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Invasive Plants and Weeds: A Threat to Biodiversity and Agriculture in Shamli

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Abstract – Weeds and invasive plants cause substantial losses to crop yields and quality, which directly affect food security and safety. According to reports approximately one-third yield losses occur globally due to weeds, in which contribution of invasive/ noxious weeds is enormous. The eradication of these plants is a big challenge for developing countries like India. It is a need of present time to enumerate the invasive plants and weeds of popular crops, so that concrete steps may be taken to eradicate these harmful plants. Considering above, a preliminary survey of invasive plant species and weeds of Shamli district of Uttar Pradesh was conducted and was found a total richness of 161 species belonging to 108 genera and 39 families. Most of these alien species (57.14 %) were introduced from tropical America including South and North America, followed by tropical Africa and other parts of Africa (17.39%). Maximum number of species were reported from the family Asteraceae (31), followed by Papilionaceae (13) Amaranthaceae (12), Solanaceae and Poaceae with 10 species each. The data revealed that invasive plant species and weeds are becoming threat to the native flora and crops as they colonize rapidly and replace native species.

Key Words – Invasive Plants, Weeds, Shamli, Crop Yield, Noxious

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INTRODUCTION

Invasive plant species are the species which have deliberately or inadvertently introduced to a region, place or area where they don't grow naturally. They are endemic to one place or territory and affect the biodiversity of another place where they try to introduce (Shah et al. 2020). Due to interspecific competition invasive plant species restrict crop species to produce optimum yield of crops. Further, due to untimely and inadequate practice of weed control, a sizeable quantity of agriculture produce is also lost each year. Weeds not only cause substantial losses in crop yield but also degrade the quality of agricultural produce. The loss of yield may vary from crop to crop and can be associated to various agro-ecological factors. According to estimates, approximately one-third yield of plant products is lost globally (Bruce 2012) and weeds are the major contributors to these losses. Singhal (2008) reported that approximately 900 billion crop losses per annum is caused by insect pests, diseases and weeds In India. Reports reveal that weeds and invasive species can cause 46.2 to 61.5% loss in rice, wheat and maize while insect and pests can cause 27.3 to 33.7% of actual losses (Oerke 2006). Zhang (2003) reported that weeds can reduce from 12.3 to 16.5% of average crop yields in China. Observations reveal that in the initial years, some weeds like parthenium start growing in the undisturbed and open non-agricultural areas, but gradually it encroached into agricultural lands and drastically affects the crops like Sorghum (Das 2002). Parthenium an annual herb, has higher growth rate in comparison to other weeds and tend to become perennial (Tadesse et al. 2010 a & b).

According to the definition given by International Union for Conservation of Nature and Natural Resources (IUCN) invasive species are foreigner species, which become established in habitat having favorable climatic conditions and threatens native biodiversity. These invasive species spread very fast and can be distributed throughout the world. The BLM (Bureau of Land Management, U.S.) considers plants invasive if they have been introduced into an environment far from the region of their evolution. As a result, they hardly found natural enemies to limit their growth and reproduction (Westbrooks 1998). The problem of invasive plants has been the matter of great concern at the national as well as international level (Maheshwari and Paul 1975, Nair 1988, Drake et al. 1989, Pandey and Parmar 1994, Huxel 1999, Meyer 2000, Mooney and Hobbs 2000, Almeilla and Freitas 2001, Hall 2003, Kohli et al. 2004, Cox 2004, Sharma et al. 2005, Raghuvanshi et al. 2005, Khuroo et al. 2007, Negi and Hajra 2007, Reddy 2008, Qian et al. 2008, Khanna 2009, Beena Kumari 2009, Joshi and Rawat 2011, Chandra Sekar 2012, Chandra Sekar et al. 2012, Gaur and Rawat 2013, Rastogi et al. 2015, Arvind Singh 2015, Wagh

and Jain 2015, Panetta and Gooden 2017, Thapa et al. 2018, Hill et al. 2020). Due to the suitable climatic conditions, invasive/noxious weeds have become a challenge in developing Asian countries, especially in India. It is a need of time to enumerate the invasive plants and weeds of popular crops, so that concrete steps may be taken to eradicate these harmful plants. The steps taken in this direction will definitely help in conserving valuable biodiversity. Considering above facts, a preliminary survey of invasive plant species and weeds of Shamli district was conducted.

