



World Scientific News

An International Scientific Journal

WSN 130 (2019) 127-136

EISSN 2392-2192

***Parthenium hystrophorus* in Ethiopia: Distribution, Impact and Management - A Review**

Wasihun Yaregal Wubneh

Ethiopian Institute of Agricultural Research, Pawe Agricultural Research Center,
P.O. Box: 25, Pawe, Ethiopia

E-mail address: wasiefikir@gmail.com

ABSTRACT

Parthenium, an aggressive invasive weed, is believed to be a native to North and South America. Due to its allelopathic effect and adaptability to different environmental conditions, it is now distributed throughout the world including Ethiopia, where it was reported first in 1988, in the eastern and later in the north-eastern parts of the country. Some scholars believe that *Parthenium* came to Ethiopia together with the donated grain when the country was hit by famine. Others opine that it entered into the country during the Ethio - Somalia war in 1976/77 through military vehicles from Somalia. Still others also presume it has slipped into Ethiopia from the neighboring countries like Kenya. The weed aggressively invaded several rangelands in the country due to its allelopathic effect, capacity to produce copious amount of seeds and its ability to compete for resources to survive. It can affect the biodiversity, agriculture, human and animal health and the economic activities of society. Although several mitigation methods, mechanical, cultural, chemical, biological and utilization methods are used to control it, there is no single effective method, as each method suffers from limitations. This noxious weed can be managed by public awareness and participatory integrated approaches. There is a need to encourage the research on utilization of this weed for insecticidal properties and try to evaluate the potential on pests of different crops. Therefore, managing this troublesome weed through integrated and eco-friendly approaches is suggested for an effective management.

Keywords: *Parthenium hystrophorus*, Ethiopia, distribution, impact, management

1. INTRODUCTION

Invasive alien species are those introduced to a region outside their natural range of distribution by an intentional or unintentional human activity (Masum *et al.*, 2013). Invasive species could be plants, animals or microorganisms that are not native to the given specific ecosystem.

In areas where they spread, invasive species can destroy the natural pasture, displace the native trees, and reduce the grazing potential of rangelands (Shashie, 2007), since they compete for the nutrients and hence reduce the productivity of croplands. *Parthenium hysterophorus* (henceforth referred to as *Parthenium*) is among the major invasive species worldwide including Ethiopia (Taye *et al.*, 2004). *Parthenium*, an aggressive invasive weed, is believed to be a native to Southern and Northern America (Wondi *et al.*, 2006).

It has spread through trade as a contaminant of grain and other crop products and via farm machineries (Tamado and Milberg, 2000).

Currently, it is widely distributed and has become a problem in countries such as Australia, India, China, Kenya, West Indies and Ethiopia. It was first reported from Ethiopia in 1988 at Dire dawa and Harerge of the eastern Ethiopia and subsequently near Desse, the north-eastern Ethiopia. Both these are the major food-aid distribution centers and there is a strong evidence that *Parthenium* seeds were imported from the subtropical North America as a contaminant of food aid during the 1980s famine and got distributed with the grain (Tamado and Milberg, 2000).

Since its introduction, it has been spreading persistently in the agricultural lands, forests, poorly managed arable crop lands and rangelands, almost throughout Ethiopia (Ayana *et al.*, 2011). It is also a health hazard to human and livestock (Masum *et al.*, 2013).

It has caused adverse effects on food security and biodiversity in the eastern and southern Africa. Sorghum grain yield losses of 40-97% were also reported in Ethiopia in areas left unmanaged throughout the season. It does not directly compete with crops; rather it releases allelopathic chemicals to the soil that affect various crops and other plants (Zelalem *et al.*, 2012).

Parthenium is already posing a threat to crop production in Ethiopia (Shashie, 2007) and its rapid spread would further aggravate the risk to the expansion and sustainable production of many crops. Therefore, managing this aggressive invasive weed in Ethiopia is crucial to boost the agricultural productivity and prevent the ecosystem from being destroyed. This review aims to assess the current status of the weed in Ethiopia and discuss the appropriate methods for its control.

2. BIOLOGY AND DISPERSAL OF *PARTHENIUM*

Parthenium is an annual much-branched herb of about 0.3 to 1.5 m height, native to tropical and subtropical America. *Parthenium* weed (*Parthenium hysterophorus* L.) is a notorious environment pollutant weed under the family Asteraceae.

