

Invasion and Distribution of *Parthenium hysterophorus* Weed in Kyerwa District in Kagera Region, Tanzania

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Abstract: A field survey was conducted at Nyabikulungo, Kagenyi and Rubwera villages in kyerwa district, Tanzania in 2014 to assess the invasion of *Parthenium hysterophorus* L. weed. Quadrates were used to determine number of parthenium weeds in each location. A total of 560 parthenium weeds were recorded from grazing lands, 384 of the weed from road sides and 289 from crop lands of Nyabikulungo, Kagenyi and Rubwera. The mean number of parthenium weed was significantly different between roadside, crop and grazing lands and among surveyed villages. Parthenium weed was found to be spreading very quickly along the roadsides, residential areas, crop and grazing lands. The density of the parthenium weed was detected as 43.3%, 56.7% and 86.7% from grazing lands of Nyabikulungo, Kagenyi and Rubwera villages. Alongside road; 36.7%, 73.3% and 90% were determined from Nyabikulungo, Kagenyi and Rubwera respectively. The percentage frequency of parthenium weeds from crop lands of Nyabikulungo, Kagenyi and Rubwera were 53.3%, 63.3% and 80%. Abundance of parthenium weeds were 9.3, 9.2 and 10.9 from grazing lands of Nyabikulungo, Kagenyi and Rubwera; 5.3, 5.6 and 6.4 from alongside road and 2.3, 3.2 and 8.0 from crop lands at Nyabikulungo, Kagenyi and Rubwera. The present study clearly indicates rapid invasion and spread of parthenium weed has species in three villages of Kyerwa district. There is a need to develop appropriate measures to contain the further spread of this aggressive weed in other areas of the country.

Keywords: Aggressive weed, *Parthenium hysterophorus*, Biodiversity, Invasive weed, Tanzania

1. Introduction

Parthenium hysterophorus is an aggressive and noxious weed native to tropical central and South America. It has now distributed in several tropical and subtropical parts of the world [1]. It is one of the most troublesome weed among the list of recorded invasive species [2]. Parthenium weed has a short life cycle, grow very quickly and survive or grow under different habitats. The weed produce enormous number of seeds which are very small in size and also light in weight and can survive as seed bank in soil for years [1]. These characteristics help parthenium weed dispersal up-to long distances and result in their rapid spread in the invaded areas.

Invasion by *parthenium hysterophorus* into the environments poses a major threat to native plant communities, cause health problems to humans and animals and affect agricultural production. [3]. A number of studies have reported on the impact of parthenium weed on crops, native plant species, and humans and animals [4-7]. For the biodiversity, the weed causes major changes in the structure and composition of the native vegetation on a large extent and as a result create pressure on the food chain and web of the ecosystem [1, 4]. It also cause depletion of biodiversity in the invaded areas by inhibiting germination and growth of other plant species [3]. In crop lands, *P. hysterophorus* weed competes with crops for sunlight, moisture, nutrients and spaces. In addition, it produces allelochemicals that inhibit germination, growth of adjacent crops and cause yield losses by 30% in sorghum and 20% in maize crop. [3, 8-10]. Thus, invasion of *P. hysterophorus* weed in a crop lands may contribute to social and economic instability, causing poverty and food insecurity. Several studies reported on the effects of

parthenium weed in humans and animals [3, 5, 6]. These studies showed that toxin produced by parthenium weed cause allergenic rhinitis, asthma, bronchitis, dermatitis, and hay fever to humans while contact with parthenium leaves and inhalation of pollen grains. In animals such as goat, sheep and cow, the toxin reduce quality of meat, cause tainting in milk and reduce yields of milk [3].

A number of studies reported on the invasion and distribution of parthenium weed in the environment [2, 6, 9]. These studies showed that *Parthenium hysterophorus* invaded crop lands, grazing lands, residential areas, open spaces and road sides in tropical America, Africa and Asia [11]. In Tanzania, parthenium weed was first recorded in 2010 in Arusha region [12]. In July 2014, parthenium weed was observed and identified in Kyerwa district Tanzania. It is believed that, the seeds of this weed came together with grains aid from America to the Rwandese refugees' camps at Kagenyi village and Rubwera sub village in 1994. Despite the presence of parthenium weed in Kyerwa district in Tanzania, there is insufficient information about its distribution, density, frequency and abundance. Thus, the present study was carried out to address two objectives:

- 1) to assess areas invaded by parthenium weed in Kyerwa district
- 2) to measure density, frequency and abundance of parthenium weed in invaded areas.

2. Materials and Methods

2.1 Study sites

A Field survey was conducted at Nyabikulungo, Kagenyi, and Rubwera villages in Kyerwa district of Kagera region

during July to August 2014 (Table 1). The sites of the study were selected based on the presence of parthenium weed following pre-survey study carried out in early July 2014.

