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Floristic Composition and Phytosociology of Weed Flora of Mulberry (*Morus spp.*) Gardens of Kashmir Valley

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ABSTRACT

Mulberry (Morus spp.L), the only food to silkworm (Bombyx mori L.) which is reared to produce silk, faces stiff competition with numerous weeds. These affect the plant adversely resulting in decrease in mulberry foliage both quantitatively and qualitatively. Keeping this in view, the present study was carried out to identify the weed species found throughout the year in mulberry farms of Kashmir. Various phytosociological parameters like Density, Frequency, Basal Area and Importance Value Index (IVI) were also calculated, based on the data collected in the spring season, which is the main period of silkworm rearing in Kashmir. A total of 98 species belonging to 38 families were identified with Asteraceae being the most dominant family (16.32 %) in terms of number of species. About 49% of the weed species identified was perennials followed by annuals (45%) and biennials (6%). In terms of the phytosociological data collected, Trifolium repens and Medicago sativa dominated the scene with an IVI of 63.59 and 61.19, respectively. Keeping in view the importance of mulberry plant and severity of weed infestation in the region, appropriate measures are required to ward off the crop from these unwanted plants to improve leaf yield in the region.

Key words: *Diversity, Floristic composition, Mulberry, Phyto sociology, Weed species.*

INTRODUCTION

Mulberry foliage is the only food for the silkworm (Bombyx mori) and is grown under varied climatic conditions ranging from temperate to tropical. Mulberry cultivation is a major economic component in sericulture since the quality and quantity of leaf produce per unit area have a direct bearing on cocoon harvest. The total area of mulberry in the country is around 2,82,244 ha, out of which 4,717 ha of mulberry area is in Jammu and Kashmir state[8]. Weeds in general are highly selective in their choice of growing conditions; the weeds observed here must be characteristic to mulberry plantation and many factors contribute to the occurrence of an association of crops with certain weeds[2].

Weeds in mulberry garden pose a serious problem for mulberry plantation in the production and quality of leaf.

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Weeds impact the growth of plants by competing for the soil nutrients, which reduce the yield and quality of mulberry leaf[7]. In mulberry gardens, weeds reduce the leaf yield by 50% and also act as an alternative host for many pests and disease pathogens harmful for mulberry[9]. Srinivasan *et al*.[13] have reported that weeds growing in mulberry plantation are responsible for reducing the mulberry leaf yield significantly. Setua *et al*.[10] are of the opinion that the reduction in mulberry leaf yield in turn affects the production of cocoon and silk. Krishna *et al*.[6] found that the weed free period of 75 days improved plant height, number of shoots per plant, number of leaves per plant and dry weight per plant significantly as compared to weed free period of either 60 days or less and weedy check; consequently, leaf yield of mulberry was significantly higher in plot kept free upto 75 days after pruning as compared to other lower weed free period and weedy check.

Weeds may act as host and vectors for plant pathogens besides being a nuisance in the management of mulberry garden. To improve yield and quality of leaf in mulberry, the weeds have to be kept under check. For this purpose, a prerequisite is to identify the weed and observe their appearance in the field. In this back ground, the present study was undertaken to study the weed flora of mulberry gardens in Kashmir so as to create a base line data for framing management strategies. This work, it is hoped will also be of considerable help to workers studying regional flora of the country.

MATERIAL AND METHODS

Extensive explorations in major mulberry growing areas of Kashmir valley namely Mirgund, Anantnag, Kulgam, Pampore etc were carried out throughout the year. This work is based on field collections made from 2015 - 2016 over a period of 1 year. Frequent visits were made to the mulberry farms and the specimens collected were identified by the help of taxonomists a Kashmir University and later compared with the relevant floristic works like Kaul[5] and Sharma[11]. Illustrations were drawn from the living specimens. In addition, various biodiversity parameters were also calculated to study the phytosociology of various important weed species during the spring season, as it is the most crucial stage in mulberry leaf production as new buds sprout in this period and the weed competition at this stage can be quite detrimental to the leaf production. Sampling plots of $1m^2$ were laid at an appropriate sampling intensity. The method for calculating various phytosociological attributes studied are described as:

Importance value index (IVI)

For each species in different quadrates relative density (RD), relative basal area (RBA) and relative frequency (RF) were calculated by following :

RD = (Density of a species x 100) / Total density of all species in a quadrat

RBA = (Basal area of a species x 100) / Total basal area of species in a quadrat

RF = (Frequency of a species x100) / Total frequency of species in a quadrat

The importance value index (IVI) for each species was worked out by using formula given by Curtis[3].

