Himalayan Biodiversity **5:** 75-83, 2017 ***ISSN :2382-5200***

A SCATHEL WEED *PARTHENIUM HYSTEROPHORUS* MENACING NATURAL AND AGRO ECOSYSTEM IN KANCHANPUR, NEPAL

M. Joshi, U. Bhat and M.D. Bhatt*

*Department of Botany, Siddhanath Science Campus (TU), Mahendranagar, Nepal

Correspondence author email:bhattmdrp@gmail.com

ABSTRACT

Eighty plant species were recorded along with *Parthenium hysterophorus* from different sites, of which 75 species were recorded from site 1,73 species from site 2 and 77 species from site 3.On the basis of density and IVI, 14 plant species were recorded as dominant (Density >12) among study sites. *Alysicarpus vaginalis* (17.3)*, Casia tora* (17.0), *Cynodon dactylon* (19.7), *Cyperus rotundus* (13.7)*, Evolvulus nummularis* (32.3)*, Mecardonia procumbens* (20.6)*, Oxalis corniculata* (18.6), *Parthenium hysterophorus* (396.0) and *Zizyphus mauritiana* (12.0) at site 1. *Cynodon dactylon* (14.7), *Dactyloctenium aegyptium* (13.0), *Cyperus rotundus* (13.0) and *Parthenium hysterophorus* (135.3) species at site 2 and *Cynodon dactylon* (19.0), *Cyperus rotundus* (29.0), *Desmodium triflorum* (12.6), *Digitaria sanguinalis* (17.7), *Euphorbia hirta* (18.6), *Evolvulus nummularis* (46.6) and *Lathirus athaca* (12.6) and *Parthenium hysterophorus* (303.6) species at site 3. The most common species were *Evolvulus nummularis*, *Cynodon dactylon, Imperata cylindrica, Cannabis sativa, Oxalis corniculata, Ageratum haustorium, Lippia nudiflora, Euphorbia hirta, Portulica olearacea,* and *Solanum xanthocarpum* in all sites. From this survey on different sites of Mahendranagar the result obtained as; the maximum density of *Parthenium* was recorded 396.67 m^{-2}, 135.3 m^{-2} and 303.7 m^{-2} at site 1, 2 and 3, respectively. The sign of higher density of *Parthenium* at site 1 proves the favorable conditions i.e. sandy dry and gravel soil with high temperature. The species richness decreased on increase of *Parthenium* density in all study sites. Socio-economic surveys recorded health problems for cattle such as skin allergies, wounds, eye redness, and wounds around the mouth, loss of thirst and loss of appetite. The height of the *Parthenium* was recorded 196.4±2.96 cm, 176 ±7.50 cm and 96.0±9.31 cm at site1, 2 and 3, respectively. Similarly, highest leaf area, petiole length and circumference was recorded 263.6±22.26 cm^2, 8.16 ±0.77 cm and 7.72±0.64 cm, respectively at site 1,2 and 3, respectively.

Key words: Important Value Index (IVI), Invasion, species composition, weed.

INTRODUCTION

Invasive species are recognized as one of the major threats to native species and ecosystems around the world (Kathiresan, 2004; Kathiresan *et al*., 2005). Invasive species are of concern because of their capability of spreading fast, their high competitiveness and ability to colonize new areas within short periods. The major invasive species *Parthenium hysterophorous* is tremendously distributed. *Parthenium* belonging to the family Asteriaceae, is an annual herb, erect; the stem is branched and covered with trichomes. Flowering occurs about a month after germination. Seeds do not have dormancy period and are capable of germinating anytime when moisture is available. It can produce large amount of seeds (up to 100,000 per plant) (CRC, 2003). The seeds of *Parthenium hysterophorous* is mainly dispersed through water currents,

animals and the movement of vehicles, machinery, livestock, grain, stock feed and other products.*Parthenium hysterophorus*, commonly known as false ragweed, star weed, bitter weed, white top, bastard, feverfew, congress grass etc. *Parthenium hysterophorus* is of particular concern because of its invasive and allopathic properties. According to Kanchan (1975), the concentration of allelochemicals *viz*. parthenin, caffeic acid and pcoumaric acid which are present in *Parthenium* have serious allopathic effects.

