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Negative impact of new invasive species *Dolichandria unguis-cati* on the flora in Balh valley of Mandi district, India

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ABSTRACT

India has rich plant and animal diversity. It is amongst twelve mega biodiversity countries of the world and has ten biogeographical regions. It is rich in wild genetic biodiversity and apart from this also hails number of exotic species. Prehistorically, number of plants were introduced and India harbours around 18% exotic flora. Himachal Pradesh is rich in wild as well as exotic plant biodiversity. Approximately, its 40% flora is exotic and of American origin. plants. These plants have reproduced, propagated and naturalized in the new region. Sometimes, these species show aggressive behavior upon finding suitable resources and environmental conditions in a given area. These species have shown high fertility, dispersal rates and it has been reported that they secrete certain allelochemicals that adversely affect the growth and survival of native plants. *Bidens pilosa*, *Lantana camara*, *Eucalyptus* sp, *Parthenium hysterophorus*, *Populus* sp, *Ageratum conyzoides*, *Argemone mexicna* are some of examples of invasive species in India. This study was conducted on a new invasive species *Dolichandria unguis-cati* in Balh valley and its effects on the surrounding flora. This species was introduced as an ornamental climber in the studied area. Within the small duration of time it shows high invasive nature and badly affects the local ecosystem of studied area. Study reveals that this species shows alarming negative effects on local genetic pool of valley. Government should pay attention to eradicate this invasive vine.

***Key words**: Introduction, Exotics, Biodiversity, Naturalization, Invasion.*

Introduction

India is rich reservoir of plant diversity and has world's four hot spot. These area shows high degree of endangered and endemic species (Hazara and Mudgal, 1997 and Chauhan, 1988). It is enriched with both indigenous and exotic species due to varied environmental conditions (McNeely *et al.*, 1990). Exotic species is a foreign or non-native species which is introduced by physical means in to new area. Some of these species show invasive characters like high reproductive rate, seed germination frequency and adaptability than the local native species (Drake *et al.*, 1989). They have freely propagated, reproduced, naturalized and then replaced the native species with their progeny (Raghubanshi, *et al.*, 2005 and Sujay *et al.*, 2010). These invaders secrete allelochemical in their surroundings to check the growth of others plant. They have changed the local environment and adversely affects original flora/fauna of an ecosystem (Sujay *et al.*, 2010 and Pant and Sharma, 2010).

People have intentionally or accidentally introduced many plant species to India. The main pur-

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pose of introduction of exotics is ornamental, high yielding food cereals, fodder, dye, spices and timber etc (Reddy *et al.*, 2008). For example, noxious invasive species *Lantana camara* was introduced as an ornamental plant at the National Botanical Garden, Calcatta in year 1807 (Bhatt *et al.*, 2012 and Kohli *et al.*, 2006). *Eucalyptus* genus has been introduced by Tippu Sultan in 1790 on Nandi Hills near Bangalore. These species are reported invasive and spreads within few years (Pant and Sharma, 2010 and Rao, 1984).

Invasive species can change the soil texture, disturb the nutrient cycles, water table label and fire patterns. Nesting has become difficult for avian. So these species start out-compete with the local flora and disturb the local environment of ecosystem. They thrill a serious threat to the biodiversity and species extinction (Mooney and Hobbs, 2000 and Pandey and Parmar, 1994).

The present study was conducted on '*Dolichandra unguis-cati*'. This is known as cat's claw, cats-claw creeper, funnel creeper in English and belongs to Bignoniaceae family. It was introduced in India as ornamental flower (Kalidass and Murugan, 2016). Species has dual mode of reproductivity. It shows vegetative propagation through adventitious roots and tubers. Sexually, it produces numerous seeds. This species has naturalized in almost all the continents expect Antarctica. Studies show this invasive vine has left 25% of America's land unusable for agriculture (USDA, 2019).

Dolichandra unguis-cati species was introduced as an ornamental flower in the studied area. In some time, this climber has naturalized and become invasive in the Balh valley. It has been easily invading number of trees, climbers and shrubs since in few years. It is widespread on barren land, open sheds, terraces, agricultural land and reaches a height of 18–20 m by climbing trees with claws. Therefore, the present study is designed to look at its invasive characteristics on local plant diversity.

