



Weed flora of raised bunds and undulated lands growing along the rice fields of Kashmir Valley

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ABSTRACT

For an effective weed management in the rice fields, it is crucial to identify the actual weeds as well as those growing on the raised bunds and undulated lands nearby rice fields. The present study was carried out with this aim to record the weeds growing on bunds and nearby undulated lands of the rice fields in Kashmir Valley, so that not only the actual weeds inside the rice field but also the nearby growing weed species that may pose future risk could also be targeted under the weed management practices. During the present study, 58 weed species belonging to 45 genera and 27 families were recorded along raised bunds and undulated lands of rice fields in Kashmir Valley. Of these, 38 weed species were terrestrial and 20 were semi-aquatic species; and it is the latter set of species that can become the future weeds of rice fields in the region.

Key words: Bund weeds, Management, Semi-aquatic, Terrestrial, Weed flora

Rice (*Oryza sativa*) is one of the top most cereal crops providing food for more than half of world's human population (Kumar *et al.* 2008, Mulungu *et al.* 2011). Being staple food for more than 3 billion people across the world, rice provides 50-80 per cent daily calorie intake (Choudhary *et al.* 2011). Throughout the world, India is the second largest producer of rice after China; and rice is the second most important crop in India (Savary *et al.* 2005). The crop plays a pivotal role in the economy of India and thus occupies top priority in the agricultural policy and food security of the country (Dangwal *et al.* 2011).

Uncontrolled infestation by obnoxious weeds is a serious problem for rice cultivation, and there are estimates that weeds incur an annual rice yield loss of 15-21% worldwide (Oerke *et al.* 1994). In fact, out of total losses incurred to rice due to various biotic stressors, weeds are known to account for one-third (Rao and Nagamani 2007). It has been estimated that infestation of weeds in rice fields reduces the grain yield by 75.8, 70.6 and 62.6% in dry seeded rice, wet seeded rice and transplanted rice, respectively (Singh *et al.* 2005).

In the Kashmir Valley, rice is regarded to be more than just the staple food, and it finds its way in local parlance for the word: “meal” (Ganie *et al.*

2015). A relatively small area of about 0.27 million hectares of land are under rice cultivation in the region and the crop contributes significantly to the regional economy (Ganie *et al.* 2015). Although the rice is crucially linked to the livelihood of local inhabitants in the Kashmir Valley, yet the yield loss incurred due to infestation of various weeds is one of the major problems in the region. It is in this backdrop the present study was undertaken to identify and document the weed species growing along raised bunds and on undulated lands of rice fields across the Kashmir Valley with an emphasis on taxonomic diversity, habit, occurrence and life span, which in turn, can provide useful insights in the development of effective weed management practices.

MATERIALS AND METHODS

Field surveys were conducted across the Kashmir Valley to identify weeds growing along raised bunds and in between undulated lands of rice fields during 2010-2014, in the months of April to October. Being situated in northern fringe of the Indian sub-continent, the Valley lies between 33°22' and 34°50' N latitudes and 73°55' and 73°33' E longitudes covering an area of about 16,000 sq. km. During the present study, 3 sites from each district with 10 spots at each site of Kashmir Valley have been selected to record the weed flora. Field surveys were conducted twice a month in each site for collection of weed species specimens. The collected plant specimens were pressed, dried, preserved and properly identified with the help of available literature

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(Hooker 1894, Stewart 1972, Cook 1995). The properly processed herbarium specimens were deposited at Kashmir University Herbarium (KASH) for future voucher specimens.

RESULTS AND DISCUSSION

Fifty eight weed species growing along raised bunds and in between undulated lands of rice fields across the Kashmir Valley were recorded (Table 1). These species belong to 45 genera in 27 families; of the latter, 23 belong to dicotyledons and 4 to monocotyledons. Habit-wise, study showed that 20 species were aquatic/semi-aquatic and 38 were terrestrial. Based on the occurrence, most of the weed species grew on both the raised bunds and undulated lands. Although rice is an annual crop, however majority of the weeds recorded were perennials (37 species), followed by 19 annual and 2 biennial species. In addition to 40 weed species previously reported by Ganie *et al.* (2015) as the actual weed species that grow inside beds in the rice fields of Kashmir Valley, one more species namely

Butomus umbellatus L. has also been recently recorded as weed of rice fields at various places in the Valley. Based on this observation, it was predicted that among the 20 aquatic/semi-aquatic species recorded during the present study which currently are still growing along margins of rice fields can become potential future weed species of the rice crop in the region.

From weed management point of view, correct taxonomic identification and the identification of potential habitats that serve as pathway for the weed species assumes first and foremost priority. Therefore, the present study recommends that, in addition to the actual weeds of the rice crop which are primary target, the weed management practices should also focus on potential weed species that inhabit side-by habitats in rice fields, such as raised bunds, undulated lands *etc.*, which may pose risk in future. Such an informed early prediction protocol for future weed species need to be integrated in the overall weed management, because the chances of weed control are maximal at this stage of infestation.