The First occurrence of the weed in Nepal was reported by Malla from Trishuli in 1967 (Tiwari *et al*., 2005). *Pathenium* weed is also known to have caused human health problems like asthma, bronchitis, dermatitis and hay fever (Sriama*et al*., 1991; Kololgi *et al*., 1997). Direct Contact with *Parthenium hysterophorus* causes inflamed udder, fever and rushes in cows and allergic inflammation in the mouth of other cattle. Buffalo and bull calves suffer from toxicity, ulceration in mouth and digestive tracts (Chippendale and Panetta, 1994). *Parthenium* offers a big challenge to all attempts of control because of its high regeneration capacity, production of huge amount of seeds, high seed germination ability and extreme adaptability to a wide range of ecosystems. Although few herbicides can control the weeds, the huge amount of *Parthenium* cannot be controlled economically by chemicals. However, in Nepal little data of scientific investigation have little information regarding *Parthenium,* its impact and about its management. It is hoped that this study comes up with information and may develop management options capable of controlling aggressive invasion of *Parthenium*.

MATERIALS AND METHODS

Study Site

Kanchanpur is the Far Western Terai district of Nepal. Geographically Far Western Development Region lies between 28^0 31' to 30^0 12' North latitudes and 80^0 4'to 81^0 45' East longitudes. The altitude varies from 176 to 7134 above the mean sea level (amsl). In Mahendranagar, the present investigation area is situated at 28^0 32' to 29^0 28' N latitudes and 80^0 03' to $80^0$33' E longitudes with an altitudinal range of 76 to 300 amsl. The present survey was planned and carried out in different sites at Mahendranagar on three different land types, *viz*. roadsides (site 1), agro-fields (site 2) and public parks (site 3).During this study the average maximum temperature ranged from 21.1° C to 38.4° C and average minimum temperature was recorded 7.5° C. The total annual rainfall was recorded 2276.6 mm at Mahendranagar.

Data collection

The life cycle of *Parthenium* completes within a year. Hence, survey was carried out during July, 2016 to July, 2017. The present survey was carried out by systematic visits of the study site at definite regular interval of a month. During the visits, the natural habit, growth form, phenology, composition of plant species with *Parthenium* was determined by visual observation. Quadrats of 1×1 m size were laid down randomly in the study sites for species composition. In these stands, three replicates were executed using the appropriate size of quadrats. The species with higher IVI value were considered as dominant species with *Parthenium.* Collected plant species were identified with the help of authentic literatures. Ten fresh and healthy plants were selected randomly from each site and height of plants from base to top was measured by scale in centimeter. For the measurement of leaf area, ten fully expanded leaves of *Parthenium*

were collected from each site on maturation and calculation was done as per Zobel *et al*. (1987). Density and frequency was calculated as per Misra (1968). The Importance Value Index (IVI) was calculated as per Curtis and McIntosh (1951) for each species. Socio-economic surveys were conducted in all study sites using open ended, semi structured questionnaires involving farmers, cattle grazers, fodder collectors, community forest users' group, and health workers, to understand the public opinions. A total of 41 interviews were conducted in the study sites. Furthermore, public discussions were held with different target groups in order to raise awareness about the impacts of *Parthenium*.

RESULTS

Composition of plant species with *Parthenium* are enumerated along with density and IVI. A total of 80 species along with *Parthenium* belonging to 31 different families. In the present survey, the dominant families found as Poaceae (12 species), Asteraceae (9 species), Cyperaceae (6 species), Leguminosae (5 species), Amaranthaceae (4 species), Commelinaceae (3 species) (Table 1). From this survey on different sites of Mahendranagar the result obtained as; the maximum density of *Parthenium* was recorded 396.67 m^{-2} at site 1, 135.3 m^{-2} site 2 and 303.7 m^{-2} at site 3. The sign of higher density of *Parthenium* at site 1 proves the favorable conditions i.e. sandy dry and gravel soil with high temperature. The species richness decreased on increase of *Parthenium* density in all study sites (Table 1).

Table 1: Diversity composition of plant species with their density and IVI in different study sites.