Table 1: Geographical location of the study areas

Study Sites	Latitude	Longitude	Altitude
Nyabikulungo	-3°25' 45"N	37° 4' 28" E	894m
Kagenyi	3° 22' 0" S	36°40' 59" E	1387m
Rubwera	-3° 21' 57" N	36°40' 28" E	1400m

2.2 Sampling description

In each site one field site was randomly selected for data collection. Distribution of the *Parthenium hysterophorus* weed was determined as presence or absence of the weed in the crop lands, grazing lands, along roadsides and near residential areas. Quadrates were used to determine number of parthenium weeds in each of the selected field; and 30 quadrates were randomly located at approximately 3 m intervals throughout the 75 m length of the field. Number of parthenium weeds was counted within 30 randomly placed quadrates (1 m x 1 m) across the 30 m x 75 m of the fields. Density frequency and abundance, of parthenium weeds were determined in a total of 30 (1 m x 1 m) quadrates. Density, frequency and abundance of parthenium weeds were determined by the formula described by El-Azazi et al. [13].

$$\text{Density} = \frac{\text{Total number of parthenium weeds in all quadrates}}{\text{Total number of quadrates used}}$$

$$\% \text{ Frequency} = \frac{\text{Total number of quadrates in which parthenium weed occurred}}{\text{Total number of quadrates studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of parthenium weeds in all quadrates}}{\text{Total number of quadrates in which parthenium weed occurred}}$$

2.3 Data Analysis

Data on the mean number of parthenium weeds among the study sites per quadrate were subjected to t-test at 5% level. Mean differences were tested by Analysis of variance single factor using Genstat 15th edition software program[14].

3. Results and Discussion

3.1 Distribution of Parthenium weeds

Parthenium weed was found growing in crop lands, grazing lands, residential areas and alongside the road at Nyabikulungo, Kagenyi and Rubwera in Kyerwa district, Tanzania (Fig. 1(a-d)). Results of the present study show that 119, 157 and 284 of parthenium weeds invaded grazing land of Nyabikulungo, Kagenyi and Rubwera. In crop lands, 36, 61 and 192 of parthenium weeds were recorded from Nyabikulungo, Kagenyi and Rubwera villages respectively. On the other hand, 58, 123, and 173 of the weed were recorded along the road sides at Nyabikulungo, Kagenyi and Rubwera villages. The mean number of parthenium weeds were significantly between grazing lands, crop lands and

along the road in three locations ($p < 0.05$) (Fig. 2). The findings of this study indicates that parthenium weeds invaded crop lands, grazing lands, residential areas and along the roadsides.



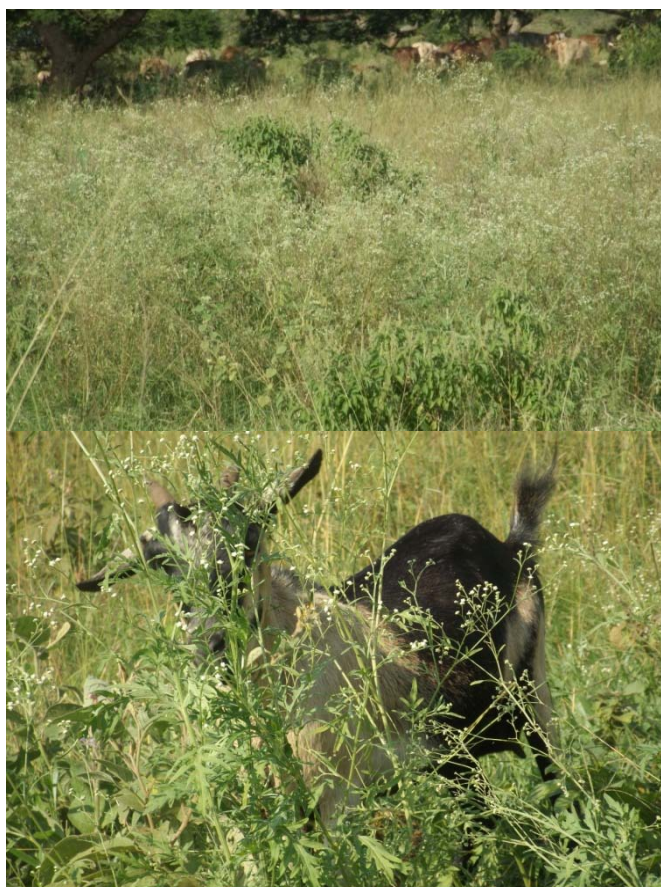
(a) Pineapple, banana and Maize fields infestation



(b) Residential area infestation



(c) Alongside the road infestation



(d) Grazing land infestation

Figure 1: (a-d): Areas infested with *Parthenium hysterophorus* weed at Nyabikulungo, Kagenyi and Rubwera in Kyerwa district, Tanzania.

