

Trianthema portulacastrum L.- the noxious weed and its control

Abstract

Horse purslane (*Trianthema portulacastrum* Linn.) of family Aizoaceae is native to South Africa and has been reported to be present in India, Pakistan, Tropical America, West Asia, Sri Lanka and Africa. It has become noxious due to substantial yield reduction on account of competition in several cultivated crops. The aim of this review is to provide general information about the physiology, distribution, ill effects, and management of horse purslane. Various methods has been tried to control this weed, but no single method would be adequate to manage horse purslane, and there is a need to integrate various management options. Successful management of this weed can only be achieved by an integrated approach with biological control as the key element.

Keywords: biological, management, noxious, *trianthema portulacastrum*

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Introduction

Horse purslane of the family Aizoaceae is a much branched, prostrate, succulent annual herb indigenous to South Africa.¹ It is widely distributed in Northern India and several other tropical and subtropical areas, including West Asia, Africa, and tropical America, as an invasive weed of cultivated fields and wastelands.^{2,3} It is commonly known as blackpig weed, carpet weed, gudbur, hog weed, itcit, santha and horse purslane. It is one of the most troublesome terrestrial weeds in various agricultural and vegetable crops and needs urgent attention.^{4,5}

Morphology

Plants are glabrous or papillose, thickened and flattened at the nodes with taproot system that reaches upto to the height of 30-50cm. Stem is more or less angular, glabrous or pubescent. Leaves are petioled, opposite, unequal, one of the lower pair much smaller than the other. Flowers are small, white or bright pink, axillary, solitary in pouch or between forks of branches. The fruit is a curved, cylindrical capsule emerging from the stem, containing 2 to 8 seeds. Seeds are reniform, muriculate and dull black in colour.⁶ The production of flowers and seeds of *T. portulacastrum* starts 20-30 days after germination of the seeds. Each plant produces 52,000 seeds in its life span. Seeds are hard seed coated hence persist in the soil for many years and infest the crops raised subsequently.⁷ Enormous seed production and low dormancy leading to a large seed bank in the soil and enables the plants to survive in the adverse condition.

Harmful effects

T. portulacastrum is a widely distributed weed in mustard, corn, pigeon pea, soybean, tomato, potato, onion, cotton, sugarcane, pearl millet, sorghum, maize, direct-seeded rice, summer and rainy season pulses, oilseed crops, fodder crops, vegetables and horticultural crops in India, Pakistan and Sri Lanka. Holm et al.,⁸ indicate *T. portulacastrum* to be a 'serious' weed in Australia, Ghana, India, Philippines and Thailand, and a 'principal' weed in Cambodia, Guyana and Nicaragua. In India, horse purslane is a problem in the states of Uttar Pradesh, Punjab, Haryana, Rajasthan, Madhya Pradesh, and Delhi. Two biotypes of *T. portulacastrum* occur in India. Typical

description refers to red biotypes that form larger plants and reddish stems with long internodes; and green and smaller type, with green stem, shorter internodes and white flowers. The red type is more abundant, but the green one appears earlier in the season. Balyan et al.,⁴ reported that horse purslane is a strong competitor, reducing the yield of mung bean by 50 to 60% when left untreated. Significant losses in maize, soybean, and peanut (*Arachis hypogaea* L.) yield are also attributed to this weed.⁹⁻¹¹ Umarani et al.,⁷ reported on the negative allelopathic effects of extracts of horse purslane on seed germination, seedling vigor, and productivity in soybeans.

Beneficial effects

The plant possess analgesic, antipyretic, anti-inflammatory, and stomachic properties and used in asthma, bronchitis, jaundice and oedema.¹² The plant used against throat troubles and as an anti-fungal agent. A decoction of the herb is used as a vermifuge and is useful in rheumatism. It is considered as an antidote to alcoholic poisoning. The fleshy nature of leaves makes them suitable for use as a wound-dressing. The leaves and stems are sometimes eaten as a vegetable, but cause toxic effects in the form of diarrhea.¹³ The plant is also used as fodder, but may cause poisoning in cattle.¹⁴

Control

There is no clear cut and established method available at present for the control of this weed. However manual, chemical and biological methods are considered to control this weed. Each of these methods has its own merits and demerits. Hand weeding and hoeing are common practices of controlling this weed in the developing countries of the world.⁵ Manual weeding 3 and 5 weeks after sowing maize, pearl millet (*Pennisetum glaucum*) green gram (*Vigna radiata*) and cowpea is necessary to avoid crop loss due to early competition from *T. portulacastrum*. Mechanical weed control or inter-row cultivation is useful in cotton and sugarcane. *T. portulacastrum* should never be allowed to reach maturity. In heavily infested fields, it should be controlled at the seedling stage. Plants in the fruiting stage should not be cut and left in the field, as they retain enough viability for the fruit to mature and the seed to be dispersed. Manual weeding is a quite expensive and time consuming thus ineffective to control this weed.