IVI = Relative density + Relative dominance + Relative frequency

Basal area

The cross sectional area of shrubs and herbs falling in the recording unit was determined by the formulae as:

Basal area = $\Pi\, d^2/4$

Where, d = diameter

Percent frequency

It is the indicator of number of samples in which the given species occurs, thus express the distribution of various species in the community

$$\text{Frequency (\%)} = \frac{\text{Number of sample units in which the species occurred}}{\text{Number of sampling units studied}} \times 100$$

Density (D)

It represents the population of a species in the community and was calculated by counting number of each species in the sample plot/sub-plot/quadrate.

Generally local names have a limited advantage in identifications of the plants the same plant may be called by different names in

different areas of the same district or a number of plant species may be called by the same name. A scientific name which is internationally accepted carries more importance. Even so local names have a definite utility so they are included wherever found feasible to record in order to preserve the local knowledge.

RESULTS AND DISCUSSION

The perusal of Table-1 gives an overall picture of the different families of weeds associated with the mulberry plantation and the number of species that were observed under each family. Total weed flora of the mulberry gardens studied comprised of 98 species belonging to 38 families. The floristic composition of recorded weed species of the mulberry gardens were grouped into Monocotyledons, Dicotyledons and Pteridophytes. The number of monocot families recorded was 8 (21.05%), dicots was 28 (73.36%), whereas only 2 families of pteridohytes were recorded (5.26%). Similiarly, the number of monocot species recorded in the study was 22 (22.44%), while the number of dicot species was 74 (75.51%). *Veronica, Euphorbia, Trifolium, Medicago, Malva, Plantago, Ranunculus, and Poa* were the larger genera with 3, 2, 2, 2, 2, 2, 2 and 2 species respectively. Family Asteraceae comprised of 16 species, followed by Poaceae which includes 14 species, Fabaceae 11 species, Brassicaceae and Lamiaceae was represented by 05 species each, Verbanaceae family was represented by 04 species. Rosaceae was represented by 03 species. The other remaining 31 families were either represented by 1 or 2 species. Out of these families, Asteraceae, Poaceae and Fabaceae were the dominant families contributing collectively 41.83% of the total recorded species (Table 1). This indicates that these three families were the most common, which constitute the main bulk of the weed flora in the mulberry gardens. This is in conformity with the results of earlier studies by Bali and Pandit[1] and Sridhara *et al*.[12]. Dangwal *et al*.[4] also reported that the families, Asteraceae, Poaceae, Amaranthaceae and Fabaceae constitute the major weed families throughout the world.

The weed plant species life-span spectrum usually varies from family to family or even within the same family. The recorded species were categorized into three main groups: annual, biennial and perennial. The recorded species include 44 annuals (44.89%), 06 biennials (6.12%) and 48 perennials (48.97%) (Table 2). Family Asteraceae comprised of 8 annuals, 6 perennials and 2 biennials, followed by family Poaceae which includes 5 annuals and 9 perennials (Table 2).

Phytosociological attributes (Table 3) revealed that *Trifolium repens* was the most dominant weed i.e, 20, 70, 000 plants per hectare (29.03%), followed by *Trifolium pratense* (17, 40, 000 ha^{-1}; 24.40%), *Avena fatua* (15, 00, 000 ha^{-1}; 21.03%) and *Medicago sativa* (14, 50, 000 ha^{-1}; 20.33%). In terms of basal area (mm^2 ha^{-1}), *Medicago sativa* (11, 66, 903 mm^2 ha^{-1}; 27.06 %), was found to occupy the most surface area, followed by *Trifolium repens* (10, 44, 050 mm^2 ha^{-1}; 24.21%) and *Plantago lanceolata* (9, 91, 062.50 mm^2 ha^{-1}; 27.06). *Trifolium repens* contributed the maximum IVI (63.59), followed by *Medicago sativa* (61.19) and *Avena fatua* (46.31). It was also noted that the number of monocot species was quite low in comparison to dicot species during the Spring season.

