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Assessment of awareness on the alien invasive species *Parthenium hysterophorus* in Vavuniya district of Northern Sri Lanka

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Abstract

An attempt was made to assess the awareness and knowledge level of urban residents on *Parthenium hysterophorus*, an obnoxious invasive alien weed. The questionnaire survey was conducted in urban council limit of Vavuniya district. To measure the level of awareness and knowledge of the respondents, a score was assigned to different knowledge dimensions such as knowledge on invasion, morphological features, life - cycle and mode of dispersion, adverse impacts, control measures and existing government law and regulation of *Parthenium* weed. The correlation between knowledge dimensions and the age, gender and educational status of the people was statistically evaluated using Pearson correlation coefficient analysis. Above 65% of the respondents pose good knowledge on the morphological characters and habitat of *Parthenium* weed. Majority of the respondents were aware about the *Parthenium* dispersion, however, the knowledge of using integrated methods to eradicate *Parthenium* was relatively lower. Manual method of controlling was well known than the other methods. The average scores for knowledge on life cycle and dispersal, adverse effects and control measures of *Parthenium hysterophorus* are relatively low. Knowledge on respective Government laws and regulations and morphological identification are in moderate level while knowledge on invasion is good. According to the results, the knowledge on invasion and identification shows strong positive correlation with age. Knowledge on invasion shows strong positive correlation with the educational status. Other knowledge parameters do not show a significant relationship with age, gender and educational status

Key words: Knowledge score, *Parthenium hysterophorus*, Pearson correlation coefficient

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1. Introduction

Weeds are undesirable and non - economic plants that compete with crops for natural resources like water, nutrients and sunlight. *Parthenium hysterophorus* is 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* has listed as one of the top ten worst weeds of the world and has been listed in the global invasive species database (Callaway *et al*, 2004). It 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) and possess some excellent weed characters as high germination ability, large seed production capacities, high survival rate, extreme adaptability in different habitats, easy dispersal of seeds, high allelopathic impact and can complete life cycles within four weeks.

The *Parthenium* weed, also known as White Top or Congress Weed, has been speculated to have invaded Sri Lanka in 1987 with the Indian Peace Keeping Force (Jayasuriya, 1999). *Parthenium* has been identified as an invasive alien plant in Sri Lanka, after a post-entry risk assessment (Ranwala *et al.*, 2011). In Sri Lanka, *Parthenium* was first identified in Vavuniya District in 1999 and subsequently it has spread throughout the country.

The plant has also been listed in the “Weeds of National Significance (WONS)” by the Sri Lanka Council for Agricultural Research Policy (SLCARP) in its National Weed Strategy for 2009-2014 (Rajapakse *et al.*, 2012) and National Priorities in Plant Protection Research 2011-2013 (Marambe *et al.*, 2011). It revealed the importance of managing this alien invasive plant in this country. *Parthenium* is known to suppress local vegetation by release of growth inhibitors through leaching, exudation of roots, decay of roots, decay of residues, etc. (Sukhada, D.K. and Jayachandra, 1979, 1980(a), 1980(b)). If not controlled, it can affect natural diversity and cause extinction of native flora (Kelaniyangoda and Ekanayake, 2008). As *Parthenium* contains parthenin, a sesquiterpenelactone, poses a significant health risk to humans and toxic to livestock. If it is present as a pure stand, animals will feed on the weed. It causes various allergies like contact dermatitis, hay fever, asthma and bronchitis in human - beings (Wiesner *et al.*, 2007) and it is known for its allelopathic effects on other plants as well as cause some ill effects to livestock (Lakshmi and Srinivas, 2007).

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 behavior and extreme adaptability in a wide range of habitats (Evans, 1997; Thapar and Singh, 2006). *Parthenium* 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). 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 and Tripathi, 1997)

The survey was conducted at the Vavuniya district where the *Parthenium* was first reported in Sri Lanka in 1999. Following the detection in Vavuniya district the Department of Agriculture has been vigilant and launched awareness programmes immediately in 2000 (Kelaniyangoda and Ekanayake, 2010). Currently in the urban council limit areas in Vavuniya district, many places are being observed with the presence of dense colonies of *Parthenium*. At present dense patches of *Parthenium* weeds can be found in road sides, drainage trenches, dumpsites, abandoned buildings, construction sites, residential areas, rangelands and crop fields of Vavuniya district, thus emphasizing the fact that successive dispersal and establishment of the weed closely follows patterns of disturbance. There have been no similar surveys carried out in the recent past at this particular region to gather information on awareness and knowledge of public on this hazardous weed. Public

awareness and participation are key factors that contribute to the success of any noxious weed eradication programme. Therefore, the present investigation was aimed to study the level of awareness and knowledge among urban people of Vavuniya district on identifying Parthenium weeds, its adverse effects on the environment and preventive measures taken so far in the study area. This study may helpful to make some effective strategy at community level to eradicate this hazardous alien species from this district.