Map 1. Studied areas found infested with *Dolichandra unguis-cati*

Studied Area and Methodology: Balh valley is a very fertile area of the Mandi district. It is located at an elevation of 800 meters. It is a doon shaped valley and famous portion of princely state Suket. Shivalik hills lie in south of the valley. Area is divided into two unequal halves by Suketi streams. Soil of the area is grey-brown loamy in texture.

People are very simple and religious. They are mainly dependent on agriculture for the economy due to the high fertility of the valley. Balh valley is also called as Mini Punjab in H.P. This region is also famous for man-made lake of the Beas-Sutlej Project. Geographically, studied area is located at an elevation of 33° 35' 0 North, 78° 53' 0 East. Balh valley has a humid subtropical climate.

An intensive survey was conducted to see the effects of this invasive species on native plants of Balh valley during the June 2018- March 2020. Semi-structured questionnaire was prepared and desired information about plant species was collected with knowledgeable people (old men, family heads, old ladies, shepherds, foresters) in accordance with the methodology given by Jain, (1987). Samples are collected, dried, identified and pasted on the standard herbarium sheet. For documentation of this topic, literature has been explored and useful information was drawn from these articles/ research papers viz. (ARC- PPRI, 2001; Bhatt, 2012; Cox, 2004; D'Antonio & Vitousek, 1992; Drake *et al.* 1989; Heywood, 1989; Huxel, 1999; Khuroo *et al.*, 2007; McGeoch *et al.* 2010; McNeely *et al.* 2001; Mooney, 1999; Mooney and Drake, 1987; Raghubanshi, 2005; Reddy, 2008; Sandilyan, 2019; Sekar, 2012; Sujay, 2010).

Observations

Dolichandra unguis-cati has spread over large area in Balh valley. It has observed that it destroys open lands, forest area, wastelands. The present study is conducted to observe its invasiveness, activity and effect over trees, shrubs and climbers of the area. A total of 97 species has been found affected by this invasive species (Table 1).

The studied species has very negative effects on

Table 1. List of Plant Species (Tree, Shrubs, Climbers) affected by *Dolichandria unguis-cati*

