

Diversity and Multipurpose Uses of Weeds and Their Relatives as Resources in Nepal

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Abstract: Weeds interfere with the use of land and water resources and thus adversely affect managed ecosystems. However, weeds are also used for curing different ailments by homeopathic practitioners and traditional local healers of Nepal. Moreover, weeds have been used in Nepal for various other purposes such as food, fiber, fodder, compost and mulches. A great variation in altitude and climatic conditions resulting into a great diversity in herbaceous flora has enriched the agro-ecosystems of this country. Phylogenetic relationships and the extent of gene exchange between crop and weed affect the amount of genetic diversity and the likelihood that weeds would provide a source of useful characters for improvement of crop species. With the perspective of weeds as resource, integrated management approach rather than conventional method of control and elimination of weed has been advocated by weed scientists and agriculturists. Various multipurpose uses of 35 most common weed species of Nepal have been reviewed based on published literature and documented indigenous knowledge.

Introduction

Weeds are plants species which often outgrow crops and bring trouble to farmers. In crop lands and forests, weeds compete with beneficial and desirable vegetation, reducing the yield and quality of produce. But it is also true that while all plants in unwanted place are weeds; all weeds are not unwanted plants. Weedy plants are valuable resource for practitioners of homeopathic medicines and traditional healers in Nepal. For these people, weeds provide potential sources of valuable life-saving drugs. Furthermore, allelopathic and industrial uses of common weeds have been recently reported (Quasem and Foy 2001). Moreover, Khanh *et al.* (2004), studied inhibitory effects from different parts of four common medicinal plant species and two leguminous grasses from Southeast Asia on two most common paddy weeds, *Echinochloa crus-galli* and *Monochoria vaginalis*. They reported strong allelopathic activities

in those plant species, suggesting a great untapped potential of weeds to develop natural herbicides.

Nepal, a small country in South Asia, covers approximately 0.1% of total global land mass but represents approximately 2% of global diversity of flowering plants (Ryman 1992). The altitudinal variation within a relatively small distance created a great variation in climatic conditions. Due to its great geographic variation and subsequent climatic difference, this relatively small country is surprisingly rich in biological diversity. The biodiversity profiles of Nepal (1996) has records of 5160 species of flowering plants and 1120 species of non-flowering plants. The group of flowering species includes cultivated crops, farmland weeds, wasteland weeds, and wild relatives of crops and weeds. Pandey (1987) claims that almost all of the climatic conditions of the earth are represented within this country of such a small distance. Occurrence of both oriental and occidental types of barley in the foothills of Himalayas, existence of wild relatives of rice in Ajigara lake of Kapilvastu district in the southwestern part of the country, and occurrence of numerous wild relatives of cultivated plants spreading over aquatic and terrestrial vegetation of the country provide evidence for the great genetic diversity of plant species in the country (Takahashi *et al.* 1968; Gupta *et al.* 1996).

Grytnes and Vetaas (2001) studied plant species richness in Nepalese Himalayan gradient by interpolation. The authors reported that the number of species in 100-m altitudinal bands increased rapidly as the altitude increased up to 1500 m above mean sea level (MSL). Between 1500~2500 m there was hardly any change in the number of species; beyond that altitude, the species richness declined. Bhattarai *et al.* (2004) conducted a study in an arid sub-alpine grass land of the central Himalayas of Nepal to elucidate relationship between plant species richness and biomass. They worked out hump-shaped relationship between two variables: species richness and biomass, and argued that the relationship could predict herbaceous species richness highest at intermediate level of biomass that corresponded to moderate competition or disturbance. The authors further tested this relationship in trans-Himalayan grassland and found similar result.

Studies conducted by De wet (1981) strengthens the general understanding that cultivated cereals are domesticated grasses. Wild progenitors of domestic cereals are aggressive natural colonizers and often become weedy in the agro-ecosystem. Similar weeds may also evolve from abandoned cultivars as a result of mutations that restore their ability for natural seed dispersal. Pickersgill (1981) reported that many crops have weedy relatives with which they are sympatric in part. The crops may have been domesticated from plants similar to the modern weedy types or the modern weeds might have been derived from the crop (often through natural hybridization); or crop and weed may have diverged simultaneously from a shared wild ancestor. Phylogenetic relationships and the extent of gene exchange between crop and weed affect the amount of genetic diversity and the likelihood that weed populations would provide a source of useful characters for improvement of the crop. This inherent

potential in the weedy species makes current efforts of conservationists relevant in collection and conservation of plant genetic resources.