1. Materials and methods

The Vavuniya district is situated in the Northern part of Sri Lanka, covers of an area about 196,700.00 ha (1967.00 Sq km) and this is 10% of the Land area of the entire North - East Province and 3% of the Island. The district is categorized under the area's dry zone of Sri Lanka with the mean temperature of 28° C and annual rainfall of 1400mm. The climatological conditions are suitable for cultivation. The district falls into three Agro ecological regions of dry zone. It lies in between geographical coordinates longitudes 80° 28' - 80° 32' and latitudes 80° 43' - 80° 48'. Due to its strategic geographic location, Vavuniya receives rainfall in a bi-modal pattern, that is the rainfall of the district is from early October to late January is the maha season and from late April to late May is the yala season. The soil of the district is highly fertile due to reddish brown earth, low humid clays and alluvial soil. Red-Yellow latro soils are found in the Northern part of the district, and that area is more fertile and has better ground water potential. Nearly 38% of the total land area in the Vavuniya district is used for agriculture making it the predominant economic activity of the district. 30, 900 farm families depend for their livelihood in this district (Anon, 2013).

A Questionnaire survey was conducted in urban council limit of Vavuniya district, Northern Province, Sri Lanka. The urban council area consists of 11 GN divisions and among that 4 GN divisions were selected for this study namely Vavuniya town, Paddanichoor, Vairavapuliyankulam and Pandarikulam. The entire survey study was based on the informal interviews and questionnaires. 200 persons were randomly selected as respondents from the study area, ages ranging in between 25 and 65 and also who were the residents of that particular region. Whenever needed, respondents were requested to visit the field and other wasteland area and show the presence of Parthenium plants. Questionnaire was prepared to collect information on the habit and habitat of Parthenium, occurrence in the area and surroundings, morphological features, dispersal mechanisms, their adverse effects on the environment, domestic animals and inhabitants and the Parthenium control measures.

To measure the level of the awareness and knowledge of the respondents a 'knowledge index' was developed by considering different dimensions such as knowledge on invasion, morphological features, life - cycle and mode of dispersal, adverse effects, control measures and respective Government laws and regulations of Parthenium weed. For each of the knowledge dimension, scores were assigned the respondents who had knowledge of Parthenium hysterophorus plant. A low-level score was given when the people had no knowledge or very less knowledge, a medium score was assigned when the people expressed their awareness or knowledge while a high-level score was assigned when the respondents expressed their complete knowledge about Parthenium hysterophorus. Finally, the questionnaires were collected, observed and summarized in form of percentage values. The correlation between knowledge dimensions and the age, gender and educational status of the people was statistically evaluated using Pearson correlation coefficient analysis. Data were analyzed using the statistical software Minitab 15.0.

2. Results and Discussion

The survey was conducted to assess the awareness and knowledge level of the people from 4 selected GN divisions within the Urban Council limit of Vavuniya District, Sri Lanka about *Parthenium* weeds and the results are presented as follows. The ages of respondents ranged from 21 to 65 years and among them 63 % of them were males and 37% were females. The table 1 shows the educational status of the respondents residing in of the Vavuniya Urban Council limit.

Table 1: Educational status of the respondents

Educational status	Percentage
Illiterate	6
primary	10
secondary	14
Tertiary	65
Graduates	5
Above graduate level	0

The table 1 shows that the respondents of the study area poses good educational background where only 6% of the respondents are illiterate. The employments status of the respondents include 4% of farmers, 28 % of housewives, 10% of government employees and 22% of self-employed. The figure 1 shows the percentage of respondents on their awareness in the identification and habitat of *Parthenium* weeds.

