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Full Length Research Paper

An invasive alien weed giant sensitive plant (*Mimosa diplotricha* Sauvalle) invading Southwestern Ethiopia

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An assessment was carried out on the highway from Jimma to Addis Ababa in November 2009 to investigate the incidence and distribution of *Mimosa diplotricha*. This assessment revealed the occurrence of the weed *M. diplotricha* on the road sides from Jimma to Wolisso town. The roadsides from Beda Buna, near Jimma town, to Assendabo were seriously invaded whereas patches were observed from Asendabo to Wolisso. The farmers indicated that the weed has invaded the area for the last three to five years and confirmed that the spread of the weed was associated with the road construction from Addis Ababa to Jimma and the allied movement of soils and heavy machineries and vehicles. The literature study confirmed that the weed was known in many parts of the world as an invasive weed. In Ethiopia, there are evidences that indicate the presence of the plant in Southwestern Ethiopia for more than 20 years with the name *Mimosa invisa*. Mechanical, chemical and biological control methods were attempted in different countries with varying degrees of success. An integrated control method with land management practices has been suggested as the most effective. Though some farmers around Jimma started controlling the plant thicket by burning, no other control method was attempted. To this end, a country-wide survey was suggested on distribution and impacts of the weed and investigations on its biology, ecology, mechanisms of invasion success and its management.

Key words: Giant sensitive plant, invasive alien weed, *Mimosa diplotricha*.

INTRODUCTION

Giant sensitive plant (*Mimosa diplotricha* C. Wright ex Sauvalle, Mimosaceae), a native plant of Brazil in tropical South America, is a serious weed of tropical and sub-tropical crops and pastures (Holm et al., 1977; Vitelli et al., 2001). It is an invasive plant that has invaded Australia, many Pacific Islands, Solomon Islands, Southeast Asia and many African countries (Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992). *M. diplotricha* plant has angular prickly stems to 3 m long (APFISN, 2007). Prickles are up to 6 mm long that curve downwards (Vitelli et al., 2001). It has bright green feathery leaves that alternate. Each leaf has about 20 pairs of small leaflets, bipinnate, sessile, opposite, lanceolate, acute, 6 to 12 mm long and 1.5 mm wide. The leaves are sensitive to disturbance and hence called giant sensitive plant (APFISN, 2007). Flowers are small, pink and clustered in fluffy balls. Spiny seed pods contain three to four one-seeded segments. The seeds are flat, ovate, spiny, 2 to 2.5 mm long and 0.6 to 1.4 mm thick that are glossy and light brown (APFISN, 2007). Seeds and pods spread by running water and as contaminants on clothes, animal fur and vehicles, and with soil and crop and pasture seeds (McFadyen, 1982; Parsons and Cuthbertson, 1992). The spiny variety of the weed is apparently evolved from the spineless variety (APFISN, 2007).

M. diplotricha is a fast-growing, sprawling annual although behaves as a short-lived perennial shrubby leguminous vine (Waterhouse and Norris, 1987; Willson and Garcia, 1992; Alabi et al., 2004). This plant forms dense, tangled clumps up to 2 m high. It produces enormous seeds ranging from 8,000 to 12,000 per m^2 and a single plant can produce 10,000 seeds per annum (Parsons and Cuthbertson, 1992). The seeds remain dormant for up to 50 years (Holm et al., 1977; Parsons and Cuthbertson, 1992; Chauhan and Johnson, 2008).

The plant can tolerate a wide range of soil conditions. However, it grows best in tropical regions in wastelands, pastures, disturbed forests, plantations, agricultural systems and along roadsides and railway tracks at an

altitude of 0 to 2,000 m above sea level (APFISN, 2007). In evergreen and semi-evergreen forests, infestation is limited to the fringes of the forest mainly where the canopy is open due to disturbance. The plant is helophytic in adaptation and can not grow under a closed canopy. It is drought-resistant but senesce leaves during dry conditions.