MATERIALS AND METHODS

Study Area

Shamli (formerly Prabudh Nagar) is a district in the Indian state of Uttar Pradesh. This district was carved out from Muzaffarnagar District on 28 September 2011 as Prabudh Nagar and renamed Shamli in July 2012. Shamli is the headquarters of the district. Shamli is located approximately 100 kilometres from Delhi along the Delhi–Saharanpur highway. The district lies in the fertile Doab region and hence the major occupation is agriculture. Shamli is located at 29.45°N 77.32°E. It has an average elevation of 248 metres (Fig. 1).

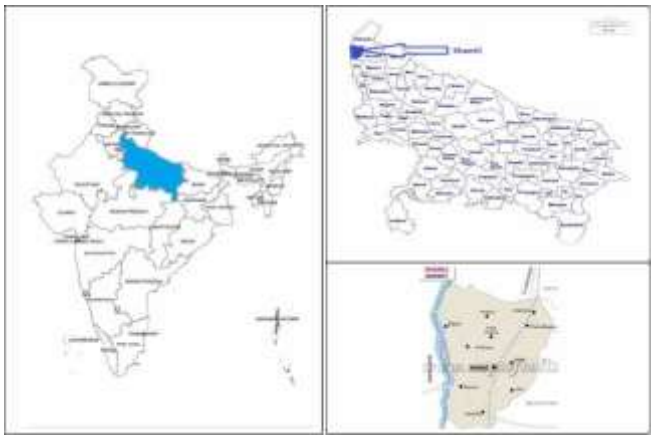

Fig. 1. Maps of Study Area

In the course of investigation during 2017-2018 and 2018-2019, the entire district was frequently surveyed. Several attempts were made for collection and study in different seasons in different botanically interested localities like Kairana, Shamli, Kandhala, Jhinjhana, Unn, Chausana, Banat etc. During field trips plants were collected from different localities like roadsides, gardens, parks, and cultivated lands of Sugarcane, Rice, Wheat, Barley, Jowar, etc. Efforts were made to collect specimens in flowering and fruiting stage and collected in polythene bags.

The collected plants were processed, preserved and mounted on herbarium sheets following the standard herbarium techniques (Jain and Rao 1978). The dried specimens were identified by consulting different deeds and literatures (Kanjilal 1928, Duthie 1903-1929, Gupta 1961, Maheshwari 1963, Babu 1977, Balakrishan 2012). The herbarium sheets have been preserved in the Department of Botany, V. S. P. Govt. (PG) College, Kairana (Shamli).

Enumeration

All the invasive plant species have been enumerated in Table 1. Botanical name of each species is tabulated followed by family name, habit, name of the native place (origin), category and propagation.

RESULTS AND DISCUSSION

The present study is an effort to enlist weed and invasive plant species of Shamli district. Total 161 species belonging 108 genera and 39 families are documented in Table 1. Dicots are dominant and represented by 143 species under 96 genera from 33 families and monocots by 18 species under 12 genera and 6 species (Fig. 3). Most of these invasive species (57.14 %) were introduced from tropical America including South and North America, followed by tropical Africa and other parts of Africa (17.39%). The study area lies under sub-tropical region, so, the plants native to tropical regions found this area suitable for their vigorous growth. Maximum number of species were reported from the family Asteraceae (31), followed by Papilionaceae (13) Amaranthaceae (12), Solanaceae and Poaceae with 10 species each (Fig. 1). Herbs accounted for 125 species, shrubs 22 species, climbers and grasses represented 7 species only (Fig. 2). Perhaps this is the first report in Shamli district, because no significant piece of literature is available so far mentioning information on these lines. More recently Malik (2015) has enlisted the flora of district Muzaffarnagar including district Shamli but he conducted his work before partition of district Muzaffarnagar. Some of the species observed during current study are similar to the report of Malik (2015).

It has been observed that few species like Parthenium hysterophorus, Lantana camara, Ageratum conyzoides, Tridax procumbens, Ipomoea carnea, Cannabis sativa and Chenopodium murale are highly invasive and have invaded not only the non-agricultural area but agricultural fields also. In addition, these species have been noticed interfering and replacing the natural flora of this region. Therefore, further detailed studies are required to assess their direct and indirect impact on agricultural crop yield.