Table 1: The family wise distribution of weed species of mulberry

S.No.	Family name		No. of Species
DICOTYLEDONS			
1.	Amaranthaceae	Amaranth family	1
2.	Apiaceae	Carrot family	1
3.	Asteraceae / compositae	Sunflower family	16
4.	Boraginaceae	Forget me not family	1
5.	Brassicaceae/ cruciferae	Mustard family	5
6.	Cannabinaceae	Hemp family	1

7.	Caryophyllaceae	Carnation family	2
8.	Chenopodiaceae	Goose foot family	1
9.	Convolvulaceae	Morning glory family	1
10.	Euphorbiaceae	Spurge family	2
11.	Fabaceae/ pappilionaceae	Pea family	11
12.	Geraniaceae	Geranium family	2
13.	Hypericaceae	St.John's Wort family	1
14.	Lamiaceae	Mint family	5
15.	Malvaceae	Cotton family	2
16.	Onagraceae	Willow herb family	2
17.	Oxalidaceae	Wood sorrel family	1
18.	Papavaraceae	Poppy family	1
19.	Plantagnaceae	Plantago family	2
20.	Polygonaceae	Sorrel family	1
21.	Portucalaceae	Purslane family	1
22.	Primulaceae	Primrose family	1
23.	Ranunculaceae	Butter cup family	2
24.	Rosaceae	Rose family	3
25.	Solanaceae	Potato family	2
26.	Scrophulariaceae	Snap dragon family	1
27.	Urticaceae	Nettle family	1
28.	Verbanaceae	Verbena family	4
		Total number of Dicotyledon species:	*74*
	MONOCOTYLEDONS		
1.	Amaryllidaceae	Amaryllis family	1
2.	Asphodelaceae	Red hot poker amily	1
3.	Colchicaceae	Colchicum family	1
4.	Cyperaceae	Sedge family	1
5.	Iridaceae	Iris family	1
6.	Lilliaceae	Lily family	2
7.	Poaceae/ graminae	Grass family	14
8.	Typhaceae	Typha family	1
		Total number of Monocotyledon species:	*22*
	PTERIDOPHYTES		
1.	Equisetaceae		1
2.	Pteridaceae		1
		Total number of species:	*2*
	Grand total (Species)		***98***

Table 2: Floristic composition of the weed flora in the mulberry plantations

S.No.	Botanical name	Common Name	Vernacular Name	Life span /Habit
i)	**DICOTYLEDONS**			
	Amaranthaceae:			
1.	*Amaranthus spinosus*	Spiny amaranth	-	Annual herb
	Apiaceae:			
2.	*Daucus carota*	Wild carrot	Jangli gazr	Biennial herb
	Asteraceaa:			
3.	*Lactuca serriola*	Prickly lettuce	Dodh kaedij	Annual herb
4.	*Chichorium intybus*	Common chicory	Handi posh	Perennial herb
5.	*Taraxacum officinale*	Dandelion	Maidan hund	Perennial herb
6.	*Anthemis cotula*	Stinking chamomile	Phak' gass'	Annual herb
7.	*Xanthium strumarium*	Common cocklebur	-	Annual herb
8.	*Xanthium spinosum*	Spiny cocklebur	-	Annual herb
9.	*Conyza canadensis*	Canadian horse weed	Shaal loat	Annual herb
10.	*Centaurea iberica*	Iberian knapweed	Kretch	Perennial herb
11.	*Achillea millefolium*	Achilles heel	Pahe'l gaas'	Perennial herb
12.	*Arctium lappa*	Burdock	Hapeth koath	Biennial herb
13.	*Onopardium acanthium*	Scotch thistle	Bagoola (pahdi)	Perennial herb
14.	*Cirsium arvense*	Field thistle	Kond	Perennial herb
15.	*Senecio vulgaris*	Groundsel	-	Annual herb
16.	*Carduus acanthoides*	Spiny plumeless thistle	-	Biennial herb
17.	*Sonchus asper*	Prickly sow thistle	Dadhege	Annual herb
18.	*Artemesia tournefortiana*	Worm wood	Tathwan	Annual herb
	Brassicaceae:			