This weed can complete their life cycle within 4 to 6 weeks and can produce a huge number of seeds per plant. (Joshi, 1991). Seeds are very light in weight and easily scattered to other areas. It has a huge soil seed bank. It can spread from one place to another just like a wild fire through wind, vehicles or crop seeds.



Figure 1. Matured of *Parthenium hysterophorus* plant.

The reasons for *Parthenium* heavy invasion in new areas included the absence of natural enemy viz., insects and diseases that control it in natural habitats and fast disturbances in the existing environment due to population pressure and development that provides conditions suitable for invasion. It grows faster than native plants and aggressively competes for available nutrients, water, space and sunlight. It releases growth inhibitors like lactones and phenols into the soil through exudation from roots and decay of residues.

These growth inhibitors suppress the growth and yield of native plants. Therefore, it reduces natural diversity by smothering native plants and may exhibit natural heterogeneity to homogeneity. *Parthenium* weed is extremely prolific, has a wide range of ecological adaptation, ability to spread quickly and grow in diverse habitats (Annapurna and Singh, 2003). It can invade new areas rapidly by means of relatively high numbers of seeds, dispersal by vehicles and rails, water, animals, farm machinery and rapid growth.

Construction sites are more vulnerable to the infestation of this weed not only through vehicles/ heavy machinery as means of dispersal but also the construction materials such as gravel, sand and soil. *Parthenium* on average produces 810 flower heads and 15,000 seeds per plant are produced. *Parthenium* roots of decayed plant release soluble sesquiterpene lactones, mainly parthenin (Pandey *et al.*, 1993). These chemicals inhibit the germination and growth of other plants including pasture grasses, cereals, vegetables, and other plant species (Evans, 1997).

3. STATUS AND DISTRIBUTION OF *PARTHENIUM* IN ETHIOPIA

In Ethiopia, *Parthenium* has become a notorious weed since its discovery in the 1980's. It has been spreading from the eastern route of Ethiopia along the Dire Dawa, Addis Ababa railway presumably between 1974 and 1980. Some believe that the weed might have been transported into the country with imported or donated grain. Others hold the belief that the weed entered the country the Ethio-Somali war in 1976/77 through military vehicles (Tamado and Milberg, 2000).

The presence of *Parthenium* in Kenya and Somalia (Njoroge, 1986) and the capacity of the seed to travel long distance through wind, water, and other means also suggested the possible entry into Ethiopia from these neighboring countries.

In the Amhara region, it is estimated that about 37,105 hectares of land is infested with *Parthenium*. It is abundantly found in Gojjam, in south and north Gonder with the potential to spread to agricultural districts of Metama and Setit Humera (Fessehaie, 2004). Furthermore, the weed is well established in many districts of South, north, and central Tigray. In Alamata district alone, about 10,000 hectares of the land has been infested with *Parthenium*.

In much of the low lands of Wello, *Parthenium* has become the most dominant weed. In these areas, the weed has been reported in 42 districts. Even though there is no actual survey report on the total area of land infested in the region, the weed is also a serious problem in Oromia region. Currently, it is spreading at an alarming rate in East Shewa, Arsi, Ziway and Bale (Muhammad *et al.*, 2014). It is thus the most abundant and troublesome weed species in small scale farms in the eastern Ethiopia (Tamado and Milberg, 2000).

The significance of the Awash National Park as a tourism spot is also being lost due to *Parthenium* (Ayana *et al.*, 2011). The same document also reveals that it has caused a decline in stand density of herbaceous species by an average of 69% within a few years since its introduction into the Park. The weed is also spreading in a series of small to large jumps to Jimma, Awassa and Gambella (Rezene *et al.*, 2005).

According to (Tamado and Milberg, 2000) *Parthenium* was ranked as the most abundant and troublesome weed species in small- scale farms in the eastern Ethiopia. Generally, the distribution of *Parthenium* in Ethiopia is concentrated to the rift valley between Arba minch and Dire dawa, stretching up along the road from Addis Ababa to the Eritrean boarder.