Tree			
Botanical Name	Family	Botanical Name	Family
Acacia catechu	Fabaceae	*Juglans regia*	Juglandaceae
Aegle marmelos	Rutaceae	*Litchi chinensis*	Sapindaceae
Albizia stipulata	Fabaceae	*Litsea sebifera*	Lauraceae
Artocarpus lacucha	Moraceae	*Mallotus philippensis*	Euphorbiaceae
Bambusa nutans	Poaceae	*Mangifera indica*	Anacardiaceae
Bauhinia variegata	Fabaceae	*Melia azedarach*	Meliaceae
Bombax ceiba	Malvaceae	*Morus alba*	Moraceae
Butea monosperma	Fabaceae	*Morus serrata*	Moraceae
Callistemon lanceolatus	Myrtaceae	*Phoenix sylvestris*	Arecaceae
Cassia fistula	Fabaceae	*Phyllanthus emblica*	Euphorbiaceae
Cedrus deodara	Pinaceae	*Pinus roxburghii*	Pinaceae
Celtis australis	Cannabaceae	*Pistacia integerrima*	Anacardiaceae
Citrus limon	Rutaceae	*Populus ciliata*	Salicaceae
Cordia obliqua	Boraginaceae	*Populus nigra*	Salicaceae
Dalbergia sissoo	Fabaceae	*Prunus cerasoides*	Rosaceae
Diospyros kaki	Ebenaceae	*Prunus domestica*	Rosaceae
Ehretia acuminata	Boraginaceae	*Prunus persica*	Rosaceae
Eriobotyra japonica	Rosaceae	*Psidium guajava*	Myrtaceae
Ficus benghalensis	Moraceae	*Punica granatum*	Punicaceae
Ficus carica	Moraceae	*Pyrus communis*	Rosaceae
Ficus glomerata	Moraceae	*Pyrus pashia*	Rosaceae
Ficus hispida	Moraceae	*Pyrus serotina*	Rosaceae
Ficus palmate	Moraceae	*Quercus leucotrichophora*	Fagaceae
Ficus reliogiosa	Moraceae	*Salix tetrasperma*	Salicaceae
Ficus roxburghii	Moraceae	*Sepium insigne*	Fabaceae
Ficus rumphii	Moraceae	*Syzygium cumini*	Myrtaceae
Ficus semicordata	Moraceae	*Terminalia bellirica*	Combretaceae
Grewia disperma	Tiliaceae	*Terminalia chebula*	Combretaceae
Grewia optiva	Tiliaceae	*Toona ciliata*	Meliaceae
Jacaranda acutifolia	Bignoniaceae	*Vitex negundo*	Verbenaceae
Shrubs			
Adhatoda vasica	Acanthaceae	*Lantana camara*	Verbenaceae
Agave americana	Asparagaceae	*Myrsine semiserrata*	Myrsinaceae
Asparagus adscendens	Asparagaceae	*Prinsepia utilis*	Rosaceae
Berberis aristata	Berberidaceae	*Rubus ellipticus*	Rosaceae
Berberis lyceum	Berberidaceae	*Woodfordia floribunda*	Lythraceae
Boehmeria macrophylla	Urticaceae	*Zanthoxylum armatum*	Rutaceae
Debregeasia seneb	Urticaceae	*Zizyphus nummularia*	Rhamnaceae
Dodonaea viscosa	Sapindaceae	*Zizyphus zuzube*	Rhamnaceae
Duranta repens	Verbenaceae	———	——–
Climbers			
Abrus precatorius	Fabaceae	*Diplocyclos palmatus*	Cucurbitaceae
Bauhina vahlii	Fabaceae	*Hedera helix*	Araliaceae
Cissampelos parriera	Menispermaceae	*Ipomoea turbinata*	Convolvulaceae
Clematis buchananiana	Ranunculaceae	*Rosa banksiae*	Rosaceae
Coccinia grandis	Cucurbitaceae	*Rosa moschata*	Rosaceae
Cuscuta reflexa	Convolvulaceae	*Sechium edule*	Cucurbitaceae
Cyclanthera pedata	Cucurbitaceae	*Smilax aspara*	Smilaceae
Dioscorea bellophylla	Dioscoreaceae	*Stephania glabra*	Menispermaceae
Dioscorea bulbifera	Dioscoreaceae	*Tinospora cordifolia*	Menispermaceae
Dioscorea oppositifolia	Dioscoreaceae	————	————–

the plant resources and depleting diversity by its invasive characteristics. It shows remarkable adverse impact on cultivated - wild edible genetic resources, medicinal, timber and fodder yielding plants of Balh valley (Table 2).

Results and Discussion

This study reveals that this exotic weed can climb over the number of trees, shrubs and climbers. So, it has hazardous effects on our valuable resources (edible, medicinal, timber, fodder and ornamental). *Dolichandria unguis-cati* unravels its dominance over 96 species in Balh valley. It shows maximum dominance over trees with 60 species belonging to 45 genera under 25 families. Further analysis shows 56 tree species with 41 genera belonging 22 dicotyledonous families and 2 species with 2 genera belonging to 2 monocotyledonous families. Two tree species of Pinaceae (Gymnosperm)-*Pinus roxburghii* and *Cedrus deodara* (State tree) has been affected with vine. Moraceae (12 spp with 3 genera) is most damaged

Table 2. List of Various Valuable Plant Resources Affected by *Dolichandria unguis-cati* of Balh Valley