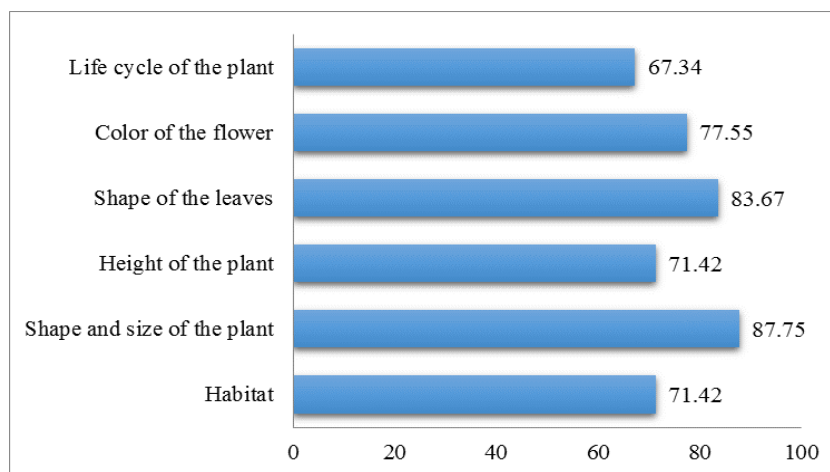


Figure 1: Awareness of respondents of Vavuniya district on *Parthenium* weed identification

The lifecycle of the weed, colour of the flower, shape of leaves, height of the plant and shape and size of the plant and the habitat were asked and recorded from the respondents. In all the categories above 60% of the respondents are having good knowledge to identify *Parthenium* weed by the morphological characteristics and habitat.

The respondents also stated that *Parthenium* has become a major weed of road sides, abandoned lands and with the prevalence of 54% and minimal patches were observed town area. Majority of the people know how to distinguish *Parthenium* from other weeds

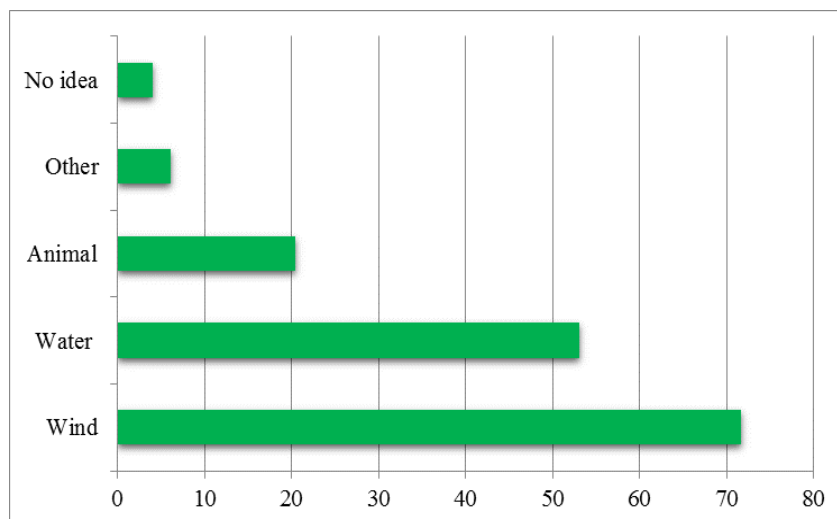


Figure 2: Awareness on *Parthenium* weed dispersal mechanisms

The figure 2 clearly shows that the majority of the respondents were aware about the *Parthenium* dispersion such as wind, water and animals. Only less than 10% of the respondents were unaware about the weed dispersion.

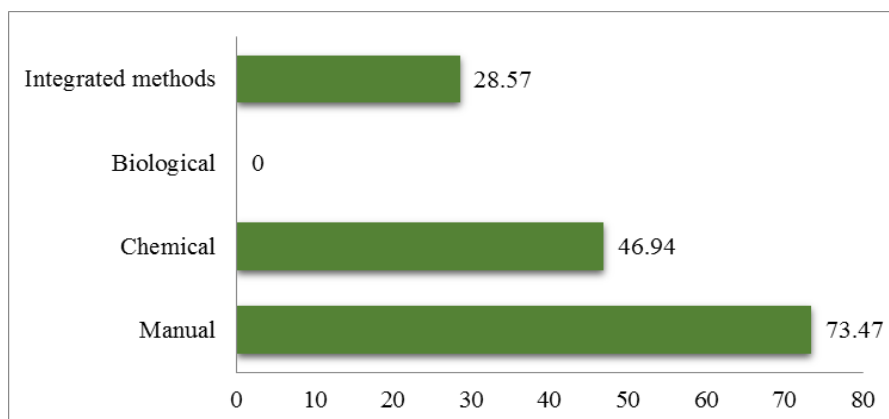


Figure 3 : Awareness on control measures

The manual method of controlling was well known than the other methods. Respondents were completely unaware regarding the biological control method. Figure 3 also reveals that the knowledge of using integrated method to eradicate *Parthenium* was relatively lower. The average scores of the respondents on various knowledge dimensions regarding *Parthenium* is shown in Figure 4.