Baral and Kurmi (2006) reported that an updated biodiversity prospecting was essential to assess and document the potential plant genetic and biochemical resources in the country. The authors claimed that such initiatives could ensure long-term conservation and utilization of rich plant heritage with participation from all stakeholder. Nepal government, being one of 190 signatories of Convention on Biological Diversity (CBD), is obliged to conservation, sustainable use and benefit sharing of plant genetic resources fairly and equitably among its stakeholder. Chaudhary (2000) has proposed that Nepal would need to develop a common *sui generis* intellectual property rights (IPRs) regime on plant varieties and biotechnology products thereby ensuring compliance on the agreement of world trade organization (WTO). In its accession negotiations Nepal had committed to full implementation of the sanitary and phytosanitary measures (SPS) requirement by 1st January 2007. With this commitment, some exporter of herbal products extended their business overseas especially to european countries. One of the companies, the Gorkha Ayurved Co. - a joint venture between Nepalese and French investors gained about 6% of the domestic market for herbal products (Shakya B. http://www.wto.org/english/res_e/booksp_e/casestudies_e/case31_e.htm). Although the share of herbal products in Nepal's export basket seems to be modest at present, it seems to have a great scope. Thus, government efforts are obviously essential to protect indigenous knowledge on multipurpose uses of herbs and weeds, thereby encouraging reasonable balance of conservation and uses of these plant species through proper regulatory measures.

This paper presents a brief review of multiple uses of the most common herbaceous weeds of crop lands, grasslands, parks, and forests as resources in Nepal.

Principal Uses of Weeds and Their Relatives in Nepal

Weed species in Nepal have multiple uses and have been categorized differently. In this paper weed flora have been classified for three broad uses and the specific uses of the most common weedy species are described after reviewing literature (Manandhar 2002; Baral and Kurmi 2006) and other unpublished sources.

Food uses of weeds

Vegetables, fruits, fermented plant parts, oil, beverages, spices and flavorings.

Medicinal uses of weeds

Treatment of coughs, colds, sore throat, diarrhea and dysentery, constipation, eye disease, stomachache, injury and snake bites, lung diseases, mouth diseases, parasitic diseases, skin diseases, urinary and venereal disease, and veterinary medicines.

Miscellaneous uses

Dyes, fibers, fish poisoning, fodder and mulches, washing clothes and bathing, and thatch making.

Distribution and Multiple Purpose Uses of Weed Species in Nepal

Ageratum conyzoides L. (Goat weed)

Distribution: Throughout Nepal, most commonly in upland crop field, wasteland and roadsides.

Uses: Crop mulching, bedding material and fodder to livestock, dry powder made from plant is applied to wounds and on ruptures caused by leprosy.

Amaranthus lividus L. (Livid amaranth)

Distribution: Western and central Nepal at an altitude of 1500-2300 m, in open places; also found in the tropical and temperate areas.

Uses: Tender leaves and shoot of plant cooked as a vegetable, a close relative of this species, *Amaranthus viridus* L, is a cultivated vegetable crop.

Argemone maxicana L. (Mexican poppy)

Distribution: Throughout the country up to an altitude of 1400 m, uncultivated land and sometimes upland in rape seed field.

Uses: Latex from shoot is used to treat dropsy, jaundice, and eye troubles; paste prepared from green fruit is applied to treat burns, oil extracted from seed is used in traditional lamps.

Artemisia indica Willd. (Asian mugwort)

Distribution: Throughout the country from 300 to 2500 m altitude; very common along waysides, roadsides, waste land and in the margin of cleared forests and seldom as a weed in upland crop field.

Uses: Considered as very important traditional source of medicine, leaves and roots are chiefly used to prepare medicines by local healers. About 4 teaspoon of juice twice a day is administered to treat diarrhea, dysentery and abdominal pain, the juice is also applied to treat ring worm infection, dried leaves are used as incense and essential oil from leaves has insecticidal properties, compost is prepared from succulent leaves and often used as fodder to goat and bedding material for livestock.

Avena fatua L. (Wild oat)

Distribution: Western and central Nepal from 2100 to 2700 m altitude on moist field, one of the most common weeds in the wheat field.

Uses: Chiefly used as fodder to livestock after weeded out from the field.

Cannabis sativa L. (Hemp)

Distribution: Throughout Nepal up to an altitude of 2700m on open field and neglected land, in Kathmandu valley it often occurs in wheat and other winter/spring crop field.

Uses: Juice prepared from leaf is given in case of diarrhea and dysentery, forr diarrhea and dysentery in livestock, powdered leaf is mixed with livestock feed, is known for preparing local drug called chares (hashish), which is mixed with tobacco and smoked, young fresh leaves are sweetened and eaten, stem bark gives good fiber for preparing racks and rough clothes.

Capsella bursa-pastoris (L.) Med. (Shepherd's purse)

Distribution: Throughout Nepal up to an altitude of 4000 m in open places, and also in the upland field of winter crops.

Uses: Tender leaves are cooked as vegetables, the plant is used as astringent for treating diarrhea and as a diuretic for dropsy.

