



ISSN: 0976-3376

Available Online at <http://www.journalajst.com>

ASIAN JOURNAL OF
SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 09, Issue, 02, pp.7501-7507, February, 2018

RESEARCH ARTICLE

INVASIVE ALIEN SPECIES IN DISTRICT UDHAMPUR, JAMMU AND KASHMIR, INDIA

*Gupta Sanjeev Kumar

Department of Botany, Govt. Degree College Billawar, Jammu & Kashmir, India

ARTICLE INFO

Article History:

Received 20th November, 2017
Received in revised form
26th December, 2017
Accepted 14th January, 2018
Published online 28th February, 2018

Key words:

Biological Invasions,
Biodiversity Loss.

ABSTRACT

A wide spectrum of plants has been introduced to India through international trade and travel. About 40 percent of the total species recorded in India are identified as alien but a very few of them tend to become invasive. Biological invasions are one of the main drivers of biodiversity loss. Some invasive alien species have successfully colonized in most of the area. Of all the recorded species *Lantana camara* is widely distributed in the study area covering hills in the lower elevations. Invasive alien species are posing a serious threat to the biodiversity of the fragile Himalayan region and also proving to be a hindrance to the conservation efforts. The effective management of invasive alien species requires a scientific knowledge of the species and an estimation of the extent of infestation followed by appropriate control and eradication measures.

Copyright © 2018, Gupta Sanjeev Kumar. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The globalization of the world has led to the introduction of many new, non-native and hitherto unknown species into the new areas. Many different words like 'alien', 'exotic', 'non-native' have been used to refer to such species occurring in ecosystems to which they are not native. The Convention on Biological Diversity (CBD, 1992) in its "Interim Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species" defines alien species as "a species occurring outside of its normal distribution". Species which are either introduced or spread outside of their native habitat may tend to out-compete native species and sometimes become invasive and noxious weeds causing huge economic loss or damage to the biodiversity of the region. Such species are designated as Invasive Alien Species (IAS). The flora of any region is subjected to change over the period of time and so is the case with the flora of district Udhampur. It has also undergone a significant change due to a number of factors including biological invasions. There are many attributes that make a habitat susceptible to invasiveness such as species poverty, poorly adapted native species, gaps created by disturbances, constant harvesting of indigenous vegetation for several purposes, presence of empty niches (Mantri *et al.*, 2002). As in other parts of the world, a wide spectrum of plants has been introduced to India through international trade and travel. About 40 percent of the total species recorded in India are identified as alien (Saxena, 1991).

About 25 percent of the introduced species in India became invasive in a short period of time of 50-100 years (Murphy, 2001). Invasion of invasive alien species is one of the main causes of biodiversity loss across the region. Among the major threats faced by native species, the one posed by the invasion of invasive alien species is truly scaring. Invasive alien species may have far reaching and harmful effects on environment and natural resources for generations. Some species also alter the environment in a manner that makes it more favourable for them, but less favourable for native species, often called as ecological facilitation. The damage caused by the invasive alien species in terms of biodiversity loss and disruption of natural ecosystems outweighs their benefits. United Nations General Assembly at its 65th session declared the period 2011-2020 to be "the United Nations Decade on Biodiversity" with a view to contribute to the implementation of the Strategic Plan for Biodiversity. Throughout the 'United Nations Decade on Biodiversity' governments are encouraged to document status survey of biodiversity for its overall conservation at regional, national and international level. The present study aims to document the invasive alien species prevalent in the area, to determine their dispersal mechanisms, impacts on the native species and biodiversity besides their toxic effects on other populations of the ecosystems.

