Jewar (68%) blocks informed that *Parthenium* weed is grazed by cattle but awareness related with the grazing of the weed by sheep was least in the rural people of both of the blocks (Tables 6).

Table 5. Knowledge of the rural people about the dispersion method of *Parthenium hysterophorus* L

S. No.	Mode of dispersion	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Wind	72 (48)	64 (42.67)
2.	Water	96 (64)	82 (54.67)
3.	Animals	30 (20)	19 (12.67)

Figures in parentheses indicate the percentage of the total.

Table 6. Knowledge of the rural people regarding the dispersion methods of *Parthenium hysterophorus* L. in Dadri and Jewar blocks.

S. No.	<i>Parthenium</i> is grazed by the animals	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Cattle	133 (88.67)	102 (68)
2.	Goat	98 (65.33)	75 (50)
3.	Sheep	41 (27.33)	23 (15.33)

Figures in parentheses indicate the percentage of the total.

Awareness of the rural people about the harmful effects of Parthenium hysterophorus L.

Parthenium hysterophorus is hazardous weed and it causes different diseases in human - beings and animals (Worku, 2010). Chemical analysis of *Parthenium hysterophorus* indicate that it contains several allelochemicals such as caffeic acid, coumaric acid, vanillic acid and hydroxyl benzoic acid (Kanchan, 1975) and leaves contain more allelochemicals in comparison to stem and root (Patil and Hegde, 1988). The sesquiterpene lactones viz. parthenin and coronipilin present in the trichomes of leaves and stems of *Parthenium* are responsible for causing various allergies in human - beings and animals (Navie *et al.* 1996; Wiesner *et al.* 2007). The bitter and reduced milk yields have been reported in buffaloes and goats fed on grass mixed with *Parthenium* (Krishnamurthy *et al.* 1977). In the present study, harmful effects of *Parthenium* weed were analyzed under three categories such as allergic diseases in human - beings, harmful effects on the animals and negative impact on the crop production and environmental biodiversity (Table 7). The data reveal that majority of the rural people in Dadri and Jewar blocks had no idea about the negative impact of *Parthenium* on biodiversity and poisonous and toxic nature of the weed for domestic animals and human beings. In Dadri block, 60.67% villagers were aware about the human diseases caused by *Parthenium* weed, only 58% and 61.33% respondents were aware regarding the poisonous effect of the weed on animals or both on human - beings and animals. Only 10% of the respondents said that *Parthenium* creates negative impact on environmental biodiversity. However, very few rural people (30 - 45%) of Jewar block had awareness about the diseases such as asthma, fever and allergy caused in human - beings by *Parthenium* weed but they had no idea about the negative impact of *Parthenium* on environmental sustainability (Neelima *et al.* 2010).

Table 7. Knowledge of the rural people regarding the adverse impacts of *Parthenium hysterophorus* L. on human - beings and animals

S. No.	Adverse impact of <i>Parthenium</i>	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Human diseases	91 (60.67)	63 (42)
2.	Poisonous to animals	87 (58)	59 (39.33)
3.	Harmful for both human and animals	92 (61.33)	48 (32)
4.	Reduces the growth of crop plants	83 (55.33)	61 (40.67)
5.	Negative effect on biodiversity	15 (10)	0 (0)

Figures in parentheses indicate the percentage of the total.

Knowledge of the rural people about the eradication methods of *Parthenium hysterophorus* L.

Ever since *Parthenium* assumed a menacing proportion in different parts of the country, several control methods such as manual, chemical, biological and integrated methods are being recommended in containing the growth of this weed (Mahadevappa, 2009). The data presented in the Table 8 reveal that majority of the rural people were uneducated and 77.33% and 59.33% respondents in Dadri and Jewar blocks adopted the manual method for *Parthenium* control such as hand weeding, burning and burying etc. Some of the educated respondents 48.67% of Dadri block adopted chemical methods to control the obnoxious weed and they used to spray salt and glyphosate in their fields to check the growth of *Parthenium hysterophorus*. All the local people informed that no effort was made to manage *Parthenium hysterophorus* by governmental and non-governmental agencies in their area. It was also observed in Dadri and Jewar blocks of Gautam Budh Nagar district that rural people did not know about the biological methods to control *Parthenium* weed or other methods of utilization of the *Parthenium* weed such as production of biofertilizers and biogas etc (Kishor *et al.* 2010).

Table 8. Knowledge of the rural people regarding the eradication methods of *Parthenium hysterophorus* L.

S. No.	Mode of eradication	Number of respondents in Dadri block	Number of respondents in Jewar block
1.	Mechanical	116 (77.33)	89 (59.33)
2.	Chemical	73 (48.67)	57 (38)
3.	Biological	2 (1.33)	0 (0)

Figures in parentheses indicate the percentage of the total.

The data reveal that majority of the respondents of the district possessed low level of knowledge about the harmful effect, mode of dispersion and eradication methods of *Parthenium* weed followed by medium level while only few respondents possessed complete knowledge of *Parthenium hysterophorus* in both of the blocks of Gautam Budh Nagar district. The level of awareness and knowledge in rural people of Dadri was more in comparison to Jewar block. It may be due to higher level of educational status of the rural people of the Dadri block. Further, training and extension programmes need to be improved among the rural people of the study area to enhance their awareness and knowledge level regarding the safe and eco - friendly management of *Parthenium* weed (Chinnusamy *et al.* 2010). Media resources can play a pivotal role in dissemination of education and awareness among the masses. Governmental and non - governmental organizations can play a significant role for the improvement in the awareness and knowledge level of the villagers about the biological control methods of the weed as well as other eco-friendly techniques for the utilization of the weed. There is an urgent need that media resources should carried out awareness programmes to enhance the knowledge level of the common people about the hazards of *Parthenium* weed and its management as it can help in combating the problem on a large scale.

Epilogue

It can be concluded that there is an urgent need to improve the awareness level of the rural people in Gautam Budh Nagar district of Uttar Pradesh in respect of *Parthenium* weed as most of the people in Dadri and Jewar blocks were unaware about the toxic effect of the hazardous weed and they were not forwarded to solve the problem. Hence, in order to suppress the weed, some functional action plans have to be chalked out and awareness programmes at grass root level that should be introduced in the area to educate the local communities about the adverse impacts of *P. hysterophorus*. Proper information should be provided to the rural people regarding the safe handling of the weed and personal protection by the governmental and non - governmental agencies. However, more efforts for creating awareness and possible preventive measures are needed to control its further invasion in the region and it should be supplemented with good publicity through mass media, video, posters, field visit, seminars and people's participation in uprooting the *Parthenium* weed before flowering and seed setting with all safety measures.

Future Prospects

A well-planned programme should be launched in different blocks of Gautam Budh Nagar district to enlighten the rural people about the ill - effects of the *Parthenium* weed for their health and seek their active participation for its elimination. An Integrated weed management approach should be adopted in place of depending on any single measure. Emphasis should be laid to adopt biological methods to control the weed by replacing the hazardous chemicals.

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