CONCLUSIONS:

From the outcome of present study, it can be concluded that Shamli district in Uttar Pradesh state of India hosts a large variety of weed and invasive plant species dominated by Asteraceae, Papilionaceae, Amaranthaceae, Solanaceae and Poaceae families. In the survey of Shamli district, it has been found that the exotic plant species were

greater in number compared to native plant species. The annual plants were reported more in comparison to plants belong to biennial and perennial nature. Majority of invasive plant species comes under herbs. Most of the reported species are naturalized but some are interfering and noxious also. There is an urgent need to take necessary steps to control invasion in new areas so that biodiversity and crop losses may reduce.

Table 1. List of weeds and invasive plant species reported from Shamli district of Uttar Pradesh.

S. N.	Name of the Species	Family	Habit	Native place	Category	Propagation
1	*Abutilon indicum* (Link) Sweet	Malvaceae	Shrub	South Asia	Naturalized	Seed
2	*Acanthospermum hispidum* DC.	Asteraceae	Herb	Brazil	Naturalized	Seed
3	*Achyranthes aspera*	Amaranthaceae	Herb	South-east Asia/ Africa	Naturalized	Seed
4	*Aerva tomentosa* Forsk. Syn. A. javanica	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
5	*Ageratina adenophora*	Asteraceae	Herb	Tropical America	Naturalized	Seed
6	*Ageratum conyzoides* L.	Asteraceae	Herb	Tropical America	Noxious	Seed
7	*Ageratum houstonianum* Mill.	Asteraceae	Herb	Tropical America	Interfering	Seed
8	*Alhagi pseudalhagi* (Bieb.) Desv.	Papilionaceae	Shrub	Eurasia and Middle East	Naturalized	Seed
9	*Alternanthera paronychioides* A. St. Hil	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
10	*Alternanthera ficoides* (L.) R.Br.& ex.Roem & Schult.	Amaranthaceae	Herb	Tropical America	Naturalized	Vegetative
11	*Alternanthera pungens* Kunth	Amaranthaceae	Herb	Tropical America	Naturalized	Seed, Vegetative
12	*Alternanthera sessilis* (L.) R. Br. ex DC.	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
13	*Alternanthera tenella* Colla.	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
14	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
15	*Anagallis arvensis* L.	Primulaceae	Herb	Europe	Naturalized	Seed
16	*Argemone mexicana* L.	Papaveraceae	Herb	Tropical South America	Noxious	Seed
17	*Argemone ochroleuca* Sweet.	Papaveraceae	Herb	Mexico	Interfering	Seed
18	*Artemisia nilagirica (Clarke) Pamp.*	Asteraceae	Shrub	Europe/Asia/Africa	Naturalized	Seed
19	*Asphodelus tenuifolius* Cav.	Liliaceae	Herb	Tropical America	Naturalized	Seed
20	*Avena sterilis L.*	Poaceae	Grass	Europe	Naturalized	Seed
21	*Bidens pilosa* L.	Asteraceae	Herb	Tropical America	Interfering	Seed
22	*Boerhavia diffusa* L.	Nyctaginaceae	Herb	Africa/ Asia/America	Naturalized	Seed
23	*Blumea crassa* DC	Asteraceae	Herb	Tropical America	Interfering	Seed
24	*Blumea lacera* (Burm f.) DC.	Asteraceae	Herb	Tropical America	Interfering	Seed
25	*Blumea oblique* (L.) Druce	Asteraceae	Herb	Tropical America	Interfering	Seed