4. IMPACTS AND MANAGEMENT OPTIONS OF *PARTHENIUM*

4. 1. Impacts

4 .1. 1. Impacts on Human health

Parthenium causes health hazard to humans and animals (Chippendale and Panneta, 1994). In human, the pollen grains, air borne pieces of dried plant materials and roots of *Parthenium* can cause allergy-type responses like hay fever, photodermatitis, asthma, skin rashes, peeling skin, puffy eyes, excessive water loss, swelling and itching of mouth and nose, constant cough, running nose and eczema (Singh and Beck, 2006; Navie *et al.*, 2004; Ashebir *et al.*, 2012; Rao *et al.*, 1977). In Ethiopia, people undertaking hand weeding in *Parthenium* infested field suffer from skin diseases (Taye *et al.*, 2002) and *Parthenium* related allergies can also bring on fever induced by malarial infection.

4. 1. 2. Impacts on Agriculture and Biodiversity

Parthenium reduces yields of agricultural crops and forests, decrease water availability, cause costly land degradation, block transport routes and contribute to the spread of disease. It generates allelopathic effects in the soils, and outcompetes crops for available nutrients and moisture. It has allelopathic effects on plants due to *Parthenium*. This exhibits inhibitory effects on number of plants including pasture grasses cereals, vegetables, weeds and trees. Its pollen is known to inhibit fruit set in many crops.

Parthenium infestation has been reported to cause detrimental effect on sorghum yield other crops. In eastern Ethiopia with heavy infestation of the weed, sorghum grain yield reductions ranged from 40 to 97% (Tamado *et al.*, 2002b) and in 18.5-86.4% in common bean (Mitiku, 2011). In India, yield decline of up to 40% in crop production has been reported (Khosla and Sobti, 1981).

Parthenium weed is an environmental weed which can cause a total habitat change in native grasslands and forestlands. In India, the forest biodiversity is being reduced and the structure of many native plant communities is being altered (Pandey *et al.*, 1993; Kumar and Rohatgi, 1999). It is an aggressive pioneer that generally colonises disturbed areas before encroaching on native vegetation. Its invasion has changed the natural diversity and balance of ecological communities.

These changes threaten the survival of many plants and indirectly animals because the competition with native plants for space, nutrients and sunlight. In Ethiopia, native plant communities have been invaded, or are vulnerable to invasion by this exotic weed that could result in changes to the structure, species composition, abundance of native communities in grazing lands. In Australia, it has become dominant species and inhibits all beneficial forage plants.

In a study conducted in rangelands of Mieso district, Ethiopia, *Parthenium* had 21.3% cover abundance value and 0.32 diversity index among broadleaved herbaceous weeds. The major problem facing the pastoral production in Ethiopia is the wide scale degradation of native pasture undesirable shrubs like *Acacia* spp., *Prosopis juliflora* and herbaceous weeds like *Xanthium* and *Parthenium*. In Mieso and Talalak districts (Afar) rangelands, the highest relative density, relative frequency importance value and cover abundance were found for *Parthenium* among the herbaceous species.

It is producing a large amount of undesirable biomass thus grazing and pasturelands are continuing to be degraded due to the pressure put forth by the weed (Kohli *et al.*, 2004).

4. 1. 3. Impacts on Animal health

All parts of the *Parthenium* plant at any stage of growth are toxic to humans and animals. The weed is toxic to domestic animals. Goats and sheep have been found frequently browsing the plant. However, leaves of *Parthenium*, if eaten can result in tainted sheep and goat meat and make diary milk unpalatable due to its irritating odour (Tudor *et al.*, 1982). It can also reduce milk yield. In animals, the plant can cause hair loss, eye irritation, skin lesions, anorexia, pruritus, alopecia, dermatitis and diarrhea, mouth ulcers with excessive salivation if eaten, and sometimes death due to rupturing and haemorrhaging of internal tissues and organs (Narsimhan *et al.*, 1977; Narsimhan *et al.*, 1980).

4. 2. Management of *Parthenium*

Control of *Parthenium* is therefore, crucial not only to boost the productivity of crops but also to sustain livestock production and economic development in the country. Various approaches have been used worldwide to manage *Parthenium*, but most of them have limited scope.

4. 2. 1. Utilization

One of the possible options is to manage *Parthenium* through utilization. Allelochemicals or plant derived chemicals offer a great promise for acting as effective pesticides as they are comparatively safer for the environment (Masum *et al.*, 2013). Over the past two decades, much work has been done on plant-derived compounds as they are environmentally safe alternatives to herbicides for weed control (Duke *et al.*, 2002). Several researchers have documented the importance of *Parthenium* as a potential source of herbicide (Tefera, 2002; Stephen and Sowerby, 1996).