MATERIALS AND METHODS

The study followed a random sampling method so that no bias is introduced. The survey areas were selected at different localities of the district including Majalta, Thial, Mansar, Ramnagar, Basantgarh, Dudu, Ghordi, Chenani, Kud, Patnitop, Sanasar, Sudhmahadev, Mantalai, Gouri-Kund and Latti. The

*Corresponding author: Gupta Sanjeev Kumar
Department of Botany, Govt. Degree College Billawar, Jammu & Kashmir, India

units selected for the study were visited many times of the year to record every stage of the species like flowering, fruiting, seed dispersal and seed germination. The samples were collected, systematically pressed, dried and preserved for identification. The plant specimens were also photographed in their wild state in the ecosystems of their occurrence. The equipments, tools and other related material employed in the study include microscope, dissection microscope, camera lucida, magnifying lens, plant press, cutters, photographic camera, field note-book and polythene bags. The plant specimens were identified by applying taxonomic keys and reference to the local floras. The identification was also facilitated by way of consultations with experts in the field of taxonomy and final confirmation was done by visiting to the local herbaria. Online identification system and ISSG database were also used to identify and determine the alien origin of species. The common names of the plants were ascertained by way of investigations from the elderly men in the vicinity. The information gathered by way of questioning to the farmers and native men was cross verified and then recorded. The plant specimens and photographs of species explored during the course of study were handed over and kept for record in nearest concerned institution. The survey and data collection on the invasive alien species of district Udhampur was carried out from 2015 to 2017. Studies on various aspects of the problem like origin, impacts, toxicity levels and invasiveness were done and have been discussed.

RESULTS AND DISCUSSION

The invasive alien species reported in the area of study were found growing in different habitat such as forestland, grassland, fallow land, wasteland and agricultural areas. Observations concerning habit, morphology, dispersal mechanisms and toxicity of invasive alien species were done. The toxic effects and other impact of such species on the native biodiversity, agriculture and the people were observed, analyzed and recorded. The invasive alien species present in the area have their origin in South, Central or North America, Europe and Africa. All the invasive alien species present and studied in the area are discussed as under:

Parthenium hysterophorus Linn.

Family: Asteraceae.

Common Name: Congress grass.

Native Range: North America.

Description: Annual herb, stem 50-150 cm tall, rigid, branched, whitish, hairy, longitudinally grooved. Leaves simple, pinnately and irregularly much dissected, alternate, forming rosette in younger plants, dissected tips acute, entire. Heads axillary and terminal, whitish with minute or hairy involucre bracts, 4-5 mm across, heterogametic, ray florets usually 5, fertile, disc florets 50 or more. Achenes ellipsoid-obovate and dark brittle.

Dispersal: Propagation takes place through seeds formed in large numbers and dispersed by different agencies like wind, water, birds and vehicles.

Impact: It is an invasive and allelopathic weed of crops, forestland, grassland and fallow land disrupting natural ecosystems by excluding native species and reduces crop yields. It is also toxic to cattle and humans causing dermatitis, respiratory disorders and occasional deaths.

Prevention and Control: (i) The hand picking of weed is advisable due to the allergic effects. (ii) Eucalyptus oil is used as a natural herbicide. It is also susceptible to the standard broad leaved herbicides like 2, 4-D, dicamba, glyphosate, atrazine and S-metolachlor. (iii) Biological control through leaf feeding beetle (*Zygogramma bicolorata*) seems partially successful.

Alternanthera philoxeroides (Mart.) Griseb.

Family: Amaranthaceae.

Common Name: Alligator weed.

Native Range: Tropical America.

Description: Decumbent or ascending perennial herb, aquatic or terrestrial, stem cylindrical, branched, hollow, rooting from the nodes or float in water. Leaves simple, opposite, sessile, elliptical, 2-7 cm x 1-2 cm, glabrous, entire, acute or mucronate, base cuneate. Inflorescence terminal and axillary, almost round clusters, flowers imperfect, bracts and bracteoles subequal, sepals 5, subequal, oblong, white, petals lacking, stamens infertile. Fruit if present, an indehiscent utricle.

Dispersal: Propagates asexually through stem fragments in the absence of seed formation due to infertile stamens.

Impact: Generally grows in the moist agricultural fields, rice fields, marshes, irrigation channels, ditches, shallow slow moving water bodies and often forming dense mats with reduced native species diversity. It also clogs water channels and reduces crop yields.