26	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Shrub	Tropical Africa	Interfering	Seed
27	*Calotropis procera* (Ait) R. Br.	Asclepiadaceae	Shrub	Tropical Africa	Interfering	Seed
28	*Cannabis sativa* L.	Cannabaceae	Herb	Central Asia	Interfering	Seed
29	*Cassia absus* L.	Caesalpiniaceae	Herb	Tropical America	Naturalized	Seed
30	*Cassia alata* L.	Caesalpiniaceae	Shrub	West Indies	Naturalized	Seed
31	*Cassia hirsuta* L.	Caesalpiniaceae	Herb	Tropical America	Naturalized	Seed
32	*Cassia obtusifolia* L.	Caesalpiniaceae	Herb	Tropical America	Naturalized	Seed
33	*Cassia occidentalis* L.	Caesalpiniaceae	Herb	Tropical South America	Naturalized	Seed
34	*Cassia pumila* Lam.	Caesalpiniaceae	Herb	Tropical America	Naturalized	Seed
35	*Cassia tora* L.	Caesalpiniaceae	Herb	Tropical South America	Noxious	Seed
36	*Celosia argentea* L.	Amaranthaceae	Herb	Tropical Africa	Naturalized	Seed
37	*Chenopodium album* L.	Chenopodiaceae	Herb	Europe	Interfering	Seed
38	*Chenopodium ambrosioides* L.	Chenopodiaceae	Herb	Tropical America	Interfering	Seed
39	*Chenopodium murale* L.	Chenopodiaceae	Herb	Tropical America	Naturalized	Seed
40	*Chloris barbata* Sw.	Poaceae	Grass	Tropical America	Naturalized	Seed
41	*Cleome gynandra* L.	Capparidaceae	Herb	Tropical America	Naturalized	Seed
42	*Cleome viscosa* L.	Capparidaceae	Herb	Tropical America	Naturalized	Seed
43	*Clerodendrum splendens* G. Don	Verbenaceae	Climber	Africa	Interfering	Seed
44	*Coccinia grandis (L.) Voigt*	Cucurbitaceae	Climber	East Africa	Interfering	Seed
45	*Commelina benghalensis* L.	Commelinaceae	Herb	Asia/Africa	Noxious	seed
46	*Convolvulus arvensis* L.	Convolvulaceae	Herb	Europe	Naturalized	Seed
47	*Corrcea lepinnatifida* Wall.	Asteraceae	Herb	Tropical America	Naturalized	Seed
48	*Corchorus aestuans* L.	Tiliaceae	Herb	Tropical America	Naturalized	Seed
49	*Corchorus fascicularis* Lam.	Tiliaceae	Herb	Tropical America	Naturalized	Seed
50	*Corchorus olitorius* L.	Tiliaceae	Herb	Tropical Africa	Naturalized	Seed
51	*Coronopus didymus* (L.) Smith	Brassicaceae	Herb	Tropical America	Interfering	Seed
52	*Crotalaria macrocalyx Ait*	Papilionaceae	Herb	Tropical America	Interfering	Seed
53	*Croton bonplandianum* Boil.	Euphorbiaceae	Herb	Temperate South America	Naturalized	Seed
54	*Cuscuta reflexa* Roxb.	Cuscutaceae	Herb	Mediterranean	Interfering	Seed
55	*Cynodon dactylon* (Linn.) Pers	Poaceae	Herb	Africa	Naturalized	Seed
56	*Cyperus cyperoides* L.	Cyperaceae	Herb	Tropical America	Naturalized	Seed
57	*Cyperus difformis* L.	Cyperaceae	Herb	Tropical America	Naturalized	Seed
58	*Cyperus iria* L.	Cyperaceae	Herb	Tropical America	Naturalized	Seed
59	*Cyperus rotundus* L.	Cyperaceae	Herb	Africa	Interfering	Seed
60	*Datura metel* L.	Solanaceae	Shrub	Tropical America	Interfering	Seed
61	*Datura stramonium* L.	Solanaceae	Shrub	Tropical America	Noxious	Seed
62	*Dicliptera roxburghiana* Nees	Acanthaceae	Herb	Asia	Naturalized	Seed
63	*Digera muricata* (L.) Mart	Amaranthaceae	Herb	South-West Asia	Interfering	Seed
64	*Duranta repens* Linn.	Verbenaceae	Shrub	America	Naturalized	Seed