Name of plant species	Family	Site 1		Site 2		Site 3	
		D*	IVI	D*	IVI	D*	IVI
Acyranthes aspera L.	Amaranthaceae	2.7	4.2	-	-	2.0	4.1
Ageratum haustorium L.	Asteraceae	5.3	17.0	4.3	18.6	2.7	4.2
Ajuga bracteasu Wall. ex Benth.	Labiatae	4.3	4.4	4.6	4.6	2.0	4.1
Alternanthera sesessilis (L.) DC.	Amaranthaceae	3.6	4.3	5.3	17.5	5.3	17.1
Alysicarpus vagenalis (L.) DC.	Leguminosae	17.3	18.4	2.0	4.4	9.0	17.6
Amaranthus spinous L.	Amaranthaceae	9.0	17.4	1.0	3.7	1.3	5.1
*Amaranthus viridus*Roxb.	Amaranthaceae	9.0	17.4	10.7	18.6	5.0	17.0
Anagallis arvensis L.	Primulaceae	3.0	4.2	9.0	18.2	5.0	16.6
Argemon Mexicana Linn.	Papaveraceae	10.3	17.6	5.7	17.6	6.0	17.2
Artemisia vulgaris Linn.	Asteraceae	1.3	4.1	11.6	18.7	0.3	3.0
Azadirachta indica L.	Meliaceae	0.6	3.5	0.3	3.1	-	-
Bacopa monnieri (L.) Tannel	Plantaginaceae	-	-	6.3	17.7	0.7	3.5
Bidens pilosa L.	Asteraceae	8.7	17.4	1.3	4.5	6.0	17.2
Brachieria ramose (L.) Stapf.	Poaceae	10.0	17.6	6.0	17.9	6.7	17.3
Calotropis gigantea Linn.R.Br	Asclepidaceae	7.3	17.2	0.3	3.1	2.0	4.2
Cannabis sativa Linn.	Cannabiaceae	10.0	17.6	4.7	4.9	2.7	16.7
Cassia tora L.	Leguminosae	17.0	18.4	1.6	3.8	3.3	4.3
Centella asiatica (L.) Urb.	Apiaceae	5.3	17.0	0.3	3.07	7.0	17.3

Chenopodium album L.	Chenopodiaceae	-	-	6.3	18.4	0.3	3.9
Cissampelos pareira L.	Menispermaceae	2.0	4.1	-	-	0.3	3.6
Clerodendrum indicum (L) Kuntze	Labiatae	2.6	4.3	0.3	3.0	2.0	4.1
Commelina benghalensis L.	Commelinaceae	2.6	4.2	7.0	17.8	2.0	4.1
Commelina paludosa Blume	Commelinaceae	8.7	17.4	5.3	17.5	2.6	4.2
Cynodon dactylon. (L.) DC.	Poaceae	19.7	18.7	14.7	19.3	19.	19.0
Cyperus difforms L.	Cyperaceae	2.0	4.14	2.0	4.41	3.0	4.3
Cyperus esculenta L.	Cyperaceae	2.6	4.2	4.0	4.8	10.0	17.7
Cyperus iria L.	Cyperaceae	2.3	4.18	8.7	18.2	4.3	4.4
Cyperus rotundus L.	Cyperaceae	13.7	18.0	13.0	19.0	29	42.8
Dactyloctenium aegyptium (L.) Gaertn.	Poaceae	6.0	17.1	13.0	19.0	6.7	17.3
Desmodium triflorum (L.) DC.	Leguminosae	7.0	17.2	8.66	18.2	12.6	26.3
Digitaria ciliaris (Retz.) Koeler	Poaceae	10.3	17.6	9.3	18.3	7.3	17.3
Digitarias anguinalis (L.) Scop.	Poaceae	3.6	4.34	8.3	5.6	17.7	18.7
Eclipta prostrata (L.)	Asteriaceae	6.3	17.1	11.0	18.6	2.3	4.2
Elsholtzia eriostachya (Benth.)	Labiatae	5.3	17.0	5	16.7	3.6	4.4
Elusine indica (L.) Gaertn.	Poaceae	4.3	4.4	9.6	18.4	8.6	17.5
Epatorium adenophorum L.	Asteraceae	10.0	17.6	3.3	4.6	5.6	17.1
Eqisetum debile (Rox)	Eqisetaceae	1.3	4.0	-	-	0.3	3.0
Eragrotis tenella (Retz.) Stapf.	Poaceae	0.6	3.0	-	-	0.3	17.7
Eragrotis unioloids (Retz.)NeesexSteud.	Poaceae	2.0	4.1	7.6	18.0	9.0	17.6
Euphorbia hirta L.	Euphorbiaceae	5.33	17.0	6.3	22.5	18.6	17.3
Evolvulus nummularis (L.) L.	Convolvulaceae	32.3	42.8	9.3	18.3	46.6	45.1
Fimbristylis miliacea (L.) Vahl	Cyperaceae	4.0	4.3	10.3	18.5	3.6	4.4
Fimbristylis ovata (N.L.Burman) Kern.	Cyperaceae	1.3	4.1	4.0	4.8	4.3	4.5
Ficus benghalensis (Linn.)	Moraceae	0.6	3.5	-	-	0.3	3.0
Hemigrapis hirta L.	Acanthaceae	8.3	17.4	6.0	17.6	7.3	17.3
Imperata cylindrical (L.) P. Beauv	Poaceae	4.0	4.3	1.3	4.2	9.0	17.6
*Ipomea aquatica*Forssk.	Convolvulaceae	3.3	4.3	2.0	4.4	-	-
Lathyrus aphaca L.	Leguminosae	2.3	4.2	8.6	18.2	12.6	5.6
Lautana camera (L.) Moldenke	Verbenaceae	4.0	4.3	-	-	2.0	4.1
Lidwigia perennis L.	Onagraceae	-	-	4.0	4.8	-	-
Linder niaprocumbens (Krock.)Borbas	Scrophulariaceae	-	-	8.0	18.0	6.0	17.2
Lippia nudiflora (L.) Rich	Verbenaceae	10.3	17.6	9.3	18.3	6.0	17.2
Marsilea minuta L.	Marsileaceae	0.3	3.0	7.6	18.0	0.6	3.0
Mecardoni aprocumbens (Miller) Small	Scrophulariaceae	20.6	4.3	6.3	17.9	4.6	4.5
Mimosa pudica L.	Leguminosae	1.6	3.6	-	-	6.0	17.2