Prevention and Control: It is difficult to control from land due to extensive underground biomass. (i) Physical removal is both time consuming and expensive. An integrated management of the alligator weed involves both the physical and chemical control. (ii) It is susceptible to the standard broad leaved herbicides like 2, 4-D, picloram etc sprayed to control the terrestrial infestation. (iii) Biological control through natural insect pests like flea beetles, thrips and moths needs to be employed.

Ageratum conyzoides L.

Family: Asteraceae.

Common Name: Billy goat weed, white weed.

Native Range: South and Central America.

Description: An erect, softly hairy, annual herb with rank smell, stems 10-50 cm tall. Leaves ovate, crenate, cordate or cuneate, lamina 4-5 cm long. Heads pale-blue or pinkish purple or white, 6-10 mm in diam., in dense, terminal corymbs. Involucral bracts narrowly linear, ribbed, scarious

margined, glabrous. Achenes black, hairy along the angles, pappus hairs concave below.

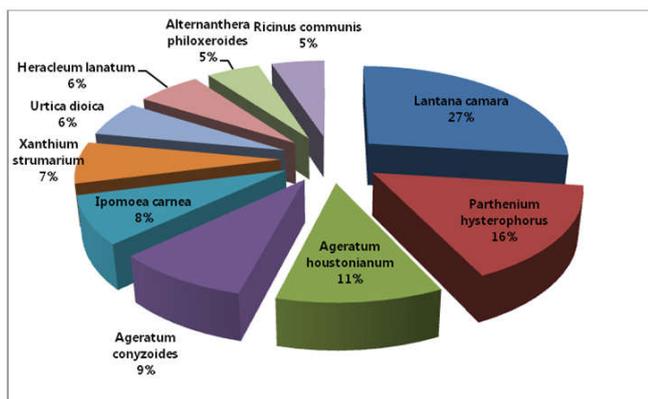


Fig. 1. Dominant Invasive Alien Species (IAS) present in district Udhampur

rounded. Flowers variable, yellow or orange-red. Fruit black and shining.