Table 1. Weed species growing on raised bunds/or in between undulated lands of rice fields in Kashmir Valley

Plant species	Family	Habit	Occurrence	Life span
<i>Achillea millefolium</i> L.	Asteraceae	Terrestrial	RB and UL	Perennial
<i>Cichorium intybus</i> L.	Asteraceae	Terrestrial	RB and UL	Perennial
<i>Conyza canadensis</i> (L.) Cronq.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Galinsoga parviflora</i> Cav.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Senecio chrysanthemoides</i> DC.	Asteraceae	Terrestrial	RB and UL	Perennial
<i>Sonchus arvensis</i> L.	Asteraceae	Terrestrial	RB and UL	Perennial
<i>Sonchus oleraceus</i> L.	Asteraceae	Terrestrial	RB and UL	Biennial
<i>Tagetes erecta</i> L.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Tagetes minuta</i> L.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Tagetes patula</i> L.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Xanthium strumarium</i> L.	Asteraceae	Terrestrial	RB and UL	Annual
<i>Myosotis caespitosa</i> Schultz	Boraginaceae	Terrestrial	RB and UL	Perennial
<i>Capsella bursa-pastoris</i> (L.) Medic.	Brassicaceae	Terrestrial	RB and UL	Annual
<i>Rorippa indica</i> (L.) Hiern	Brassicaceae	Semi-aquatic	UL	Annual
<i>Nasturtium officinale</i> L.	Brassicaceae	Aquatic	UL	Perennial
<i>Thlaspi arvense</i> L.	Brassicaceae	Terrestrial	RB and UL	Annual
<i>Cannabis sativa</i> L.	Cannabaceae	Terrestrial	RB and UL	Annual
<i>Chenopodium album</i> L.	Chenopodiaceae	Terrestrial	RB and UL	Annual
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Terrestrial	RB and UL	Perennial
<i>Euphorbia prostrata</i> Ait.	Euphorbiaceae	Terrestrial	RB and UL	Annual
<i>Lathyrus aphaca</i> L.	Fabaceae	Terrestrial	RB and UL	Annual
<i>Trifolium pratense</i> L.	Fabaceae	Terrestrial	RB and UL	Perennial
<i>Trifolium repens</i> L.	Fabaceae	Terrestrial	RB and UL	Perennial
<i>Vicia sativa</i> L.	Fabaceae	Terrestrial	RB and UL	Annual
<i>Medicago lupulina</i> L.	Fabaceae	Terrestrial	RB and UL	Perennial
<i>Geranium nepalense</i> Sweet	Geraniaceae	Terrestrial	RB and UL	Perennial
<i>Myriophyllum spicatum</i> L.	Haloragaceae	Aquatic	UL	Perennial
<i>Ocimum basilicum</i> L.	Lamiaceae	Terrestrial	RB and UL	Perennial
<i>Prunella vulgaris</i> L.	Lamiaceae	Terrestrial	RB and UL	Perennial
<i>Scutellaria discolor</i> Colebr.	Lamiaceae	Terrestrial	RB and UL	Perennial
<i>Scutellaria galericulata</i> L.	Lamiaceae	Semi-aquatic	RB and UL	Perennial
<i>Lythrum salicaria</i> L.	Lythraceae	Aquatic	UL	Perennial

Plant species	Family	Habit	Occurrence	Life span
<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Aquatic	UL	Perennial
<i>Epilobium hirsutum</i> L.	Onagraceae	Semi-aquatic	UL	Perennial
<i>Oenothera drummondii</i> Hook. F	Onagraceae	Semi-aquatic	UL	Perennial
<i>Spiranthes sinensis</i> (Pers.) Ames	Orchidaceae	Semi-aquatic	UL	Perennial
<i>Oxalis corniculata</i> L.	Oxalidaceae	Terrestrial	RB and UL	Perennial
<i>Plantago lanceolata</i> L.	Plantaginaceae	Terrestrial	RB and UL	Perennial
<i>Plantago major</i> L.	Plantaginaceae	Terrestrial	RB and UL	Perennial
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Terrestrial	RB and UL	Perennial
<i>Poa angustifolia</i> L.	Poaceae	Terrestrial	RB and UL	Perennial
<i>Poa annua</i> L.	Poaceae	Terrestrial	RB and UL	Annual
<i>Poa pratensis</i> L.	Poaceae	Terrestrial	RB and UL	Perennial
<i>Persicaria amphibium</i> (L.) Delarbe	Polygonaceae	Aquatic	UL	Perennial
<i>Persicaria nepalensis</i> (Meisn) Miyabe	Polygonaceae	Aquatic	UL	Annual
<i>Persicaria lapathifolium</i> (L.) Delarbe	Polygonaceae	Semi-aquatic	UL	Annual
<i>Rumex dentatus</i> L.	Polygonaceae	Semi-aquatic	UL	Perennial
<i>Rumex nepalensis</i> Spreng	Polygonaceae	Semi-aquatic	UL	Perennial
<i>Portulaca oleracea</i> L.	Portulacaceae	Terrestrial	UL	
<i>Stuckenia pectinata</i> (L.) Börner	Potamogetonaceae	Aquatic	UL	Perennial
<i>Potamogeton crispus</i> L.	Potamogetonaceae	Aquatic	UL	Biennial
<i>Ranunculus sceleratus</i> L.	Ranunculaceae	Semi-aquatic	UL	Perennial
<i>Rubia cordifolia</i> L.	Rubiaceae	Terrestrial	RB and UL	Perennial
<i>Veronica anagallis-aquatica</i> L.	Scrophulariaceae	Semi-aquatic	UL	Perennial
<i>Veronica beccabunga</i> L.	Scrophulariaceae	Semi-aquatic	UL	Perennial
<i>Solanum americanum</i> Mill.	Solanaceae	Terrestrial	RB and UL	Annual
<i>Typha angustifolia</i> L.	Typhaceae	Aquatic	UL	Perennial
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Terrestrial	RB and UL	Annual

RB= Raised Bunds; UL= Undulated Land

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