Murdannianudiflora (L.) Brenan	Commelinaceae	-	-	7.0	18.0	5.0	17.0
Oplimenus burmanii (Retz.) P. Beauv.	Poaceae	1.66	3.6	4.6	4.9	2.0	4.1
Oxalis corniculata L.	Oxalidaceae	18.6	17.2	5.6	17.6	7.3	17.3
Parthenium hysterophorus L.	Asteraceae	396.0	146.9	135.3	125.9	303.6	139.7
Paspalidium flavidum (Retz.) A. Camus	Poaceae	1.6	3.6	2.3	4.4	1.3	3.6
Paspalum conjugatum Berg.	Poaceae	2.0	4.1	2.6	4.5	4.6	4.5
Persicari abarbata (L.) Hara	Polygonaceae	5.6	17.0	1.3	3.7	2.6	4.2
Phyllanthus urinaria L.	Euphorbiaceae	2.3	4.2	4.3	16.8	3.6	4.4
Portulica oleracea L.	Portulaceae	9.0	17.4	4.3	4.8	9.0	17.6
Primula veris(L.)	Primulaceae	2.3	4.1	2.0	3.9	4.6	4.5
Rumex nepalensis Sprenge	Polygonaceae	11.0	4.2	1.3	3.7	8.6	17.5
Scoparia dulcis L.	Scrophulariaceae	2.3	3.7	1.6	3.8	6.0	4.3
Senecio vulgaris L.	Compositeae	6.0	17.1	5.0	17.5	8.0	17.4
Setaria glauca Beauv.	Poaceae	3.3	4.3	7.0	17.8	10.6	17.8
Sida acuta Burm. f.	Malvaceae	5.6	17.0	2.6	4.5	2.6	4.3
Sida rhombifolia L.	Malvaceae	5.7	17.0	4.0	4.8	1.0	3.4
Solanum nigrum (L.)	Solanaceae	3	4.2	4.3	4.9	2.7	4.2
Solanum xanthocarpum Sachrad and Wendl	Solanaceae	8.3	17.4	5.0	17.5	3.0	4.3
Sonchus asper (L.) Hill	Solanaceae	4.3	4.4	2.0	4.4	7.0	17.3
Syzygium cumini (L)Skeels	Myrtaceae	1.3	3.4	0.7	3.1	0.6	3.5
Tridax procumbens L.	Asteraceae	0.7	3.5	1.0	3.7	1.3	4.1
Trifolium repens L.	Leguminosae	3.3	4.3	7.3	17.9	9.7	17.7
Urena sinuate L.	Malvaceae	1.7	4.1	0.6	3.1	1.0	3.4
Xanthium strumarium L.	Asteraceae	4.0	4.4	0.6	3.1	1.3	4.1
Zizyphus mauritiana Lam	Rhamnaceae	12.0	17.8	-	-	0.7	3.5
	-	396.6	-	135.3	-	303.7	-

D= Density, IVI= Importance Value Index.