Chenopodium album L. (Pigweed)

Distribution: Throughout the country up to about 4000 m in moist places, open places and is a common weed of spring crops such as wheat.

Uses: Tender leaves and fruits are used as vegetables, the plant is laxative and anthelmintic, juice from plant relieves eye trouble and cures bloody dysentery, seeds are chewed to cure urinary trouble and relieve discharge of semen through the urine.

Cirsium arvense (L.) Scop. (Canada thistle)

Distribution: Eastern and central part of the country up to an altitude of 1200 m in open places, wasteland and sometimes with upland crops.

Uses: At the young stage, this plant often looks like plant of Mexican poppy, paste prepared from roots, mixed with paste prepared from *Amaranthus spinosus* in equal amount, is administered to treat indigestion.

Convolvulus arvensis L. (Field bindweed)

Distribution: Western and central Nepal from plain area in the south stretching from east to west to the country, also known as Terai, to 4000 m in open places, wasteland and in the wheat field, has been recorded as objectionable weed in the wheat seed certification program.

Uses: Juice made from root of this plant is given to treat fever.

Coryza bonariensis (L.) Cronq. (Hairy horseweed)

Distribution: Western and central Nepal from Terai to 2800 m as a garden escape or weed most commonly occurring in the corn field in mid hill region.

Uses: Juice prepared from plant is applied to treat wounds.

Cynodon dactylon (L.) Pears. (Bermuda grass)

Distribution: Throughout country especially in warm regions up to an altitude of 3000 m, common weed of upland crops, and is found on trails, grassland and uncultivated land.

Uses: Juice of plant is used as medicine to indigestion and is considered anthelmintic, paste from plant is applied to cut and wound, plant has good fodder value, leaves are deemed auspicious in traditional nepali rituals.

Cyperus rotundus L. (Nut sedge)

Distribution: Throughout Nepal in moist and warm places from 300-2400 m.

Uses: Tubers have medicinal value; mainly used as sedative, astringent, and stimulant, also mixed with pounded fruit of black pepper and administered to treat stomach aches.

Digitaria ciliaris (Retz.) Koel. (Crab grass)

Distribution: Eastern and central Nepal up to 600-1500 m in moist places, common weed to both the upland and lowland crops.

Uses: Provides nutritious animal fodder.

Dioscorea pentaphylla L. (Wild yam)

Distribution: Throughout Nepal up to 600-1500 m in moist places, weedy to garden and moist field but not a very common weed.

Uses: Root tubers are boiled, peeled and prepared as a vegetable, curry and pickle. Juice of plant is applied to treat boils.

Eclipta prostrata (L.) L. (False daisy)

Distribution: Throughout Nepal to about 1500 m on moist neglected grounds and upland crop fields.

Uses: Tender leaves and shoots are cooked as vegetable, plant has good medicinal and tonic properties, considered that the plant sap squeezed in water purifies blood and gives energy, paste from plant is also applied to treat wounds and skin diseases.

Echinichloa colona (L.) Link (Jungle rice)

Distribution: Throughout Nepal at 600-2400 m, commonly found in the rice field and mimic to rice at early growth stage.

Uses: Grains are edible and local liquor is also be prepared from the grain, cultivated in marginal upland for grain.

Echinochloa crus-galli (L.) P. Beauv. (Barnyardgrass)

Distribution: Throughout Nepal at 700-2400 m, one of the most troublesome weeds in rice field, especially in the direct seeded rice and also mimic to rice at early growth stage.

Uses: Cultivated in marginal upland for grain, grains are edible and the plant is also used as cattle fodder.

Eichhornia crassipes (Marit.) Solms (Water hyacinth)

Distribution: Common aquatic weed and is distributed throughout Nepal at 200-1500 m. It is commonly found in the moist and boggy areas.

Uses: Tender buds are cooked as vegetables.

Elusine indica (L.) Gaert. (Crowfoot grass)

Distribution: Throughout Nepal up to 2600 m, found both in the rice field and upland crop field as a weed.

Uses: Provides good fodder and bedding material.

Fimbristylis milicia (L.) Vahl (Grasslike fimbry)

Distribution: The most common weed of rice as well as upland crops and is distributed in eastern and central Nepal up 2000 m.

Uses: Provides good fodder to livestock.

Fumaria parviflora Lam. (Fineleaf fumitory)

Distribution: Common to wheat and spring crops and is distributed in central Nepal at about 1300 m. It thrives mostly in moist and shady places.

Uses: The juice from plant is applied to treat cut and wounds.

Galium aparine L. (Stickywilly)

Distribution: Common garden weed and also found in rocky trails of central and western Nepal up to an altitude of 3700-3600 m.

Uses: Juice of plant is applied to treat cuts and wounds, also given in doses of about 4 teaspoons three times a day to relieve from indigestion.