It can be utilized for the production of biogas, compost especially vermicompost and as a green manure. Plants up to pre-bloom stage should only be used otherwise while handling such materials, dispersal may take place. It has also nematicidal properties for the control of root- knot nematodes. Fruit and receptacles contain water soluble plant growth inhibitors which are detrimental to certain weeds in aquatic system (Pandey *et al.*, 1993). It has medicinal properties too. Use of *Parthenium* for such purpose will reduce the further buildup of soil seed bank.

4. 2. 2. Prevention

Preventing the spread of *Parthenium* is the most cost-effective management strategy. It is one of the most important means to check the spread of *Parthenium* to another area. Strict quarantine laws not to transport infested seed and nursery stock from infested to non-infested area should be enacted. Nobody should be allowed to have *Parthenium* plants in the vicinity of his home or crop fields/ orchards. There is a high risk of spreading *Parthenium* by the movement of vehicles, livestock and crop produce. Also, cattle feed and crop seeds purchased from infested areas should be checked thoroughly for contamination by *Parthenium* plants.

4. 2. 3. Manual, physical and cultural methods

Manual method is labor intensive and uneconomical (Anita *et al.*, 2014), because *Parthenium* produces seeds throughout the year (Rao, 1956) and requires repeated removal

(Zelalem *et al.*, 2012). It may be effective only in agro-ecosystems with space weed cover (Anita *et al.*, 2014). However, it is not economical for infested pastures and wastelands of wider areas (Shashie, 2007). Moreover, direct contact with the weed could cause dermatitis to susceptible individuals.

Physical management involves intercultural operations coupled with hand weeding, a time consuming and unpleasant job, made worse by the health hazards involved with handling *Parthenium* weed. Burning, another strategy employed to manage weed, is not a useful control strategy for *Parthenium*. Burning destroys all other economically important plants growing in its vicinity. Manual uprooting of *Parthenium* before flowering is the most effective method. Uprooting the weed after seed setting will increase the area of infestation. Several cultural practices like thorough land preparation, use of crops and varieties which have smothering effect, maintaining optimum plant population, crop rotation, mulching, soil solarisation, stale seed bed technique and proper fertilizer and water management are important in controlling this weed (Ray and Gour, 2012; Javaid, 2007).

4. 2. 4. Biological control

Biological control is an effective and environmentally sound method of mitigating the pests and their effects through the use of natural enemies. This method does not involve in the complete eradication of the unwanted organism. But it maintains its population lower than its average that would occur in the absence of bio control agents. In the last three to four decades a great interest has been given to manage *Parthenium* by many bio-control ages (Ray and Gour, 2012; Watson and Wymore, 1990). Many biocontrol agents like insects, fungi, nematodes, slugs, botanicals and microorganisms are used for controlling *Parthenium* (Sushilkumar, 2009). Of the various biocontrol agents, control of weeds by using plant pathogens has gained acceptance as a safe, practical and environmentally beneficial method (Aneja, 2009).

4. 2. 5. Chemical method

Using herbicides to control *Parthenium* weed is not environmentally sound and economical feasible for small holder farmers and pastoralists in Ethiopia. However, under special situations spraying pasture with herbicides can be a useful way of eliminating the weed. However, *Parthenium* should be sprayed early before it has set seed. Again, small and isolated infestation should be treated immediately. Usually, herbicide control will involve a knockdown herbicide to kill plants that are present. Residual herbicide, on the other hand, is applied to control future germination. Repeated spraying may be required even within one growing season to prevent future seed productions. However, to overcome excessive infestation one should carry out herbicide treatment in conjunction with pasture management (Mountmorgan, 2006).

4. 2. 6. Integrated management of *Parthenium*

Any single method for weed management may not be effective in controlling *Parthenium*. Integration of different methods like preventive measures, mechanical, cultural, biological and chemical means keep the weeds under check at an economic threshold level. Integrated *Parthenium* management uses a variety of technologies in a single weed management with the objective to increase the productivity of crop at a minimum cost taking in to consideration ecological and socio-economic constraints under a given agro-ecosystem.