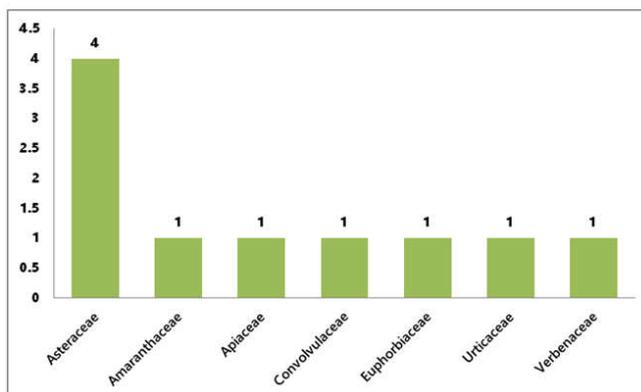


Fig. 2. Dominant families of Invasive Alien Species present in district Udhampur

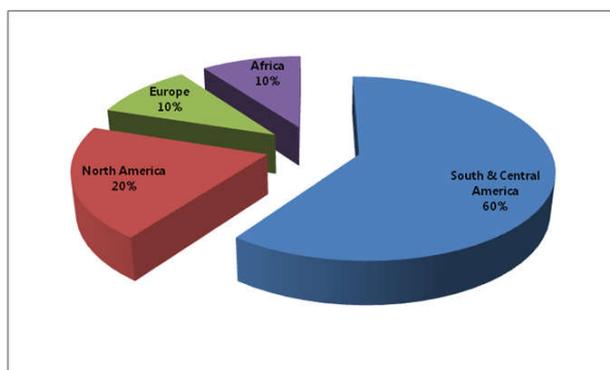


Fig. 3. Native Range of Invasive Alien Species present in district Udhampur

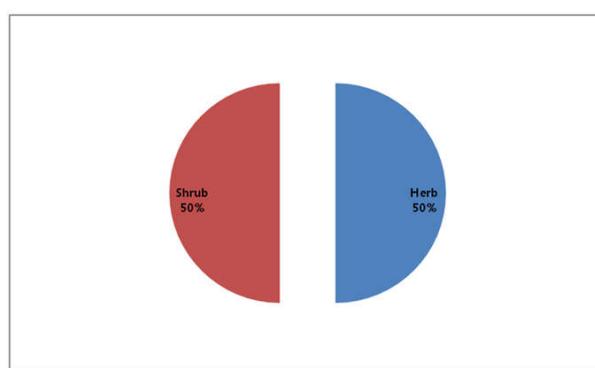


Fig. 4. Predominant life-forms of Invasive Alien Species present in district Udhampur

Dispersal: Propagation occurs through seeds which are formed in large numbers and easily blown by wind to long distances.

Impact: An aggressive invader of agricultural land, grassland, forestland, orchards and by virtue of competition, habitat destruction and allelopathy it excludes native plant species. The toxicity effects of the weed include liver lesions and tumors.

Prevention and Control: (i) Due to its shallow rooted habit it is relatively easy to uproot and control by using mechanical means rather than hand-picking. (ii) It is susceptible to the selective application of a wide range of standard herbicides like butachlor, 2, 4-D, bentazone, oxidiazon, ametryne, terbutryne and acetochlor.

Lantana camara L.

Family: Verbenaceae.

Common Name: Lantana, Tick berry, big sage.

Native Range: Central and South America.

Description: An aromatic straggling, gregarious shrub, branches prickly, 4-angled, densely interlaced into large impenetrable thickets. Leaves rugose, scabrid with rough hairs, ovate or ovate-oblong, 3-10 x 3-6 cm, base cordate, cuneate or

Dispersal: Propagation occurs both vegetatively through axillary shoots and seeds dispersed by birds to long distances.

Impact: An aggressive colonizer of grassland, field margins, pastures, forest edges, fallow lands and degraded forestland, often forming permanent thickets which exclude native plant species and severely harm plant diversity.

Prevention and Control: (i) It is susceptible to the selective application of broad-leaved standard herbicides. Often cleared areas are rapidly colonized through root sprouting or seed. (ii) A combination of mechanical and chemical treatment is more effective to control this weed. (iii) Biological control by using natural pests and pathogens need to be employed.

Ageratum houstonianum Mill.

Family: Asteraceae.

Common Name: Blue Weed, Mexican Paint Brush.

Native Range: Central America.

Description: Annual, hairy herb, 15-60 cm long, erect or decumbent, stem reddish to green, pubescent. Leaves ovate to deltoid, lower opposite, upper alternate, hairy, lamina 3-6 x 2-4 cm, crenate-serrate. Heads homogametic, in terminal corymbs, 5-8 mm across, several disc florets only, ray florets



Fig. 5. Invasive Alien Species (IAS) present in different ecosystems of the study area

absent, corolla 5, tubular, lavender blue, pink, lilac or white. Involucral bracts stipitate glandular on outer surface. Achenes hairy, pappus scales 5, white.

Dispersal: Propagation occurs through seeds dispersed by wind, water, animals and vehicles.

Impact: It is a noxious allelopathic weed which grows in dense patches in crops, forestland, grassland, fallow land and excludes the native plant species from the ecosystems. The weed significantly reduces crop yields and also toxic to cattle.

Prevention and Control: (i) The hand picking of weed is advisable due to its allergic effects. (ii) A 20% solution of common salt can be safely used in non-cropping areas. (iii) It is susceptible to the selective application of standard broad leaved herbicides like 2, 4-D, dicamba and metsulfuron-methyl. Diphenamid application to the soil also reduces the growth of weed.

Urtica dioica L.

Family: Urticaceae.

Common Name: Stinging Nettle, European Nettle.

Native Range: Europe.

