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A REVIEW ON GENUS *ALTERNANTHERA* WEEDS IMPLICATIONS

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ABSTRACT

Alternanthera is a genus of approximately 200 low herbaceous plant species in Amaranthaceae, the amaranth family. The most problematic Alternanthera species which have been reported in the literature include A. angustifolia, A. denticulata, A. nana, A. nodiflora, A. sessilis, A. paronychioides, A. philoxeroides, A. punguns, A. tenella and A. triandra. Alternanthera philoxeroides, A. sessilis and A. punguns are the non native aquatic members that occur in Pakistan. Review of literature revealed A. philoxeroides as the most troublesome and extensively studied Alternanthera species in the world. Yield losses of 19-60% have been reported due to A. sessilis and A. philoxeroides in field crops. Alkaloids and phenols present in Alternanthera species inhibit the germination and early seedling growth of crops and vegetables. Fluchloralin, pendimethalin, penoxsulam and pretilachlor are recommended for control of various Alternanthera species in field crops. Dichlobenil, dichloform, fluridone, glyphosate, imazapyr and metsulfuron-methyl are recommended for control of A. philoxeroides in aquatic, semi-aquatic and terrestrial areas.

Key words: Allelopathy, *Alternanthera* species, biocontrol agents, competition, herbicides, yield losses.

INTRODUCTION

Most species of *Alternanthera* are terrestrial not aquatic. Vogt *et al*. (1979) stated that there are 170 species of *Alternanthera* in the western hemisphere and 120 species occur in South America. Only 5% of the species in South America are aquatic. Fifteen native and non native species of *Alternanthera*, most of which are terrestrial, occur in the USA (Godfrey and Wooten, 1981). Kartebz (1994) listed 15 species in USA and Canada including ornamental species. Small (1933) listed 6 species in southeastern united states under the synonym, *Achyranthus* L. The synonymy, morphology, and biology of alligator weed have been detailed by Julien and Broadbent (1980). The *Alternanthera* species which have been listed in Australia include *A. angustifolia* (narrow leaved joyweed), *A. denticulata*, R. Brown (common joyweed), *A. nana* (hairy joyweed), *A. nodiflora* (common joyweed), *A. sessilis*

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(sessile joyweed or dwarf copper leaf) and *A. philoxeroides* (alligator weed). Sekar (2012) stated that *Alternanthera* is among the genera with the highest number of alien invasive species namely *A. paronychioides* St. Hill (smooth joyweed), *A. philoxeroides* (Mart) Griseb, *A. pungens* Humb. Bonpl & Kunth (khaki weed), *A. sessilis* (L.) DC. and *A. tenella* Colla (Joyweed) in the Indian Himalyan region. Tiwari *et al*. (1995) reported presence of *A. triandra* in India. Conossa *et al*. (2008) and Vivian *et al.* (2008) reported presence of *A. tenella* in Brazil. *Alternanthera philoxeroides* and *A. sessilis* have been reported from Pakistan. *Alternanthera philoxeroides* occurs naturally in Paraguay, Uruguay, Brazil, Bolivia and has spread to Australia, Newzealand, India, China, Indonesia, Burma, Thialand, Puerto Rico and America (Julien and Stanley, 1998; Garbari and Pedulla, 2001). *Alternanthera philoxeroides* is used as a substitute of green fodders and in calve ration (Bhatta and Das, 1995; Kumar and Vishwakarma, 2005) and as a leafy vegetable in India and Australia (Gunasekera and Bonila, 2001). *Alternanthera sessilis* is also used as a leafy vegetable in Srilanka and *A. denticulata* as a herbal species by Srilankan community in Australia (Gunasekera and Bonila, 2001). The present review discusses the competition and allelopathic effects of genus Alternanthera weeds on crops along with their control.