5. CONCLUSION AND FUTURE PROSPECTS

Parthenium, which often displaces the native plant species of the ecosystem and dominates the area alone, has become a global problem. The allelopathic chemicals released from this weed are the main factors responsible for its rigorous invasion. Since its introduction, *Parthenium* is adversely affecting the food security, and the human and animal health in Ethiopia, but the method of its control is confined to hand weeding involves a direct health risk. Different methods are being performed to control the weed in Ethiopia.

The management or control strategies are not successful because of its high regeneration capacity, high seed production ability and high germination ability throughout the year and more resistance to many chemical herbicides and also high adaptability in wide range of ecosystem. This noxious weed can be managed by public awareness and participatory integrated approaches.

There is a need to encourage the research on utilization of this weed for insecticidal properties and try to evaluate the potential on pests of different crops. So far only fewer efforts have been made to control *P. hysterophorus* by using bio herbicides. More intense research in this direction is vital in the development of bioherbicides. Also, more efforts need to be done by agriculturists, scientists and government to work together for managing this troublesome weed through integrated and eco-friendly approaches.

References

- [1] Aneja KR. (2009) Biotechnology: an alternative novel strategy in agriculture to control weeds resistant to conventional herbicides. In: Antimicrobial Resistance from Emerging Threats to Reality, Narosa Publishing House, New Delhi, 160-173.
- [2] Anita S, Neeraj K, Anuja Sh, Manpreet K, Anita Y. (2014) Utility Potential of *Parthenium hysterophorus* for its Strategic Management. *Advances in Agriculture* Volume 2014, Article ID 381859, 16 pages. <http://dx.doi.org/10.1155/2014/381859>
- [3] Annapurna C. and Singh J. (2003) Variation of *Parthenium hysterophorus* in response to soil quality: implications for invasiveness. *Weed Research* 43, 190-198
- [4] Ashebir B., Sharma JJ, Nigatu L. (2012) Allelopathic Effects of Aqueous Extracts and Plant Residues of *Parthenium hysterophorus* L. on Kabuli Chickpea and Sesame. *Ethiopian Journal of Weed Management* 5: 1326
- [5] Ayana E., Ensermu K, Teshome S. (2011) Impact of *Parthenium hysterophorus* L. (Asteraceae) on Herbaceous Plant Biodiversity of Awash National Park (ANP), Ethiopia. *Management of Biological Invasions* 2: 69-80
- [6] Chippendale JF, and Panneta FD (1994) The cost of *Parthenium* weed to the Queensland cattle industry. *Plant Protection Quarterly* 9: 73-76
- [7] Duke S, Dayan F, Aliota G, Rongani I. (2002) Chemicals from nature for weed management. *Weed Sci.* 50: 138151
- [8] Evans, H.C. (1997) *Parthenium hystrophorus*: A review of its weed status and the possibilities for biological control. *Biocontrol News and Informations* 18, 389398