19.	*Sisymbrium loeselli*	Tall hedge mustard	Dand hakh	Annual herb
20.	*Descurainia Sophia*	Flix weed	Cher laesij	Annual herb
21.	*Capsella bursa pastoris*	Shephard's purse	Kraal mond	Annual herb
22.	*Eruca sativa*	Garden rocket	Toml gass'	Annual herb
23.	*Roripa islandica*	Yellow cress	Th ru	Annual herb
Boraginaceae:				
24.	*Myosotis palustris*	Water forget me not	Tser gaas'	Perennial herb
Cannabinaceae:				
25.	*Cannabis sativa*	Hemp	Bhang	Annual herb
Caryophyllaceae:				
26.	*Stellaria media*	Chick weed	Aab kach	Annual herb
27.	*Cerastium viscosum*	Sticky chick weed	-	Annual herb
Chenopodiaceae:				
28.	*Chenopodium alba*	White goose foot	Woast haakh	Annual herb
Convolvulaceae:				
29.	*Convolvulus arvensis*	Field bind weed	Threer	Perennial grass
Euphorbiaceae:				
30.	*Euphorbia helioscopia*	Sun spurge	Gur sochal	Annual herb
31.	*Euphorbia prostrate*	Prostrate sand mat	-	Annual herb
Fabaceae:				
32.	*Trifolium pratense*	Red clover	Batakh neur	Perennial Herb
33.	*Trifolium repens*	White clover	Batakh neur	Perennial herb
34.	*Medicago sativa*	Alfa alfa	Posh gass'	Annual herb
35.	*Medicago polymorpha*	Bur clover		Annual herb
36.	*Amorpha fruticosa*	False indigo	-	Perennial shrub
37.	*Astragalus falcate*	Milk vetch	-	Perennial herb
38.	*Lathyrus aphaca*	Yellow pea	-	Annual herb
39.	*Melilotus alba*	Sweet white clover	Kat si gaas'	Annual herb
40.	*Lotus corniculata*	Bird's trefoil	Gur mu sur'	Annual herb
41.	*Vicia sepium*	Bush vetch	Ha' bil hemb	Perennial herb
42.	*Indigofera gerardiana*	Himalayan indigo	Kaetch	Perennial shrub
Geraniaceae:				
43.	*Geranium nepalensis*	Himalan crane's bill	-	Perennial herb
44.	*Erodium cicutarium*	Red stem stork's bill	-	Annual herb
Hypericaceae:				
45.	*Hypericum perforatum*	St John's wort	-	Perennial herb
Lamiaceae:				
46.	*Salvia moorcroftiana*	Clary sage	Solar'	Biennial herb
47.	*Nepeta cataria*	Cat nip	Braer gaas'	Perennial herb
48.	*Mentha arvensis*	Field mint	Pudina	Perennial herb
49.	*Thymus serphyllum*	Creeping thyme	Chhok dawa	Perennial shrub
50.	*Scutellaria gaelericulata*	Skull cap	Gan'dh lun	Perennial herb
Malvaceae:				
51.	*Malva sylvestris*	Mallow	Boat sochal	Annual herb
52.	*Malva neglecta*	Dwarf mallow	Sochal	Annual herb
Onagraceae:				
53.	*Oenothera drummondii*	Evening primrose	-	Biennal herb
54.	*Epilobium hirsutam*	Willow herb	-	Perennial herb
Oxalidaceae				
55.	*Oxalis corniculata*	Wood sorrel	She bargi	Annual herb
Papavaraceae:				
56.	*Papaver rhoeas*	Field poppy	Thaenul	Annual herb
Plantaginaceae:				
57.	*Plantago major*	Common plantain	Veuth gulle	Perennial herb
58.	*Plantago lanceolata*	Narrow leaved plantain	Gulle	Perennial herb
Polygonaceae:				
59.	*Rumex nepalensis*	Sorrel	Obuj	Perennial herb
Portulacaceae:				
60.	*Portulaca oleracea*	Purslane	Nunar	Annual herb
Primulaceae:				
61.	*Anagallis arvensis*	Scarlet pimperel	Chare sabun	Annual herb
Ranunculaceae:				
62.	*Ranunculus acris*	Meadow buttercup	Batakh lund	Perennial herb
63.	*Ranunculus arvense*	Corn buttercup	Chirim	Annual herb