Description: A stinging herbaceous perennial, 80-175 cm. Stem robust, upright, grooved, pubescent, fibrous, arising from basal rhizomes. Leaves simple, opposite, 5-10 cm, lower ovate and the upper ones lanceolate, base cordate, acuminate, coarsely serrate, petiolate, petiole not more than half as long as the lamina, stipules free, four at each node 1-2 mm wide, lanceolate, lamina with conspicuous stinging hairs at least on the upper surface, non-stinging hairs relatively coarse and sparse. Inflorescences axillary, spike-like, four per node, many-flowered, flowers small, greenish and unisexual, male and female flowers are found on separate plants, flowers tiny, greenish, the males more upright or patent and the females

tending to be pendent, the male with four perianth segments and four stamens, the female with two smaller and two larger perianth segments and a one-celled ovary with a sessile tufted stigma. Fruits single seeded achenes, flattened, encircled by persistent perianth.

Dispersal: Propagation takes place through underground rhizomes and seeds formed in large numbers. Seeds are dispersed through wind, water and animals.

Impact: Generally seen in large patches in places like wasteland, fallow land, grassland, fence lines, roadside and often forming monospecific stands which besides its horizontal spread through rhizomes destroys habitat and restricts or prevents the growth of native species. The stinging trichomes cause irritation, pain and burning sensation related health problems in humans and animals.

Prevention and Control: The control and eradication of stinging nettle is difficult due to stinging leaves and a large root mass. (i) It can be controlled to some extent by repeated tillage and cultivation of the infested area. Repeated cutting also prevents monospecific stand formation. (ii) Repeated and selective herbicide treatment by using picloram, 2, 4-D, clopyralid, triclopyr and dicamba. (iv) Biocontrol by using natural pests and pathogens like *Eupateryx urticae*, *Liocoris tripustulatus*, *Dasinura urticae* and *Trioza urticae* need to be employed.

Xanthium strumarium L.

Family: Asteraceae.

Common Name: Common Cocklebur.

Native Range: South America.

Description: A stout, foetid, coarse, annual up to 1m tall with purple spotted stem. Leaves long petiolate, undulate, scabrid, obscurely lobed, toothed, lamina 5-12 cm long. Heads discoid, green, male about 6 mm in diam., towards the top of inflorescence, female involucre with 2-enclosed apetalous florets. Fruiting involucre ovoid, hard, 1.5-2 cm long, clothed with hooked prickles. Achenes black and ribbed on the faces.

Dispersal: Propagation occurs through seeds. The spiny burs get attached to animal fur, human clothing and also carried through water.

Impact: It is an invasive weed of grassland, open land, agricultural land and disturbed land. It usually forms thick monospecific stands which drastically reduce soil fertility and crop yield. The weed more commonly out-competes and reduces native species in their natural ecosystems. The glandular hair on leaves and stem cause dermatitis and are poisonous to mammals.

Prevention and Control: (i) Physical removal of seedling reduces infestation. The adoption of zero tillage can reduce population because burs seldom germinate on the soil surface. (ii) It is susceptible to selective application of broad-leaved herbicides like 2, 4-D, glyphosate, dicamba, paraquat and triazines. (iii) Biological control by using natural insect pests

and fungal pathogens like *Puccinia xanthii* and *Alternaria helianthi* is useful to check the invasion.

Heracleum lanatum Michx.

(Synonym: *Heracleum candicans* Wall. ex DC.)

Family: Apiaceae.

Common Name: Cow parsnip, white leaf hogweed.

Native Range: North America.

Description: Erect, pubescent, perennial shrub, up to 2 m in height, stem robust, branched, grooved, hollow, rootstock perennial and odorous. Leaves pinnately lobed, 20-60 cm long, pinnae 2-3 pairs, elliptic to ovate, 7-10 cm long, 3-5 cm wide, densely white tomentose, margins serrate, apex mucronate or obtuse, upper leaves sheathed, sheath large and boat shaped. Inflorescence in compound umbels, 10-20 cm across, peduncles 15-28 cm long, pubescent, umbellules 20-25-flowered, flowers small, white, bracts usually absent, bracteoles 5-8, linear to lanceolate, calyx teeth minute, petals 5, free, notched at tip, outer petals large, bi-lobed. Fruit flattened, obconic, 7-12 mm long, 4-6 mm wide, with broad lateral wings, minutely hairy, glabrous when mature, primary rays many and hairy.