Species Composition: The density and composition of plant species (Table 1) with *Parthenium* at site 1; 396.6 m^{-2}, at site 2; 135.3m^{-2} and at site 3; 303.7m^{-2} indicate that agro-site has lower species density than the other two sites. In the road site the maximum density was contributed by *Evolvulus nummularis* (32.3 m^{-2}), and the least density was contributed by *Marsilea minuta* (0.3 m^{-2}). Similarly, at agro-field the maximum density was contributed by *Cynodon dactylon* (14.7 m^{-2}) and least density was contributed by *Clerodendrum indicum*, *Azadirecta indica* and *Centella asiatica* (0.3 m^{-2}). In the public place the maximum density was contributed by *Evolvulus nummularis* (46.6 m^{-2}) and the least density was contributed by *Artemisia vulgaris, Chenopodium album, Cissampelos pareira, Eqisetum debile* and *Eragrotis tenella* with density 0.3 m^{-2}.Some of the similarities of present survey agrees with the finding of Bhatt *et al*. 2007 in Far Western Nepal.

Socio-economic Survey: In the present study, socio-economic surveys were conducted in all study areas using open ended, semi structured questionnaires involving farmers, cattle grazers, fodder collectors, community forest users' group, and health workers, to understand the public opinions. By grazing cattle on *Parthenium* invaded areas, 46 % noticed health problems for cattle such as skin allergies, wounds, eye redness, and wounds around the mouth, loss of thirst and loss of appetite. Most of the fodder collectors from each site noticed allergy when the body surface came to contact with dew present in *Parthenium* leaves. More health risks were noticed during sunny days too. Among forest user it was noticed that the disappearance of *Cassia tora, Ageratum haustorium, Cyperus rotundas, Euphorbia hirta, Cynodon dactylon, Dactyloctenium aegyptium, Amaranthus spinosus* etc and many herb species due to its infestation. From health worker it was recorded that allergic problems of throats and skin for cattle were mostly documented (55 %) during the summer season at all sites. About 44 % of veterinary doctors of all sites used Avil injection and Flexona for the allergic treatments of animals and found effective.