Geranium nepalense Sweet (Crane's bill)

Distribution: Throughout Nepal at 1000-4000 m in moist shady places along ditches and streams.

Uses: Chewed fresh and juice from plant is used in treating renal diseases, roots contain 25-32% tannin.

Imperata cylindrica (L.) P. Beauv. (Thatch grass)

Distribution: Common in upland crops and in the open grassland, distributed throughout Nepal up to 2400 m.

Uses: Good medicinal value in treating diarrhea, dysentery, indigestion and gastric trouble, juice from root is used to relieve asthma, jaundice, and dropsy, paste from inflorescence is applied to cuts and wounds and acts as a sedative when taken internally, commonly used for thatching roof in the rural area and gathered for fodder.

Ischaemum rugosum Salisbury var. *segetum* (Ribbed murainagrass)

Distribution: Common in upland crops and in the open grassland, distributed throughout Nepal up to 800 m in moist places.

Uses: Provides good fodder to livestock.

Mirabilis jalapa L. (Four o'clock plant)

Distribution: Upland weed and is distributed throughout Nepal up to 1800 m in moist open places.

Uses: Tender leaves are cooked as vegetables, the plant has diverse medicinal properties, root is purgative and paste is applied to scabies and muscular swelling, juice prepared from root is beneficial to diarrhea, indigestion and fever.

Monochoria vaginalis (Burman fil.) K. Presl (Duke's tongue)

Distribution: An aquatic and common weed of paddy field, distributed up to 1800 m, also occurs in open places such as margins of ponds and ditches.

Uses: Tender leaves and buds are cooked as vegetable, flower is eaten raw, root is chewed to treat toothaches.

Orobanche aegyptiaca Pers. (Broomrape)

Distribution: Parasitic weed, more common in fodder crop and corn field, distributed from Terai up 3000 m.

Uses: Juice from the root is applied to treat eczema and ring worm.

Paspalum distichum L. (Knot grass)

Distribution: Weed of canal, pond and ditches which reduces irrigation efficiency, distributed throughout Nepal up to 2000 m altitude, occurs in the ponds, ditches, and canals. Uses: Provides good fodder to livestock.

Perilla frutescens (L.) Britton (Knot grass)

Distribution: Weedy in grassland, roadside and garden, distributed throughout Nepal from 600 to 2400 m altitude.

Uses: Roasted seeds are pickled. oil obtained from seed is an ingredient in cookery. Juice prepared from leaves is applied to treat cuts and wounds, contains 1.6% essential oils.

Phalaris minor Retz. (Littleseed canarygrass)

Distribution: The most problematic weeds of wheat, also occurs in barley and is distributed in central and western Nepal at 1000-1600 m altitude.

Uses: Provides good fodder to livestock.

Poa annua L. (Annual bluegrass)

Distribution: Common in upland crops and pasture land, distributed in eastern and central

Nepal at 2300 to 3500 m altitude.

Uses: Provides good fodder to livestock.

Saccharum spontaneum L. (Wild cane)

Distribution: Weed of upland and open places with extensively deep roots. distributed throughout Nepal up to 1700 m.

Uses: Plant is used for thatching roofs and used as livestock fodder.

Vicia hirsuta (L.) S. F. Gray (Vetch)

Distribution: Common weed in spring crops such as wheat, chickpea, lentil and barley, distributed throughout Nepal up to 2700 m.

Uses: Tender leaves, shoots and fruits are cooked as vegetable.

Conclusion

The perspectives on dealing with weeds have changed over the past few decades. Although specific weeds cause a huge loss of field crop yield, invade and destroy natural vegetation and increase the cost of land management, local and indigenous people have been using weeds in daily life for multiple purposes including food, fiber, fodder, traditional medicines, compost and mulches. Weeds are either close or distant relatives of modern day crop varieties. Some plant species left as weed in one part of the world have been utilized as crops in other part. Furthermore, weedy relatives of modern crop varieties retain useful resistant sources for pests and pathogens, which would otherwise be lost in the continuous breeding during variety development. Utilization of weeds to develop natural pesticides could be another reliable resource alternative to modern synthetic agricultural chemicals. Considering all those features of weedy species, a well balanced approach of vegetation management could be a best alternative to avoid harmful economic impacts of weed in the crop field, pastures, gardens, parks and reserves. There is far-reaching scope of harnessing specific benefits from weeds thereby protecting indigenous knowledge and Intellectual Property Rights (IRPs) of local stakeholder in compliance with international commitments such as convention on biological diversity (CBD) and trade related intellectual property rights (TRIPs). The government of Nepal should accelerate its initiatives in introducing regulatory measures which would ensure equitable benefit sharing thereby assisting the upliftment of marginalized local communities who have been using weedy plant species for centuries.

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