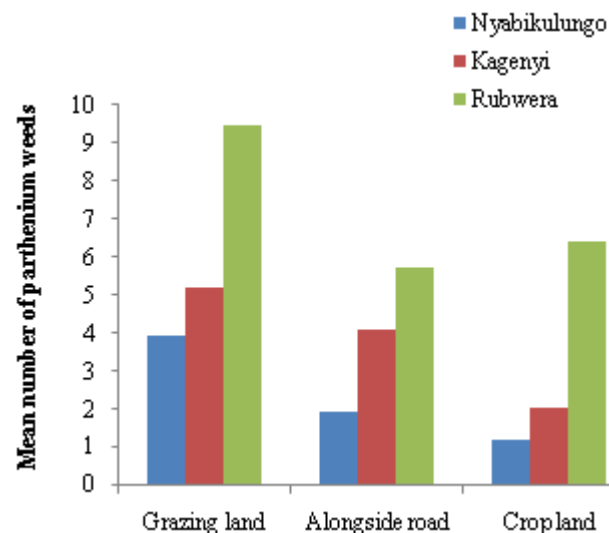


Figure 2: Comparison of the mean number of *Parthenium hysterophorus* weeds at three locations: Nyabikulungo, Kagenyi and Rubwera villages in Kyerwa district, Tanzania.

Invasion and distribution of *Parthenium* weed in Kyerwa district might be due to ecological and morphological characteristics of the weed that enable it to adapt a wide climatic and soil conditions, photo insensitivity, and drought tolerance [2]. The weed has short life cycle of 3-4 weeks that might contribute to the rapid spread in different areas in three villages of Kyerwa district [15]. Furthermore, *parthenium* weed produces large number of seeds (15,000 to 25,000 per plant) which are small in size and light in weight. With these characteristics the seeds can spread over long distances through moving water, winds and animal and human dispersal [16]. Results of this study correspond to the findings of the previous studies [2, 9, 10, 12, 17] who found that *parthenium hysterophorus* weed invaded and spreads on road sides, residential, crop and grazing lands in Tanzania and Ethiopia.

3.2 Density, frequency and Abundance of *Parthenium* weed

Data from the field survey shows that the highest *parthenium* weed densities were recorded in grazing land, crop land and alongside road at Rubwera sub village followed by Kagenyi and Nyabikulungo (Table 2, 3 and 4). The percentage frequency of occurrence of *parthenium* weed alongside road, grazing and crop lands was high at Rubwera compared to Kagenyi and Nyabikulungo (Table 2, 3 and 4). Of the three study sites, Rubwera village had highest abundance of *Parthenium hysterophorus* weeds, followed by Kagenyi and Nyabikulungo (Table 2, 3 and 4). The highest population and wide spread of *Parthenium* weed at Rubwera and Kagenyi might be attributed to soil disturbance due to construction of road, agricultural practice and lack of natural enemies of *parthenium* weed. [2, 6].

Table 2 Density, frequency and abundance of *parthenium* weeds in Grazing lands

Study sites	Density (Plants/m ²)	Frequency (%)	Abundance
Nyabikulungo	3.9	43.3	9.2
Kagenyi	5.2	56.7	9.2
Rubwera	9.5	86.7	10.9

Table 3 Density, frequency and abundance of parthenium weeds alongside road

Study sites	Density (Plants/m ²)	Frequency (%)	Abundance
Nyabikulungo	1.9	36.7	5.3
Kagenyi	4.1	73.3	5.6
Rubwera	5.8	90.0	6.4

Table 4 Density, frequency and abundance of parthenium weeds in crop land

Study sites	Density (Plants/m ²)	Frequency (%)	Abundance
Nyabikulungo	1.2	53.3	2.3
Kagenyi	2.0	63.3	3.2
Rubwera	6.4	80.0	8.0

In three surveyed villages, parthenium weed was observed along the road side, crop and grazing lands. The presence of this weed alongside road might have helped the dispersal and spread of parthenium hysterophorus weed in crop and grazing lands in Kyerwa district. Also the quick spread of parthenium weed in non-infested areas of Kyerwa district could be attributed to dispersal of seeds by winds, water movement, animal and human activities such as using the weed as groom for cleaning the environment at residential areas. The findings of present study added information of the 2010 report and 2014 about the invasion and distribution of Parthenium weed in Arusha, Tanzania [12, 17]. Furthermore, results this study provide information to community, scientists, ecologists and other stakeholders on the extent of the widespread of the invasive weed *parthenium hysterophorus* along road side, residential areas, crop and grazing lands of the country.

4. Conclusion and Recommendations

The results of the present study provide a baseline information and quantitative comparison of the invasion and spread of parthenium weed alongside roads, croplands, residential areas and grazing lands of Nyabikulungo, Kagenyi and Rubwera villages in Kyerwa district. There is a need to develop appropriate measures to contain the further spread of this aggressive weed in non-infested areas of other villages and districts of the country.

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Author Profile



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