Control of *T. portulacastrum* with various pre and post-emergence herbicides in different agricultural crops have been attempted. Pre-emergence application of oxyfluorfen, isoproturon, oxadiazon, pendimethalin and fluchloralin effectively controlled horse purslane in various crops.¹⁵⁻¹⁷ Acifluorfen and lactofen used alone, or in combination with 2, 4-DB controlled *T. portulacastrum* up to 70 per cent. Grichar⁹ reported more than 75% control with five post-emergence herbicides alone or in combination (e.g. acifluorfen, acifluorfen plus bentazon, pyridate plus 2,4 DB and lactofen) Although these measures can control the weed on a small scale, they are not feasible for large infestations or infestations in environmentally sensitive areas. Further, increased and indiscriminate use of herbicides has resulted in herbicide resistance¹⁸ and environmental concerns. Worldwide efforts are underway to reduce the heavy reliance on chemical herbicides and finding alternative strategies for weed management¹⁹ is the need of time. Allelopathy and mycoherbicides could be an appropriate potential technology for this purpose.

To control the weeds in many crops, it is suggested that crops with strong competitive ability and allelopathy should be used in combined form.²⁰ Results from many studies indicated that the crop plants like sorghum,²¹ sunflower,²² brassica and mulberry²³ have inhibitory effects on germination of *Trianthema portulacastrum*.²⁴ Presently emphases are on biological control of horse purslane with fungal pathogens as it has gained acceptance as a practical safe and environmentally beneficial method. Earlier studies^{5,25,26} indicate the potential of biological control of horse purslane using plant pathogens. Mycoherbicides are primarily attractive because they can be weed specific, have low environmental impact, and are often cost effective.²⁷ However, not much work has been done on the biocontrol of this weed. A total of five fungal pathogens namely *Cercospora trianthemae*,²⁸ *Colletotrichum gloeosporioides*,²⁹ *Drechslera indica* (=Bipolaris indica),^{30,31} *Fusarium oxysporum*,²⁹ *Gibbago trianthemae*,^{32,33} have been recorded on the weed worldwide. *Gibbago trianthemae* Simmon, a phaeodictyoconidial hyphomycetes fungus, the causal agent of leaf spot on horse purslane was first of all isolated in 1986 from the USA followed by its isolation from Kurukshetra, India in 1990 from the diseased plants,³³ thus recorded only from two countries of the world. *Gibbago trianthemae* has the potential to control horse purslane when applied as foliar spray in field controlled conditions. If we are to exploit fungal pathogens for the effective control of this weed, we must improve the methodology of formulation and application of mycoproducts. If we are to maximize the benefits from the biological control agents already in use or in testing stages, an integration of various control approach become imperative. Experts agree that a multidisciplinary integrated control approach rather than single control method offer the best prospect for long term management of weeds.

Conclusion

The horse purslanegrows in a wide variety of habitats and capable of out-competing native and non-native palatable plants that are important to livestock. Furthermore, the changes in vegetation and soil nutrients could lead to ultimate changes in other trophic levels and alter the function of the ecosystem. Appropriate methods for the management of *T. portulacastrum* are necessary to avoid potential threats to agricultural and economic losses. The efficient and environment-friendly alternative to other time-consuming, costly, toxic, physical, and chemical methods is the use of biological control through allelopathy, insects and fungal pathogens. A total of nine

pathogens (eight fungi, one virus) and two insects namely (*Spoladea recurvalis* (=Hymenia recurvalis) and *Spodeptera littoralis*) have been recorded on this weed worldwide but except *G. trianthemae*, no other fungal pathogen has been evaluated for its biocontrol. Need of the hour is to intensify research on how to control this weed either through biological control agents or integrated management using biological agents viz insects fungus and allelopathic plants with chemical herbicides.

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Conflict of interest

The author declares no conflict of interest.

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