Medicinal Plants		
Abrus precatorius	*Clematis buchananiana*	*Pistacia integerrima*
Acacia catechu	*Dioscorea bulbifera*	*Prinsepia utilis*
Adhatoda vasica	*Diplocyclos palmatus*	*Rosa moschata*
Aegle marmelos	*Ficus benghalensis*	*Smilax aspara*
Agave americana	*Ficus carica*	*Stephania glabra*
Asparagus adscendens	*Ficus glomerata*	*Terminalia bellirica*
Bauhinia vahlii	*Ficus hispida*	*Terminalia chebula*
Berberis aristata	*Ficus reliogiosa*	*Tinospora cordifolia*
Berberis lyceum	*Hedera helix*	*Vitex negundo*
Boehmeria macrophylla	*Mallotus philippensis*	*Woodfordia floribunda*
Butea monosperma	*Melia azedarach*	*Zanthoxylum armatum*
Cassia fistula	*Myrsine semiserrata*	———
Cissampelos parriera	*Phyllanthus emblica*	—-
Cultivated edible resources		
Citrus limon	Mangifera *indica*	*Pyrus communis*
Diospyros kaki	*Prunus domestica*	*Sechium edule*
Eriobotyra japonica	*Prunus persica*	*Syzygium cumini*
Juglans regia	*Psidium guajava*	———
Litchi chinensis	*Punica granatum*	———
Wild edible genetic resources		
Aegle marmelos	*Ficus benghalensis*	*Phoenix sylvestris*
Bauhinia variegata	*Ficus carica*	*Phyllanthus emblica*
Berberis aristata	*Ficus hispida*	*Pyrus pashia*
Berberis lyceum	*Ficus palmata*	*Pyrus serotina*
Cordia obliqua	*Ficus roxburghii*	*Rubus ellipticus*
Dioscorea bellophylla	*Ipomoea turbinata*	*Zanthoxylum armatum*
Dioscorea bulbifera	*Morus alba*	*Zizyphus nummularia*
Dioscorea oppositifolia	*Morus serrata*	*Zizyphus zuzube*
Timber resources		
Albizia stipulata	*Ehretia acuminata*	*Populus ciliata*
Bauhinia variegata	*Litsea sebifera*	*Populus nigra*
Bombax ceiba	*Melia azedarach*	*Quercus leucotrichophora*
Cedrus deodara	*Morus alba*	*Salix tetrasperma*
Celtis australis	*Morus serrata*	*Toona ciliata*
Dalbergia sissoo	*Pinus roxburghii*	—
Ornamental		
Callistemon lanceolatus	*Jacaranda acutifolia*	*Rosa banksiae*
Fodder		
Albizia stipulata	*Bauhinia variegata*	*Grewia disperma*
Bauhinia vahlii	*Debregeasia seneb*	*Grewia optiva*

family followed by fabaceae (7 spp with 7 genera) and Rosaceae (7 spp with 3 genera). Vine causes maximum harm to *Ficus* genus (9 spp). *Ficus* is widely used for edible and medicinal purposes in area.

Study shows that 17 spp with 15 Genera belonging to 11 families of shrubs has been affected in the area. These shrubs are mostly dicot (15 spp with 13 genera belongings to 10 families). Only one monocotyledonous family (2 species with 2 genera) has shown its presence. The numbers of climbers are also not getting rid from this climber.

Data reveals that 19 spp with 16 Genera belonging to 9 families of climbers has been affected. These climbers are mostly dicot (18 spp with 15 genera belongings to 8 families) (Fig. 1). Only 1 species with 1 genera belonging to one monocotyledonous family is covered with vine. Two climbers-*Bauhina vahlii* and *Rosa moschata* are badly damaged. So invasive species shows its dominance mostly on dicotyledonous plants.

Cultivated edible resources (13spp), wild edible resources (24 spp), medicinal (37 spp), timber (17 spp), ornamental (3 spp) and fodder (6 spp) are affected by vine. this is an alarming situations in the area (Fig. 2). This invasive vine hangs and makes a strong wrap with its claws around timber plants and has caused loss to the commercial furniture wood.

Ornamental trees - *Callistemon lanceolatus* and *Jacaranda acutifolia* are badly affected by this invasive vine. *Albizia stipulata*, *Bauhinia variegata*, *Grewia optiva*, *Grewia disperma* are main fodder resources but not escaped from invasion of this species. *Eucalyptus globulus* and *Eucalyptus tereticornis* are exotic and invasive species in the area, but this vine is unable to invade this genus. This species shows its influence on an invavise species named *Latana camara*. Other invasive species viz. *Ageratum conyzoides*, *Ageratina adenophora*, *Galinsoga parviflora*, *Parthenium hysterophorus* and *Bidens pilosa* has no effect of the studied species. *Sepium insigne* is not useful species in this area, but it is badly affected by this species. *Bambusa nutans* is highly utilized bamboo species; rarely *Dolichandra unguis-cati* shows its invasion on it. The studied species has very harmful effect to our wild genetic pool.