Dispersal: Propagation occurs mainly through seeds dispersed by different agencies like wind, animals, human clothing and water.

Impact: Often seen growing in thickets in woodland, open slopes and meadows. The invasive growth in thick stands destroys habitat and a significant reduction in the native species diversity. The weed due to the presence of furanocoumarins in the sap causes skin rashes and dermatitis to humans, and also harmful to mammals.

Prevention and Control: The management of the infestation of cow parsnip is difficult due to the presence of underground rhizomes and seeds formed in large quantities. The severity of infestation around the fields can be contained by repeated cutting over the years and cultivation of land.

Ipomoea carnea (Mart. Ex Choisy) Austin.

Family: Convolvulaceae.

Common Name: Morning glory.

Native Range: Tropical America.

Description: A robust, perennial shrub, up to 3 m tall, erect or sub-erect, gregarious, diffuse, milky latex present in all parts, stem slender, woody, hollow, glabrous, light-brown in older parts. Leaves simple, alternate, petiolate, ovate, cordate, entire, acute, pubescent, 12-26 by 5-15 cm. Flowers purplish-pink, in terminal cymes, trumpet like, 7-8 by 6-7 cm., sepals 5, free, petals 5, gamopetalous, funneliform, stamens 5. Capsule ovoid, 1.5 by 1.2 cm. Seeds black, densely silky with long and brownish hairs.

Dispersal: Propagates more commonly through stem fragments and also by seeds dispersed through wind and water.

Impact: Generally grows gregariously in swamps, pools, ponds, ditches, marshes as well as on land. The dense growth and allelopathic effects result in loss of aquatic habitat and species diversity.

Prevention and Control: (i) Manual and mechanical removal is not effective in the aquatic environment. (ii) Although the weed is susceptible to the commonly used herbicides but their use is restricted in aquatic habitat due to the harmful effects on other organisms.

Ricinus communis L.

Family: Euphorbiaceae.

Common Name: Castor bean.

Native Range: North-eastern Africa.

Description: Evergreen shrub, up to 5 m tall, glaucous, stem branched, hollow, non woody. Leaves simple, 15-50 cm long, alternate, long petiolate, stipulate, stipules 1-3 cm long, fused into a sheathing bud, caducous, lamina orbicular, membranous, palmately lobed, lobes 5-12, coarsely toothed, reddish-purple to bronze when young, with a reddish tinge when mature. Inflorescence a terminal panicle, cyathia unisexual, in lateral cymes, shortly pedicellate, calyx 3-5, fused, lobed, corolla lacking, male cyathia towards base with many branched stamens, female cyathia distal in position, tricarpellary syncarpous gynoecium represents female cyathium, styles 3, reddish, ovary superior, softly spiny. Fruit ellipsoid to sub-globose, dehiscent, brown, spiny, 1.5-2 cm long, seeds compressed, mottled, shining with caruncle at the base.

Dispersal: Propagation takes place through seeds formed in large number and dispersed by different agencies like birds, rats, water and human activities.

Impact: Generally seen in thick stands in grassland, riparian areas, disturbed areas, field margins, fallow land and waste land where it out-competes and displaces native species. The weed is highly poisonous due to the presence of ricin which is the most toxic naturally occurring substance. It often causes vomiting and even death if ingested accidentally.

Prevention and Control: (i) Physical removal of seedlings and young plants bring down the infestation. (ii) Large plants require stump-treatment with herbicides such as glyphosate, picloram and 2, 4-D which are effective if applied before the plant has set fruits.