65	*Echinochloa colona* (L.) Link	Poaceae	Grass	Tropical South America	Naturalized	Seed
66	*Echinochloa crus-galli* (L.) Beauv.	Poaceae	Grass	Tropical South America	Noxious	Seed
67	*Echinops echinatus* Roxb.	Asteraceae	Herb	Afghanistan	Interfering	Seed
68	*Eclipta prostrata* (L.) Mart.	Asteraceae	Herb	Tropical America	Naturalized	Seed
69	*Emilia sonchifolia* (L.) DC.	Asteraceae	Herb	Tropical America	Naturalized	Seed
70	*Eragrostis minor* Host	Poaceae	Grass	Eurasia and Africa	Naturalized	Seed
71	*Eragrostis pilosa* (L.) P. Beauv.	Poaceae	Grass	Eurasia and Africa	Naturalized	Seed
72	*Erigeron bonariensis* L.	Asteraceae	Herb	South America	Interfering	Seed
73	*Eupatorium adenophorum* Sprengel	Asteraceae	Shrub	Mexico	Noxious	Seed
74	*Eupatorium odoratum* L.	Asteraceae	Shrub	Tropical America	Interfering	Seed
75	*Euphorbia hirta* L.	Euphorbiaceae	Herb	Tropical America	Naturalized	Seed
76	*Euphorbia prostrata*	Euphorbiaceae	Herb	Tropical America	Naturalized	Seed
77	*Euphorbia cyathophora* L.	Euphorbiaceae	Herb	Tropical America	Naturalized	Seed
78	*Evolvulus nummularius*(L.) L.	Convolvulaceae	Herb	Tropical America	Naturalized	Seed
79	*Fumaria indica (Hausskn.) Pugsley*	Fumariaceae	Herb	Eurasia and Africa	Naturalized	Seed
80	*Galinsoga parviflora* Cav.	Asteraceae	Herb	Tropical America	Naturalized	Seed
81	*Gnaphalium polycaulon* Pers.	Asteraceae	Herb	Tropical America	Interfering	Seed
82	*Gnaphalium pulvinatum Delile.*	Asteraceae	Herb	Tropical America	Interfering	Seed
83	*Gomphrena celosioides* Mart.	Amaranthaceae	Herb	Tropical America	Naturalized	Seed
84	*Gomphrena globosa* Linn.	Amaranthaceae	Herb	America	Naturalized	Seed
85	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Herb	Tropical South America	Naturalized	Seed
86	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Herb	Tropical South America	Naturalized	Seed
87	*Imperata cylindrica* (L.) Raeusch.	Poaceae	Herb	Tropical America	Naturalized	Seed
88	*Indigofera astragalina* DC.	Papilionaceae	Shrub	Tropical South Africa/ Asia	Naturalized	Seed
89	*Indigofera glandulosa* Roxb. Ex Willd	Papilionaceae	Herb	Tropical America	Naturalized	Seed
90	*Indigofera hirsuta* Hook.	Papilionaceae	Herb	Tropical Africa	Naturalized	Seed
91	*Indigofera linnaria* Ali	Papilionaceae	Herb	Tropical Africa	Naturalized	Seed
92	*Indigofera linifolia* (L. f.) Retz.	Papilionaceae	Herb	Tropical South America	Naturalized	Seed
93	*Indigofera tinctoria* L.	Papilionaceae	Shrub	Africa and Asia	Naturalized	Seed
94	*Ipomoea eriocarpa* R. Br.	Convolvulaceae	Climber	Tropical Africa	Interfering	Seed
95	*Ipomoea fistulosa* Mart DC.	Convolvulaceae	Shrub	Tropical America	Interfering	Seed
96	*Ipomoea nil* (L.) Roth.	Convolvulaceae	Climber	North America	Naturalized	Seed
97	*Ipomoea obscura* (L.) Ker. Gawl.	Convolvulaceae	Climber	Tropical Africa	Interfering	Seed
98	*Ipomoea pes-tigridis* L.	Convolvulaceae	Climber	Tropical East Africa	Interfering	Seed
99	*Ipomoea purpurea* (Linn.) Roth	Convolvulaceae	Herb	America	Interfering	Seed
100	*Ipomoea quamoclit* L.	Convolvulaceae	Climber	Tropical America	Interfering	Seed