- [9] Goyal CP, Brahma BC (2001) A ray of hope against Parthenium weed in Rajaji National Park. *Indian Forester* 127: 409-414
- [10] Javaid A. (2007) Efficacy of some chemical herbicides against Parthenium hysterophorus L. *Pakistan J Weed Sci Res* 13, 93-98
- [11] Joshi, S. (1991) Biocontrol of Parthenium hysterophorus L. *Crop Protection* 10, 429-431
- [12] Khosla, S. N.& Sobti, S.N. (1981) Effective control of Parthenium hysterophorus L. *Pesticides* 15, 18-19
- [13] Kohli, R.K., Dogra, K.S., Rani, D. & Singh, R.B. (2004) Impact of invasive plants on the structure and composition of natural vegetation of Northwestern India, Himalayas. *Weed Technology* 18, 1296-1300
- [14] Kumar, S. and Rohatgi, N. (1999) The role of invasive weeds in changing floristic diversity. *Annals of Forestry* 7, 147-150
- [15] Lisanework, N., Hassen, A., Sharma, J.J., Adkins, S.W. (2010) Impact of Parthenium hysterophorus on grazing land communities in north-eastern Ethiopia. *Weed Biology and Management* 10, 143-152
- [16] Masum S, Hasanuzzaman M and Ali M. (2013) Threats of Parthenium hysterophorus on agroecosystems and its management: a review. *International Journal of Agriculture and Crop Sciences* 6(11): 684-697
- [17] Muhammad I, Teklu Gand Salma H. (2014) Potential threat of alien invasive species: Parthenium hysterophorus L. to subsistence agriculture in Ethiopia. *Sarhad J Agric.* 30: 118-123
- [18] Narsimhan TR, Ananth M, Narayana SM, Rajendra BM, Mangala A, (1977) Toxicity of Parthenium hysterophorus L. to cattle and buffaloes. *Experientia* 33(10): 1358-1359
- [19] Narsimhan T R, Ananth M, Narayana SM, Rajendra BM, Mangala A, (1980) Toxicity of Parthenium hysterophorus L. Partheniosis in cattle and buffaloes. *Indian Journal of Animal Science*, 50: 173-178
- [20] Navie SC, Panetta FD, McFadyen RE, Adkins SW (2004) Germinable soil seed banks of central Queensland rangelands invaded by the exotic weed Parthenium hysterophorus L. *Weed Biology and Management* 4(3): 154-167
- [21] Njoroge, J.M., (1986) New weeds in Kenya coffee. *Kenya Coffee*, 51: 331-335
- [22] Pandey DK, Kauraw LP, Bhan VM, (1993) Inhibitory effect of Parthenium (Parthenium hysterophorus L.) residue on growth of water hyacinth (Eichhornia crassipes Mart Solms.). Effects of leaf residue. *Journal of Chemical Ecology* 19(11): 2651-2662
- [23] Rao SPVA, Mangala BS, Rao S, Prakash KM. (1977) Clinical and Immunological studies on persons exposed to Parthenium hysterophorus L. *Experientia* 33(10): 1387-1388
- [24] Ray P, Gour HN. (2012) Integrated management of Parthenium hysterophorus L. (Asteraceae): a weed of worldwide significance. *Indian J Mycol Plant Pathol* 5, 605-632

- [25] Rezene F, Mekasha Ch, Mengistu H. (2005) Spread and Ecological Consequences of *Parthenium hysterophorus* in Ethiopia. *Ethiopian Weed Science Society* 6: 11-21
- [26] Shashie A. (2007) The impact of parthenium (*Parthenium hysterophorus*) on the range ecosystem dynamics of the Jijiga rangeland, Ethiopia. M.Sc. Thesis, Haramaya University.
- [27] Singh MN, Beck MH (2006) *Parthenium* contact sensitivity travels to the U.K. *British Journal of Dermatology* 155(4): 847-848
- [28] Stephen W, Sowerby M. (1996) Allelopathic potential of the weed, *Parthenium hysterophorus* L. in Australia. *Plant Protection* 11: 20-23
- [29] Sushilkumar. (2009) Biological control of *Parthenium hysterophorus* in India: status and prospects. *Indian J Weed Sci* 41, 118
- [30] Tamado T, Milberg P. (2000) Weed flora in arable fields of eastern Ethiopia with emphasis on the occurrence of *Parthenium hysterophorus*. *Weed Research* 40: 507-521
- [31] Tamado T., L. Ohlander and P. Milberg, (2002 b) Interference by the weed *Parthenium hysterophorus* L. with grain sorghum: influence of weed density and duration of competition. *International Journal of Pest Management* 48(3), 183-188
- [32] Taye T, Gossmann M, Einhorn G, Büttner C, Metz R (2002) The potential of pathogens as biological control of *Parthenium* weed in Ethiopia. *Meded Rijksuniv Gent Fak Landbouwkd Toegep Biol Wet* 67(3): 409-420.
- [33] Tefera T. (2002) Allelopathic effects of *Parthenium hysterophorus* extracts on seed germination and seedling growth of *Eragrostis tef*. *J Agron. Crop Sci.* 188: 306-310
- [34] Tudor GD, Ford AL, Armstrong TR, Bromage EK (1982) Taints in meat from sheep grazing *Parthenium hysterophorus* L. *Australian Journal of Experimental Agriculture* 22 (115): 43-46
- [35] Watson AK, Wymore LA. (1990) Identifying limiting factors in the biocontrol of weeds. In: *New Directions in Biological Control: Alternatives for Suppressing Agricultural Pests and Diseases*, Academic Press, New York, NY, USA. 305-316.
- [36] Zelalem B, Temam H, Taye T. (2012) Distribution, incidence, severity and effect of the rust on *Parthenium hysterophorus* L. in Western Hararghe Zone, Ethiopia. *Afr. J Plant Sci.* 6: 337-345