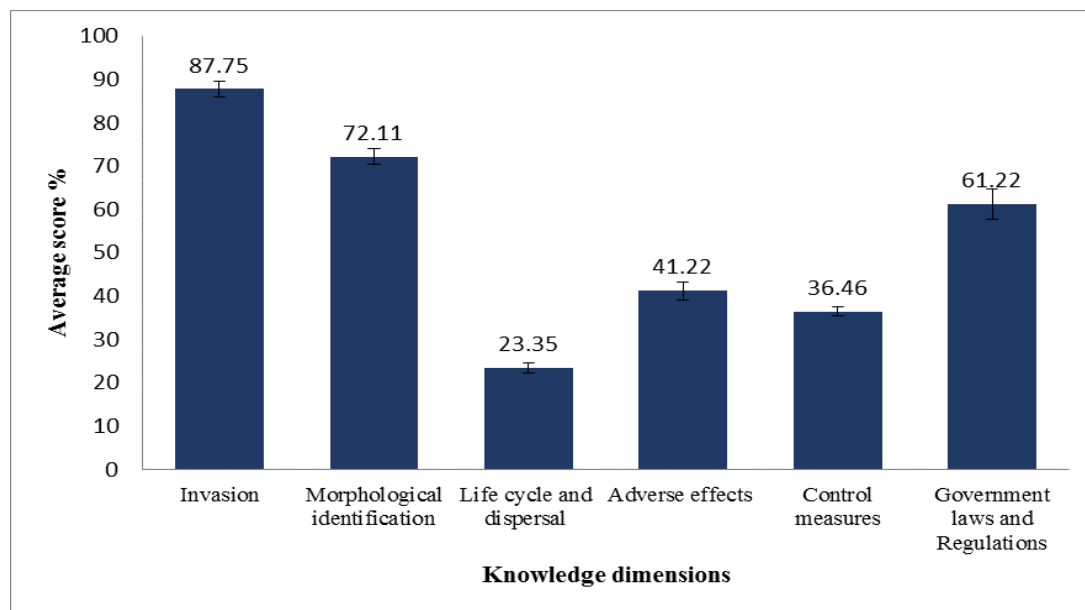


Figure 4: The average scores of respondents against the selected knowledge dimensions

The average scores for knowledge on life cycle and dispersal, adverse effects and control measures of *Parthenium hysterophorus* are relatively low. Knowledge on respective government laws and regulations and morphological identification are in moderate level while knowledge on invasion is good. It clearly shows that the respondents were not adequately aware on this hazardous weed's serious consequences. The correlation between knowledge dimensions and the age, gender and educational status of the people was statistically evaluated using correlation analysis and the Pearson correlation values with their p-values are shown in the table 2.

Table 2: Pearson correlation values of knowledge parameters with age, gender and educational status of respondents

Knowledge Parameter	Age	Gender	Educational status
Invasion	0.692	0.413	1.000
	0.000	0.000	*
Morphological identification	0.648	0.293	0.272
	0.001	0.195	0.000
Life cycle and dispersal	-0.077	-0.151	-0.052
	0.282	0.035	0.467
Adverse effects	-0.021	-0.068	-0.167
	0.766	0.344	0.020
Control measures	-0.149	-0.023	0.294
	0.038	0.750	0.000
Government laws and regulations	-0.032	-0.224	0.316
	0.661	0.002	0.000

The table 2 reveals that the knowledge on invasion and identification shows strong positive correlation with age. Knowledge on invasion shows strong positive correlation with the educational status. Gender weakly correlates with the knowledge parameters such as invasion, morphological identification, life cycle and dispersal. Educational level weakly correlates with morphological identification, Life cycle and dispersal, adverse effects, control measures and government laws and regulations. Other knowledge parameters not show good relationship with age, gender and educational status

2. Conclusion

Throughout the survey, it can be concluded that 65% of the respondents residing at the urban council limit area of Vavuniya district have tertiary educational qualification and having higher level of awareness on the invasion of exotic weed *Parthenium* in Sri Lanka. Aged respondents have more knowledge regarding the *Parthenium* invasion and the morphological identification. Especially awareness on the integrated control measures were low. The study identifies the importance of raising awareness regarding the potential dangerous invasive alien species *Parthenium hysterophorus* among the habitants of Vavuniya UC limit to prevent future invasions. Hence, in order to suppress the weed, some functional action plans have to be initiated 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 public regarding the safe handling of the weed and personal protection by the governmental and non - governmental agencies.

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