101	*Jatropha curcas*	Euphorbiaceae	Herb	Tropical America	Naturalized	Seed
102	*Jatropha gossypifolia* L.	Euphorbiaceae	Shrub	Brazil	Naturalized	Seed
103	*Lagascea mollis* Cav	Asteraceae	Herb	Tropical Cent. America	Noxious	Seed
104	*Lantana camara* L.	Verbenaceae	Shrub	Tropical America	Noxious	Seed
105	*Lathyrus aphaca* L.	Papilionaceae	Herb	Europe and North America	Naturalized	Seed
106	*Lathyrus odoratus* L. P	Papilionaceae	Herb	Europe and North America	Naturalized	Seed
107	*Launaea asiatila* (Roth.) Babcock	Asteraceae	Herb	Tropical America	Naturalized	Seed
108	*Leonotis nepetifolia* (L.) R. Br.	Lamiaceae	Herb	Tropical Africa	Interfering	Seed
109	*Lepidium sativum* L.	Brassicaceae	Herb	Eurasia	Naturalized	Seed
110	*Leucaena leucocephala* (Lam.) de. Wit	Mimosaceae	Herb	Tropical America	Noxious	Seed
111	*Malva parviflora* L.	Malvaceae	Herb/ Shrub	North Africa. Europe and Asia	Naturalized	Seed
112	*Malvastrum coromandelianum* (L.) Gar.	Malvaceae	Herb	Tropical America	Naturalized	Seed
113	*Mecardonia procumbens* (Mill.) Small	Scrophulariaceae	Herb	Tropical North America	Naturalized	Seed
114	*Melilotus alba* Desr.	Papilionaceae	Herb	Europe	Naturalized	Seed
115	*Melilotus indica* (L.) All.	Papilionaceae	Herb	Europe	Naturalized	Seed
116	*Mimosa pudica* L.	Mimosaceae	Herb	Brazil	Naturalized	Seed
117	*Nicotiana plumbaginifolia* Viv.	Solanaceae	Herb	Tropical America	Naturalized	Seed
118	*Ocimum basilicum* L.	Lamiaceae	Herb	Tropical America	Naturalized	Seed
119	*Ocimum canum* L.	Lamiaceae	Herb	Africa and Asia	Naturalized	Seed
120	*Opuntia elatior* Mill.	Cactaceae	Herb	Tropical America	Noxious	Seed
121	*Oxalis corniculata* L.	Oxalidaceae	Herb	Europe	Naturalized	Seed
122	*Oxalis corymbosa* DC.	Oxalidaceae	Herb	South America	Naturalized	Seed
123	*Parthenium hysterophorus* L.	Asteraceae	Herb	Tropical North America	Noxious	Seed
124	*Pedaliium murex* L.	Pedaliaceae	Herb	Tropical America	Naturalized	Seed
125	*Peperomia pellucida* (L.) Kunth.	Piperaceae	Herb	Tropical South America	Naturalized	Seed
126	*Peristrophe paniculata* (Forsk.) Brummitt	Acanthaceae	Herb	Tropical America	Interfering	Seed
127	*Phalaris minor* Retz	Poaceae	Grass	North Africa. Europe and Asia	Naturalized	Seed
128	*Phyllanthus tenellus* Roxb.	Euphorbiaceae	Herb	Mascarene Islands	Naturalized	Seed
129	*Physalis angulata* L.	Solanaceae	Herb	Tropical America	Naturalized	Seed
130	*Physalis minima* L.	Solanaceae	Herb	Tropical America	Naturalized	Seed
131	*Physalis peruviana* L.	Solanaceae	Herb	Tropical America	Interfering	Seed
132	*Pilea microphylla*	Urticaceae	Herb	Tropical South America	Naturalized	Seed
133	*Portulaca oleracea* L.	Portulacaceae	Herb	Tropical S. America	Naturalized	Seed
134	*Portulaca quadrifida* L.	Portulacaceae	Herb	Tropical America	Naturalized	Seed
135	*Ricinus communis* Linn.	Euphorbiaceae	Shrub	Africa	Interfering	Seed
136	*Ruellia tuberosa* L.	Acanthaceae	Herb	Tropical America	Naturalized	Seed
137	*Rumex dentatus* L.	Polygonaceae	Herb	Africa	Naturalized	Seed
138	*Saccharum spontaneum* L.	Poaceae	Herb	Tropical West Asia	Interfering	Seed
139	*Scoparia dulcis* L.	Scrophulariaceae	Herb	Tropical America	Naturalized	Seed
140	*Sesbania bispinosa* (Jacq.) W. F. Wight	Papilionaceae	Shrub	Tropical America	Naturalized	Seed
141	*Sida acuta* Burm f.	Malvaceae	Herb	Tropical America	Naturalized	Seed
142	*Sida cordifolia* L.	Malvaceae	Herb	Tropical America	Naturalized	Seed
143	*Sida rhombifolia* L.	Malvaceae	Herb	Tropical America	Naturalized	Seed
144	*Solanum khasianum*	Solanaceae	Herb	Tropical America	Interfering	Seed
145	*Solanum nigrum* L.	Solanaceae	Herb	Tropical America	Naturalized	Seed
146	*Solanum torvum* Sw.	Solanaceae	Shrub	West Indies	Interfering	Seed
147	*Solvia anthemifolia* (Juss) R.	Asteraceae	Herb	America	Interfering	Seed
148	*Sonchus asper* Hill.	Asteraceae	Herb	Mediterranean	Interfering	Seed
149	*Sonchus oleraceus* L.	Asteraceae	Herb	Mediterranean	Interfering	Seed
150	*Silene conoidea* L.	Caryophyllaceae	Herb	Eurasia and America	Naturalized	Seed
151	*Stellaria media* (L.) Vill.	Caryophyllaceae	Herb	Eurasia	Naturalized	Seed
152	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Herb	West Indies	Naturalized	Seed
153	*Tribulus terrestris* L.	Zygophyllaceae	Herb	Tropical America	Naturalized	Seed
154	*Tridax procumbens* L.	Asteraceae	Herb	Tropical Cent. America	Naturalized	Seed, Vegetative
155	*Triumfetta rhomboidea* Jacq.	Tiliaceae	Herb	Tropical America	Naturalized	Seed
156	*Urena lobata* L.	Malvaceae	Shrub	Tropical Africa	Interfering	Seed
157	*Vernonia cinerea* (L.) Less.	Asteraceae	Herb	Tropical Africa and Asia	Naturalized	Seed
158	*Withania somnifera* (L.) Dunal	Solanaceae	Shrub	North Africa. Europe and Asia	Naturalized	Seed
159	*Xanthium strumarium* L.	Asteraceae	Herb	Tropical America	Noxious	Seed
160	*Youngia japonica* (L.) DC.	Asteraceae	Herb	Tropical South America	Naturalized	Seed
161	*Zephyranthes candida* Lindl.	Amaryllidaceae	Herb	America	Naturalized	Seed, Vegetative