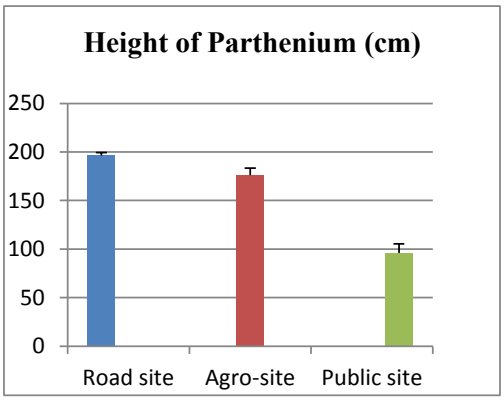

Fig. 1: Height of *Parthenium* at different sites

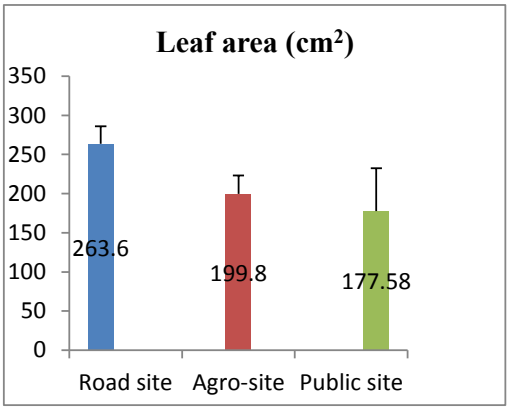

Fig. 2: Leaf area of *Parthenium* at different sites

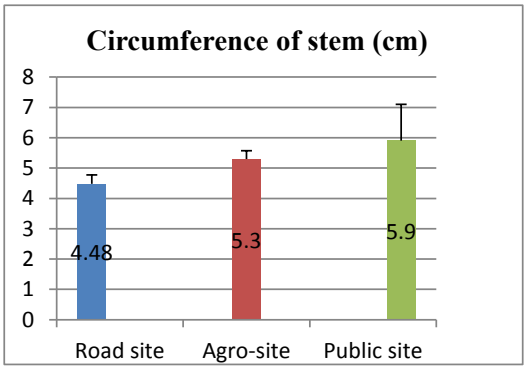

Fig. 3: Circumference of *Parthenium* at different sites

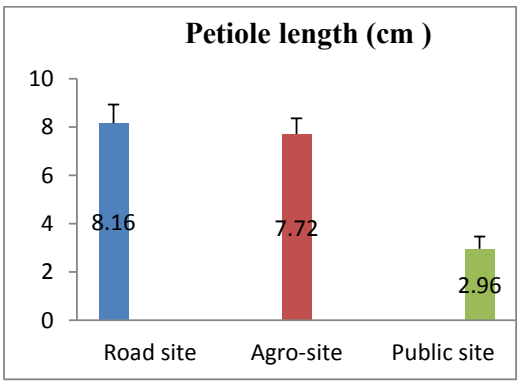

Fig. 4: Petiole length of *Parthenium* at different sites

Ecological study of *Parthenium*: The average height of the *Parthenium* was recorded 196.4±2.96 cm, 176±7.50cm and 96.0±9.31 cm at road site, agro field and public places, respectively (Fig. 1).The highest leaf area was

recorded at the road side, i.e. 263.6±22.26 cm^2 and minimum at public places (177.58±54.64 cm^2) (Fig. 2). Similarly, the maximum mean length of the petiole was recorded 8.16±0.77 cm at road site and the minimum length 2.96 ±0.51 cm at public places site. Petiole length at agro site was recorded 7.72±0.64 cm (Fig. 3). The mean of the circumference of the stem was recorded highest at road site 5.9±1.20 cm and lowest at public places 4.48 ±0.29 cm (Fig. 4).

DISCUSSION

The present distribution of *Parthenium* in Nepal covers most urban areas in tropical to sub-tropical regions at altitudes ranging from 75 to 1350 m (Tiwari *et al.,* 2005). Because of the invasive nature*, Parthenium* is spreading rapidly along roadsides, fallow lands, and range lands in urban areas and it is gradually invading agricultural lands and forest in Nepal (Joshi, 2005; Timilsina, 2007; Shrestha, 2008). The composition of plant species with *Parthenium* was varied among the different sites. In the present survey, 80 plant species from different 31 families including *Parthenium hysterophorus* were studied in all study site. Among them 75 (93.75%) species of plant with *Parthenium* were recorded from road site. Similarly, 73 (91.25%) and 77 (96.25%) plant species were recorded among agro-site and public site, respectively. In road site *Bacopa monnieri, Chenopodium album, Ludwigia perennis, Lindernia procumbens, Murdannia nudiflora* species were absent*,* whereas *Mimosa pudica, Lantana camera, Ficus benghalensis, Equisetum debile, Cissampelos pareira, Achyranthes aspera, Zizyphus mauritiana* were absent in agro-field. Similarly*, Ludwigia perennis, Ipomea aquatica*, *Azadirachta indica* species were absent at public park site. Due to the favorable conditions for seed dispersal mode, high disturbance on natural vegetation cover, the low fertility of soil and the dry habitat around the industrial areas and road sides, invasion might be high in those sites. The common species of plant found in all sites were *Evolvulus nummuralus*, *Cynodon dactylon, Oxalis corniculata*, *Ageratum haustorium, Cannabis sativa, Amaranthus spinosus, Amaranthus virudus*. The dominant families were found to be Poaceae (15%), Asteraceae (11.25%), Cyperaceae (7.5%), Leguminosae (6.25%), Amaranthaceae (5%), and Commelinaceae (3.75%).