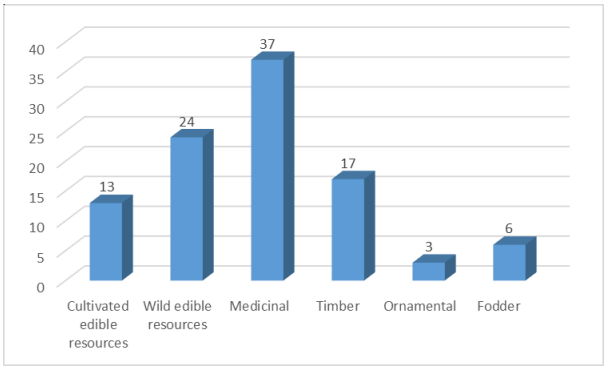

Fig. 2. Histogram Reflecting Quantitative Number of Various Valuable Plant Resources Affected by *Dolichandria unguis-cati* in the Studied Area.

Dolichandria unguis-cati is highly invasive and listed as a category I exotic species (ARC- PPRI, 2011). Intensive research work has been done on exotic and invasive plants of India. Reddy *et al*. and

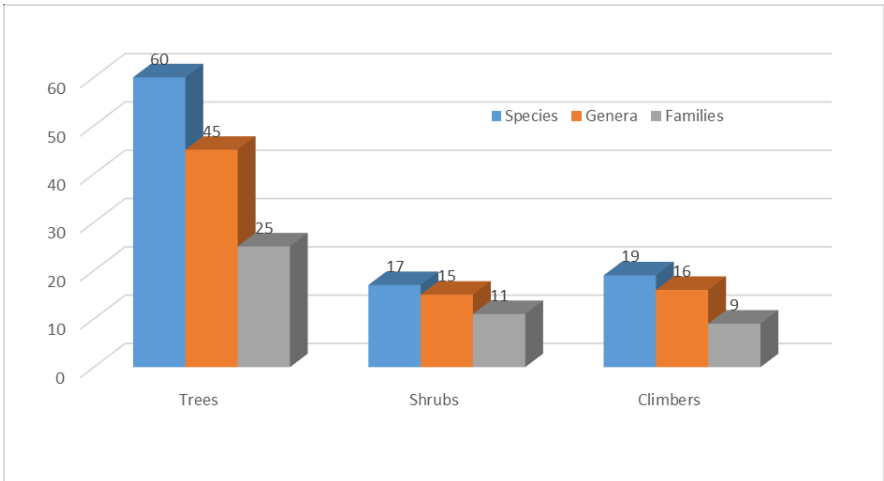

Fig. 1. Histogram Reflecting Quantitative Number of Trees, Shrubs and Climbers Affected by *Dolichandria unguis-cati* in the Studied Area.

Sandilyan has enlisted 173 and 170 invasive plant species in India respectively. Sekar, (2012) has reported 190 invasive species of Himalayan region. But in these studies, this species has been not reported.

Dolichandra unguis-cati species is a new invasive species in the Himalayan region and eroding and deteriorating the valuable genetic resources. This weeds show intensive wide spread during its flowering season (April to May). Yellow funnel shaped flowers can be seen over a large area of Balh valley. Reproductive cycle is very short. Its long flattened beans have been seen hanged over the trees from August month to entire year. This vine has shown a strong dual sexual and vegetative means of reproduction. It produces number of beans enriched with numerous seeds. They germinate without any delay. It shows extensive growth in all directions and make a thick mat on ground. Species has climbed very quickly and densely covered all the branches and stems of affected plants. This causes heavy loss to plant.

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Conflict of interest

This study reveals an alarming situation to environmentalists and ecologist. Species shows high invasive characters and invade a large area of forests, roadsides, orchards, gardens, fields, grounds and other areas over the last few years. Native people have been facing problems due to its adverse effect on the useful plant resources and agricultural land. It is also causing scarcity of fodder in the Balh valley. Ethnobotanically, vine has no medicinal properties or either used for any purpose by the local populace. This species should be removed by physical or chemical means. Local authorities/organizations should take exemplary steps to eradicate this weed from the highly fertile valley.

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