M. diplotricha is a big menace to agricultural land, pastures and forest ecosystems. It is a major weed of annual and perennial crops such as cassava, banana, upland rice, soybeans, and maize; plantations such as sugarcane, coconut, rubber and tea; and pastures, roadsides, riverbanks and unproductive lands (Holm et al., 1977; Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992; Akobundu and Agyakwa, 1987; Alabi et al., 2001). Thick growth of *M. diplotricha* hinders the regeneration, reproduction and growth of native species in all infested areas and consequently results in gradual loss of biodiversity (APFISN, 2007). Crops infested are difficult to weed and harvest because of the thorns (Alabi et al., 2001; Chauhan and Johnson, 2008). Hence, invasion by *M. diplotricha* can result in increased production costs, reduced crop yield, loss of crops and biodiversity, soil degradation and reduced land value (APFISN, 2007). Furthermore, the tangled and thorny growth of *M. diplotricha* hinders penetration by livestock or humans and hampers movement of wild animals and consequently access to food and other resources (Alabi et al., 2001; Vitelli et al., 2001). Sharp and recurved thorns of the weed make animals reluctant to graze on it and they usually avoid the spiny clumps but trapping in a large thicket of *M. diplotricha* is fatal (Waterhouse and Norris, 1987). The rows of sharp recurved spines (3 to 6 mm long) along each angle of the square stems seriously injure humans. All parts of *M. diplotricha* produce mimosin, a non-protein amino acid, a toxin which is toxic to herbivores if ingested as it can cause vascular endothelial damage, necroses of the heart and liver and anemia in cattle (APFISN, 2007). The plant is also known to be an alternative host of nematodes (Galinato et al., 1999). Therefore, *M. diplotricha* is an important invasive alien weed as it is highly competitive, produces enormous seeds, difficult to control by hand and is an alternative host for nematodes (Galinato et al., 1999; Chauhan and Johnson, 2008).

In Ethiopia, though the plant has been known as *Mimosa invisa* for more than 20 years, it was only recently that it has noticed invading the southwestern Ethiopia at an alarming rate. Little is known about its distribution as well as its biology, ecology, mechanisms for invasion success and management options in Ethiopia. Therefore, the aim of this brief paper was to signal the incidence and distribution of *M. diplotricha* in the southwestern Ethiopia and to identify potential control options for further investigation based on literature study and to call for further studies meant to investigate its biology, ecology, its mechanisms for invasion success and management options in Ethiopia.

MATERIALS AND METHODS

An assessment was carried out from Jimma to Addis Ababa (1700 to 2300 m above sea level) to investigate the incidence and distribution of *M. diplotricha* in the Southwestern Ethiopia in November 2009. During this travel, the presence and intensity of the plant around the roadside was visually observed. Plant sample was collected and sent to Addis Ababa University for species identification. Farmers in Merewa Kebele, in Kersa Woreda of Jimma Zone, Oromia Regional State were asked randomly for the year of incidence of the weed, its distribution, impacts and methods of control. This short interview was supported by a literature study about the occurrence of the weed in Ethiopia and its distribution worldwide and the control options available so far.

RESULTS AND DISCUSSION

Incidence and spread of *M. diplotricha*

The aim of the current assessment was to investigate the incidence and distribution of *M. diplotricha* in Southwestern Ethiopia and to explore the possible methods for control available so far worldwide. The survey revealed that the plant was invading several places in the Southwestern part of Ethiopia on the way from Addis Ababa to Jimma starting from Wolisso currently. The plant was extremely abundant on roadsides with severe infestation from Jimma town to Asendabo whereas many discontinuous tangled thickets from Asendabo town to Gibe river and few patches from Gibe river to Wolisso (Figure 1). From Beda Buna to Serbo town some of the roadsides were completely covered by the plant to 4 m width from the edge of the road and in some places it has already entered into the farmlands (Figure 1a). The plant is scrambling over the asphalted road completely blocking the waterways and making the foot paths unavailable for humans and animals (Figure 1b). This might force humans and animals to travel on the road that is intended for vehicles and this might lead to severe car accidents. Matured plants flowered (Figure 1c) and produced pods (Figure 1d) each producing an average of four seeds (Figure 1e). Plants that produced seeds dry and the seeds shatter forming a seed mass on the roadside among which some of the seeds already germinated on the asphalted road (Figure 1f).