INTERFERENCE

Singh and Dhan (1997) and Mishra *et al*. (2007) reported 59.50% and 25.9% reduction in grain yield of soybean and rice, respectively when different weeds including *A. sessilis* were allowed to compete with respective crops upto maturity. The decrease in yield of dry-seeded rice was 60% when *A. sessilis* and other weeds competed with rice upto maturity and nutrient removal was 10.79 kg N, 2.78 kg P and 7.22 kg K ha^{-1} by weeds (Mishra and Singh, 2008). *Alternanthera philoxeroides* is responsible for grain yield losses of 45, 19 and 20% in rice, maize and vegetables, respectively (Yi, 1992; Zhang *et al*., 2004). Lu *et al*. (2002) and Ye *et al*. (2003) reported *A. philoxeroides* as an invasive weed of rice, maize, cotton, soybean and vegetables. *Alternanthera philoxeroides* is the most important worldwide distributed and studied weed among Alternanthera species. By farming dense mats of interwoven stems over water or land, this invasive weed may threaten the native flora and fauna, reduce crop yields, block ships and promote flooding (Holm *et al*., 1997).

Paria and Mukherjee (1991) recorded complete inhibition of mustard and rice seed germination and seedling growth with leaf extract of *A. philoxeroides*. Inhibitory effect of *A. philoxeroides* leaf on root growth of lettuce (*Lactuca sativa*) and barnyard grass (*Echinochloa crus-galli*) was reported by Liuqing *et al*. (2007). The

inhibition rate increased with the increasing dose of *A. philoxeroides*. Similarly Mandal and Mondal (2011) reported inhibitory allelopathic effect of *A. philoxeroides* on spore germination of edible pteridophytes (*Ampelopteris prolifera*). Rice showed more resistance to germination and seedling growth inhibition than other species indicating that the effect of *A. philoxeroides* was species dependent. The inhibition rate of root extract was higher than that of stem and leaf of *A. philoxeroides* indicating that parts of same weed differ in their allelopathic potential. Tiwari *et al*. (1995) reported a detrimental effect of root washings of *A. triandra* on germination and early seedling growth of three legumes viz. soybean, groundnut (*Arachis hypogea*) and green gram (*Vigna radiata*). Extract of *A. polygonoides* showed suppressive effect against *Parthenium hysterophorus* (Quazi and Khan, 2010). This inhibitory effect has been attributed to the presence of alkaloids and phenols in the extracts of Alternanthera species.

CONTROL

Bentazone, dicamba, dichlobenil, dichloform, fluridone, glyphosate, hexazinone, imazapyr, metsulfuron-methyl, pendimethalin, triclopyr and propanil herbicides are recommended for control of *A. philoxeroides* in aquatic, semi-aquatic, terrestrial, fruits, ornamentals and backyard areas (Langeland, 1984; Gunasekera and Adair, 1999).

Fluchloralin at 1.25 kg ha^{-1} followed by pendimethalin at 1.25 kg ha^{-1} and fluazifop butyl at 0.3 kg ha^{-1} was found most effective in reducing the density and dry matter of weeds including *A. sessilis* L. and increasing grain yield of soybean (Singh and Dhan, 1997). Mishra *et al*. (2007) reported better control of *A. sessilis* and increased grain yield of rice with early post-emergence application (10 DAT) of penoxsulam at 22.5 g ha^{-1} than its pre-emergence application (5 DAT). Integration of pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} or pretilachlor @ 0.75 kg ha^{-1} with one hand weeding (30 DAS) or sequential application of pre-emergence herbicides followed by post-emergence application of 2, 4-D @ 0.5 kg ha^{-1} and fenoxaprop @ 0.07 kg ha^{-1} proved quite effective against different weeds including *A. sessilis* in dry-seeded irrigated rice (Mishra and Singh, 2008).

Dwivedi and Shrivastava (2011) reported maximum reduction in number of total weeds including *A. triandra* with alachlor @ 1.5 kg ha^{-1} as pre-emergence + hand weeding at 40 DAS with maximum grain yield of maize (*Zea mays*) and blackgram (*Vigna mungo*).

Agasicles hygrophila (leaf beetle), *Yogtia malloi pastrana* (moth), *Amynothrips andersoni* (thrips) and *Nimbya alternantherae* (fungus) are promising *A. philoxeroides* biocontrol agents (Buckingham, 1996; Pomella *et al*., 2007).

This review led to conclude that the Alternanthera species if allowed to grow and stand for full or partial life span of crops could cause a serious impediment in the germination and early seedling establishment of crops and thereby could limit their yield. Furthermore there is need to control Alternanthera weed species one should adopt situation dependent option.

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