The *Evolvulus nummarulus* might have strong association or competitive vigour with *Parthenium hysterophorus.* Karki (2009) reported *Xanthium strumarium* as most competitive species with *Parthenium*. But *Azadirachta indica, Cissampelos pareira, Cyperus difforms, Equisetum debile, Ficus benghalensis, Ipomea aquatica, Launtana camera, Ludwigia perennis, Paspalidium flavidum, Tridax procumbens, Urena sinuate,* were negatively affected by *Parthenium* invasion. Suppression of these species, in their growth and seed germination might be due to the lower competitive vigor of those species against *Parthenium hysterophorus.* Timlsina (2007) reported *Trifolium repens*, *Imperata cylindrica* and *Dactyloctenium aegypticum* as affected by *Parthenium* invasion and abundance of palatable species decreased with possible impact on fodder supply. Ahmed (2003) and Belaynesh (2006) indicated that due to this new invader (*Parthenium*) in the area, most of the valuable species are disappearing as a consequence there was forage scarcity. Similar problem was reported from the pastoral areas of central Queensland where *Parthenium* was the dominant species under certain conditions by producing negative effects on the growth and performance of the associated beneficial forage plant species.

Density of *Parthenium hysterophorus* was found to be 396.7 m^{-2}, 135.3 m^{-2} and 303.7 m^{-2} at road site, agro site and public site, respectively. It might be due to the high seed dispersion by the movement of vehicles and abandonment of land in road site areas. Species richness found decreasing on increasing *Parthenium's* density. Adkins and Sowerby (1996) experimentally proved that *Parthenium* have allopathic effect in its root and shoot leachates and thus has the ability to reduce growth and germination of numerous associated species. Mechanism of decrease of species richness is elaborated by Navie *et al*. (1996). Sometimes at early stage, *Parthenium* takes the form of rosette that requires suitable open area to grow, spreads rapidly to grow thus interfering the emergence of other seedlings.

Parthenium is responsible for health problems in cattle and human beings such as skin allergies, wounds, boils, and eye redness, wound around the mouth, loss of thirst and loss of appetite directly or indirectly. Feeding of the fodder from *Parthenium* invaded area spoiled both the quality and the quantity of milk and meat. Some people suggested that it would be better to prevent animals from feeding on *Parthenium* at least five days prior to slaughtering in order to minimize the risk of losing the meat quality (Ayele, 2007). A female livestock owner in Kirtipur Municipality who collected *P. hysterophorus* to be used as an animal bedding also developed a significant skin allergy (Shrestha, 2008). The accidental inclusion of *P. hysterophorus* within harvested fodder grasses has led some Nepalese farmers to abandon this practice of harvesting within invaded regions (Karki, 2009). During the early 1990s, farmers in Hetauda used this weed as animal bedding and subsequently for composting (Karki, 2009). However, they soon noticed lesions on their stock's skin, with buffaloes reported to be more sensitive than cattle.

The average height of *Parthenium* was recorded from range 96– 197 cm. Shrestha (2008) reported *Parthenium* height 112 cm in his study held in Kathmandu valley. His finding is included within value range of our examined height. Kumariand Kohli (1987) reported *Parthenium* height as 150cm. Leaf area was obtained at range value of 170-263 cm^2 from all study site.

Although small in area, Nepal is exceptionally rich in biodiversity. The diverse climatic condition is very much favorable to grow and establish several kinds of flora and fauna. But the introduction of alien invasive species *Parthenium,* is suppressing the growth of various species. Our investigations demonstrate that agro field is less affected by *Parthenium* at present time i.e crops are less suppressed. More than 80% of Nepalese people depend upon agriculture for their socio- economy. What results if crop fields are also invaded by *Parthenium* as in many other countries? That's why its control becomes an urgent need to conserve socio economy. Long term management programs and awareness programs should be carried out to control this weed. Government should conduct well organized, co-ordinate and concerned efforts strictly to control or eliminate this weed. Local people also rise to control this weed in unison with NGO's, INGO's and other social institutions.

ACKNOWLEDGEMENTS

The First two authors are thankful to their supervisors Dr. M.D. Bhatt, Head, Department of Botany Siddhanath Science Campus, Mahendranagar, Nepal, for his cooperation in identification of plant species, manuscript preparation, overall supervision, and facilities through the project period.

REFERENCES

Ahmed, B., (2003). Soil condition and vegetation cover in human impacted rangelands of Jijiga, Somali Regional State. An MSc Thesis Presented to the School of Graduate Studies of Alemaya University, Ethiopia. 108p.

Ayele, S. (2007). *The Impact of Parthenium (Parthenium hysterophorus L.) on the Range Ecosystem Dynamics of the Jijiga Rangeland, Ethiopia* [M. A. Dissertation] Department of Animal Sciences, School of Graduate Studies, Haramaya University. 117p.