According to some farmers interviewed from Merewa Kebele in Kersa Woreda, *M. diplotricha*, the plant that they call '*dalantu*' in Afan Oromo, to indicate the sensitivity of the leaves to touch which is related to sensitive plant as an English common name has been invading the roadsides for the last three to five years. The farmers clearly associated the spread of the plant with road construction from Addis Ababa to Jimma and the allied spread of soils and the movement of heavy machineries and vehicles. They boldly mentioned their worries about this fast spreading and thorny plant that once if it enters into the agricultural field, it might lead to abandonment of the field since there were no control

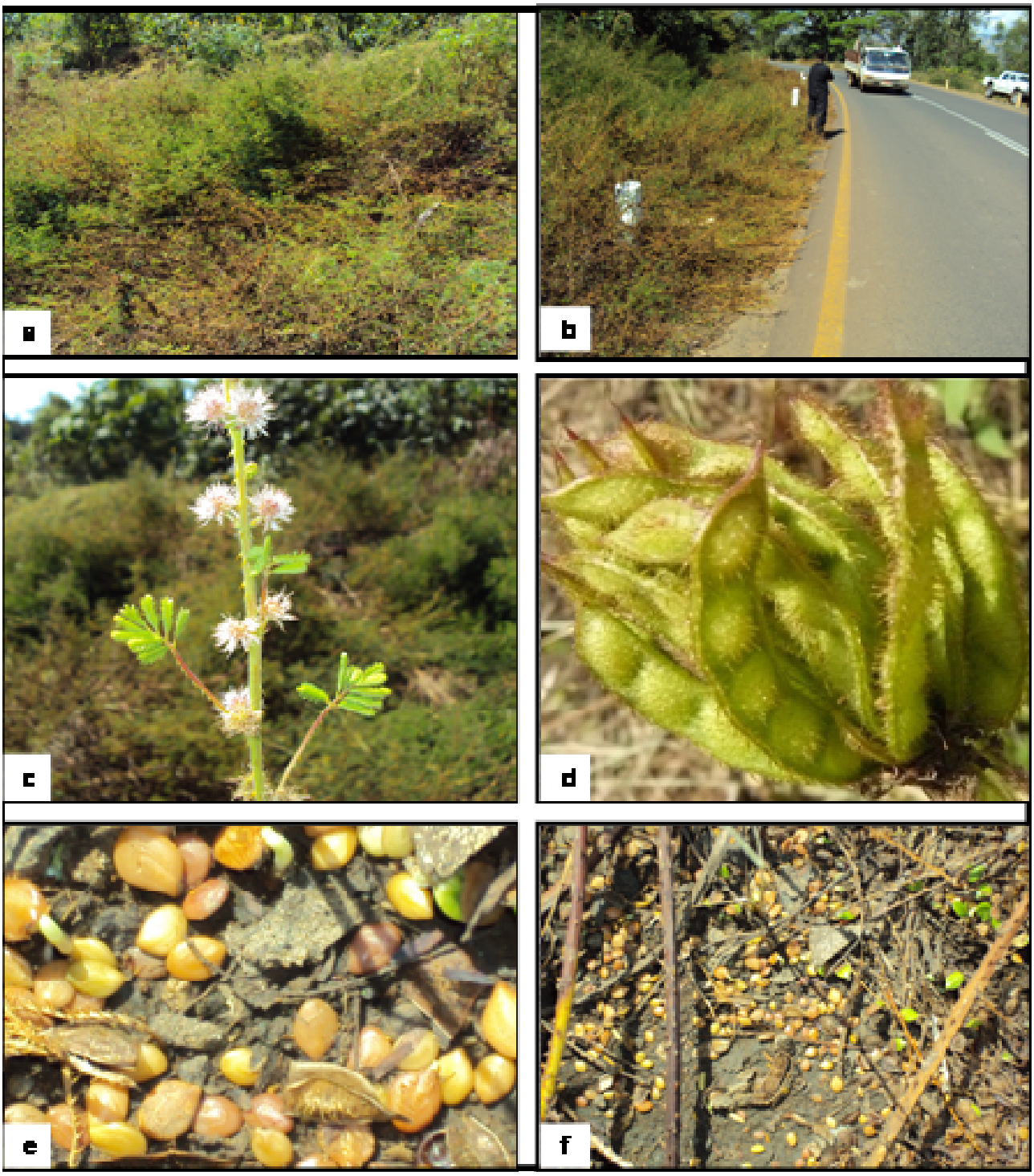

Figure 1. (a) *Mimosa diplotricha* thicket at Merewa Kebele of Kersa Woreda, Jimma Zone, Oromia National Regional State, southwestern Ethiopia, (b) covering the waterway and the road, (c) inflorescence, (d) mature pods, (e) seeds and (f) shattered and germinating seeds on the asphalt road.

options so far for this noxious weed in Ethiopia.