Conclusion

Biological invasions now operate on a global scale and will undergo rapid increase in this century due to interaction with other changes such as increasing globalization of markets, rise in global trade, travel and tourism. Many of the introduced alien weeds have successfully colonized in the area. They exhibit high growth rate, rapid multiplication, high dispersal ability and phenotypic plasticity with the result some of them have become invasive in the new environment. In the present

study, the species which have been listed and described along with their toxicity levels and ecological impacts are to be the cause of immediate concern in district. All the invasive alien species are a serious threat to the biodiversity of this fragile Himalayan region. The invasive alien weeds are also proving to be a hindrance to the conservation efforts. Apart from their threats to biodiversity of the region, the invasive weeds have undesirable impacts on crop production, animal husbandry, forestry and human health. *Lantana camara* is widely distributed in the area covering hills in the lower elevations. *Parthenium hysterophorus* and *Ageratum houstonianum* are also among the dominant invasive alien species present in the district. *Ipomoea carnea* generally attacks the ponds and wetlands. No steps have been taken to control and eradicate these obnoxious weeds except by the cultivators in their own piece of land. The effective management requires appropriate knowledge of their ecology, morphology and reproductive biology followed by appropriate management practices. In planning a control programme, it is important to know the weed's life cycle. If it is possible to interrupt the life cycle it becomes very effective control. Crop competition and crop rotation are also the cheapest and most useful methods to curb the weed menace. Crop competition often means using the best crop production methods so favourable to the crop that weeds are crowded out. Early weed competition usually reduces crop yields for more than late season weed growth. A proper quarantine mechanism in place may also check the infusion of species of similar nature in future. The management of invasive alien weeds needs serious collaborative efforts such as (i) Use of certified "Weed Free" seeds. (ii) Building management capacity. (iii) Immediate re-vegetation of disturbed land. (iv) Early detection and eradication. (v) Promote sharing of information (vi) Promote biological control. (vii) Education and awareness.

Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper. All the contents of this article including observations, results, discussion, conclusion and figures are based on the original research work of the author.

Acknowledgements

The author is thankful to the Head, Department of Botany, University of Jammu for providing access to the departmental herbarium, library and other required facilities during the course of research work.

REFERENCES

- FAO Corporate Document Depository. 2003. "Identification of risks and management of invasive species using the IPPC framework: The plant quarantine order in India." 2009.
- Hooker. J.D, (1872-1897). Flora of British India, Vol. I to VII, L. Reev & Co. London.
- IUCN, 2000. Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species. Gland, Switzerland: IUCN.
- Kowarik. L, 2003. Human agency in biological invasions, secondary releases foster naturalization and population expansion of alien plant species. Biological Invasions.

- Mack. M & D'Antonio, C.M, 1998. Impacts of biological invasions on disturbance regimes. *Trends in Ecology and Evolution* 13: 195– 198
- Mandal. F.B, 2011. The Management of alien species in India. *International Journal of Biodiversity and Conservation* 3(9): 467–473.
- Mark. A. Davis 2003. Biotic Globalization: Does Competition from Introduced Species Threaten Biodiversity? May 2003 / Vol. 53 No. 5 • Bio Science 481-489.
- McNeely, J.A, Neville. L.E, Schei. P.J & Waage. J. K., 2004. *Invasive Alien Species: A New Synthesis*. Washington DC: Island Press. Jeffrey. A. McNeely, Harold A. M, Laurie. E. N, Schei. P. J and Waage. J. K. 2004. Global strategy on invasive alien species. In: *Global Invasive Species Programme*.
- Parker. I.M, *et al.* 1999. Impact: Toward a framework for understanding the ecological effects of invaders. *Biol. Invasions*, 1: 3-19.
- Swami. Ajai, Gupta. B.K, 1998. Flora of Udhampur. Bishen Singh Mahender Pal Singh, Dehra Dun.
- Vardien. W, Richardson. D.M, Foxcroft. LC, *et al.* 2012. Invasion dynamics of *Lantana camara* L. (sensu lato) in South Africa. *S Afr J Bot* 81:81–94
- Westbrooks. R. 1998. *Invasive plants, changing the landscape of America: Fact book*. Federal Interagency Committee for the Management of Noxious and Exotic weeds (FICMNEW), Washington, DC.