Belaynesh Debalkie, (2006). Floristic composition and diversity of the vegetation, soil seed bank flora and condition of the rangelands of the Jijiga Zone, Somali Regional State, Ethiopia

Bhatt, M.D., S.P. Singh and A. Tewari (2007). Floristic composition and Phenology of major weed species associated with paddy fields in foothills of Far Western Nepal. *Nepal Journal of Science and Technology* **8:** 27-33.

Chippendale, J. F. and F. D. Panetta (1994). The cost of *Parthenium* weed in Australia Cattle industry. *Plant Protection Quarterly* **9**:73-76.

Curtis, J.T, and R.P. Mclntosh (1951). *An upland forest continuum in the Prarie Forest border region of Wisconsin. Ecology* **32**: 476-96.

Joshi, S. (2005). *Reproductive Efficiency and Biomass Allocation of Invasive weed, Parthenium hysterophorus* L. [M.Sc. Dissertation]. Central Department of Botany, Tribhuvan University, Kathmandu, Nepal. 69 p.

Kanchan, S.D. (1975). Growth inhibitors from *Parthenium hysterophorus* L. *Current Science*. **44**: 358-359.

Karki, D., (2009). Ecological and Socio-economic Impact of *Parthenium hysterophorus* L. Invasion in Two Urban Cities of South-Central Nepal [MSc theis]. Central Department of Botany, 338. *J. Nat. Hist. Mus.* **25**, 2010 Tribhuvan University, Kathmandu.

Kathiresan, R. M. (2004). Invasive weeds in agro-ecosystems of South India [Abstracts]. In: *National Workshop on Invasive Alien species and Biodiversity in India*, Banaras Hindu University, Vanarasi, India. 149 p.

Kathiresan, R.M., I. Gnanavel, R. Anbhazhagan, S.P. Padmapriya, N.K. Vijayalaxmi and M.P. Arulchezhian, (2005). Ecology and control of *Parthenium* invasion in command area. *Proceedings of the 2nd International Conference on Parthenium Management*, December 5-7, 2005, Bangalore, India. pp:77-80.

Kololgi, P.D., S.D. Kololgi and M.P. Kololgi. (1997). Dermatologic hazards of *Parthenium* in human beings. In: *Proceedings of first international conference on Parthenium management University of Agricultural Science*, Dharwad, India. Pp. 18-19.

Kumari, A. and R. K. Kohli (1987). Autotoxicity of Ragweed *Parthenium* (*Parthenium hysterophorus* L.). *Weed Science* **35**: 629-632.

Misra, R. (1968). *Ecology Workbook*. Oxford and IBH Publishing Co., New Delhi, India.

Navie, S. C., R. E. McFadyen, F. D. Panetta and S. W. Adkins (1996). The biology of Australian weeds 27. *Parthenium hyterophorous* L. *Plant Protection Quaterly* **11**: 76-88.

Shrestha, B. B., (2008). *Phaileda Hanikarak Banaspati* [Nepali]. Kantipur National News 17th May 2008. p10.

Sriama, R., S. Naggpal, B.S. Rao, O. Prakash and P.V. Rao (1991). Immediate hypersensitivity to *Parthenium hysterophorus* clinical studies on the prevalence of *Parthenium* rhinitis. *Clinical Experiment Allergy*, 21:55-62.

Timlsina, B. (2007). *Impact of Parthenium hysterophorus* L. *Invasion on Soil and Plant species composition of Grasslands of Central Nepal*. [M. Sc. Dissertation] Central Department of Botany, Tribhuvan University, Kathmandu, Nepal.

Timlsina, B., B.B. Shrestha, M.B. Rokaya and Z. Munzbergova. (2011). Impact of *Parthenium hysterophorus* L. invasion on plant species composition and soil properties of grassland communities in Nepal. *Flora* **206**: 233-240.

Tiwari S., B. Adhikari, M. Siwakoti and K. Subedi (2005). *An Inventory and Assessment of Invasive Alien Plant Species of Nepal*. IUCN, Kathmandu, Nepal.

Zobel, D.B., P.K. Jha, N.J. Behan and U.K.R. Yadav. (1987). *A practical manual for ecology*. Ratna Book Distributors, Kathmandu, Nepal.

(Received 7 July 2017, revised accepted 19 Aug 2017)