The aim of the literature study was to review the occurrence of the weed in Ethiopia and its distribution worldwide and the control options available so far. Literatures indicated that, it is an invasive plant that has invaded Australia, South and Southeast Asia and many African countries (Holm et al., 1977; Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992; Galinato et

al., 1999). It is a major weed of forest ecosystems, agricultural land and pastures (Holm et al., 1977; Waterhouse and Norris, 1987; Parsons and Cuthbertson, 1992; Akobundu and Agyakwa, 1998; Alabi et al., 2001). There are evidences that indicate the presence of the plant in Southwestern Ethiopia for more than 20 years with the name *M. invisa* (Hedberg and Edwards, 1989).

Windows of opportunities for control

Regarding control methods, uprooting and burning, grubbing and slashing are the most common methods practiced so far (APFISN, 2007). Uprooting is the most efficient method to control the weed mainly at early stages of establishment (APFISN, 2007). However, uprooting should be done at least twice a year to achieve an adequate level of control (Alabi et al., 2004). The first uprooting may be done before flowering and seed setting and latter followed by the second soon after the first showers when seedlings emerge (APFISN, 2007). Slashing is not advisable since the weed can easily re-generate from the cut stumps. Grazing by animals was reported to prevent the dominance of Mimosa in Queensland, Australia (APFISN, 2007).

The use of glyphosate, paraquat, diuron, acetochlor plus atrazine, starane, atrazine plus metolachlor and atrazine-500 g a. i. at 0.75, 0.5, 2 to 4, 0.92 + 0.63, 1.3 - 1.5 l, 0.82 + 1.68 kg and 4 to 6 l per ha resulted in good control of the plant under Australian condition (APFISN, 2007). Herbicide applications before the onset of flowering and fruiting were recommended for best control. However, periodic applications are required depending on the re-growth of the weed as the efficacy of herbicides is short-term.

Several natural enemies of the weed have been reported from its natural range with variable success stories. A sap-feeding bug from Brazil, *Heteropsylla spinulosa* (Hemiptera: Psyllidae), had some success in causing growing tip distortion and reduces seed production in Australia, Fiji and Papua New Guinea (Willson and Garcia, 1992). However, it was inefficient during prolonged drought and flood conditions (Ablin, 1995). A cosmopolitan fungus, *Corynespora cassiicola*, causes stem spot, defoliation and dieback in Queensland and Papua New Guinea and the fungus was very damaging under hot humid weather conditions (APFISN, 2007). A moth which feeds on the leaves, flower buds, tender seedpods and tender stems, *Psygida walkeri* was also studied for host specificity which has been tested on 110 plant species from 29 families including Mimosaceae in Brazil and Colombia (Garcia, 1983; Vitelli et al., 2001). Twenty-nine of these plant species supported some degree of larval feeding. Further biological control studies are in progress in different countries (APFISN, 2007).

Control methods should be designed considering the (agro) ecosystems. For instance, the use of manual or mechanical control methods is comparatively safer than chemical methods to minimize environmental impacts in natural forest ecosystems (APFISN, 2007). In other ecosystems, long term control of the weed requires the integrated use of mechanical, chemical and biological methods. In pastures and non-crop situations, regular slashing is effective to prevent seedlings whereas cultivation is also effective but requires much labour (APFISN, 2007). For successful control of *M. diplotricha*, an integrated approach of different control methods including mechanical, chemical and biological with land management practices is most effective. Furthermore, any integrated management program should be supplemented with a strong extension and education component to ensure the adoption of methods suitable to different ecosystems.

To avoid further spread of *M. diplotricha*, non-infested regions should refrain from introducing the plant as a cover crop. A maximum possible care should be given while moving construction machinery from infested to non-infested area. Also, strict enforcement and implementation of quarantine regulations, especially during the import of seeds, will help to keep the plant not to enter to new countries and/or regions (APFISN, 2007).

CONCLUSION AND PROSPECTS

Currently, to the level of the coverage of this assessment, *M. diplotricha* was invading the roadsides of Southwestern Ethiopia from Wolisso to Jimma towns. Therefore, this brief report indicates the severity of the invasion in the region and urges the importance of a country-wide survey on distribution and impacts of the weed and investigations on its biology, ecology, mechanisms of invasion success and windows of opportunities for management.

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