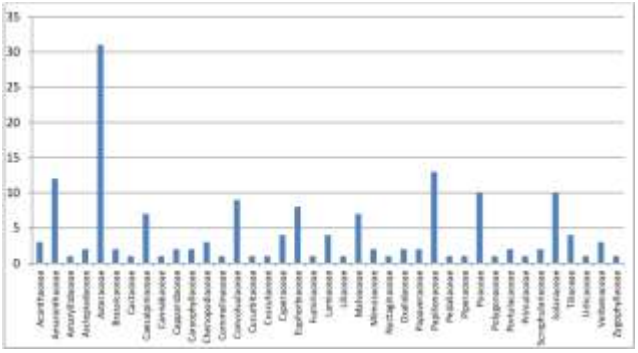

Fig.1. Representation of various families in species diversity of Shamli district.

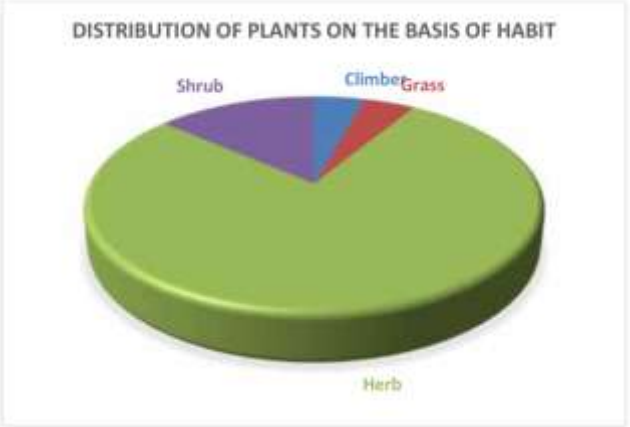

Fig.2. Representation of various habit forms in reported plant species

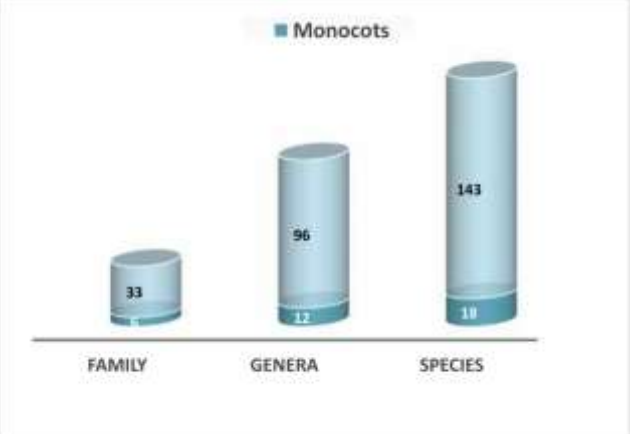

Fig.3. Representation of Monocots and Dicots in Families, Genera and Species

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