Rosaceae:				
64.	*Rubus fruticosus*	Black berry	Chaanch	Perennial shrub
65.	*Potentilla reptans*	Creeping cinquefoil	Panch paetir	Perennial herb
66.	*Rosa moschata*	Musk rose	Kreed	Perennial shrub
Solanaceae:				
67.	*Solanum nigra*	Black night shade	Kaabei'	Annual herb
68.	*Datura stramonium*	Jimson's weed	Datur	Annual herb
Scrophulariaceae:				
69.	*Verbascum Thapsus*	Mullein	Hapet tamoakh	Biennal herb
Urticaceae:				
70.	*Urtica dioica*	Stinging nettle	Soi	Perennial herb
Verbenaceae				
71.	*Veronica anagalis*	Water speed well	Kreer	Annual herb
72.	*Veronica arvense*	Field speed well	-	Annual herb
73.	*Veronica persica*	Persian speed well	-	Annual herb
74.	*Verbena officinalis*	Vervain		Perennial herb
ii)	**MONOCOTYLEDONS**			
Amaryllidaceae				
75.	*Narcissus psuedonarcissus*	Wild Daffodil	Yamberzal	Perennial herb
Asphodelaceae				
76.	*Asphodelus tenuifolius*	Wild onion	Peyar	Perennial herb
Colchicaceae				
77.	*Colchicum luteum*	Meadow saffron	Virkum posh	Perennial herb
Cyperaceae				
78.	*Cyperus rotundus*	Nut grass	Moos gass'	Annual grass
Iridaceae				
79.	*Iris ensata*	Japanese iris	krisham	Perennial herb
Lilliaceae				
80.	*Asparagus racemosa*	Shatavari	Paragloss	Perennial herb
81.	*Tulipa stellata*	Lady tulip	Neel mund	Perennial herb
Poaceae:				
82.	*Sorghum halepensis*	Johnson grass	Dirham	Perennial grass
83.	*Cyanodon dactylon*	Bermuda grass	Dramun	Perennial grass
84.	*Dicanthium annulatum*	Skeda grass	-	Perennial grass
85.	*Aegilopsis tauschii*	Tausch's goat grass	-	Annual grass
86.	*Elymus virginicus*	Virginia wild rye	-	Perennial grass
87.	*Poa pratensis*	Meadow grass	Me'hi' gaas'	Perennial grass
88.	*Poa bulbosa*	Bulbous meadow grass	-	Perennial grass
89.	*Lolium perenne*	Perennial rye grass	-	Perennial grass
90.	*Avena fatua*	Wild oat	-	Annual grass
91.	*Phragmites karka*	Common reed	Nur gass'	Perennial grass
92.	*Bromus mollis*	Soft brome	Shoal	Annual grass
93.	*Agrostis tenuis*	Bent grass	-	Perennial grass
94.	*Echinochloa crusgalli*	Cockspur grass	Hama	Annual herb
95.	*Digitaria sanguinalis*	Hairy crab grass	-	Annual herb
Typhaceae:				
96.	*Typha augustata*	Narrow leaf cat tail	Pechi gass'	Perennial herb
iii)	**PTERIDOPHYTES**			
Equisetaceae				
97.	*Equisetum palustre*	Shade horse tail	Gandam gond	Perennial Forb
Pterydoceae				
98.	*Adiantum capillus*	Maiden hair fern	Gaw theer	Perennial fern

Table 3: Phytosociological attributes of the most dominant species (Spring)

S.No.	Species	Density (No. ha^{-1})	Relative Density[1]	Frequency[1]	Relative frequency[1]	Basal area (mm^2 ha^{-1})	Relative Basal Area[1]	IVI*
1	*Anthemis cotula*	46,000.00	00.64	40.00	06.89	14,522.50	00.33	07.88
2	*Avena fatua*	15,00,000.00	21.03	60.00	10.34	6,43,700.00	14.93	46.31
3	*Conyza Canadensis*	10,000.00	00.14	20.00	03.45	3,532.50	00.08	03.67
4	*Convolvulus arvensis*	20,000.00	00.28	20.00	03.45	1,570.00	00.04	03.76
5	*Lactuca serriola*	16,000.00	00.22	40.00	06.90	1,4695.20	00.34	07.46
6	*Medicago sativa*	14,50,000.00	20.33	80.00	13.79	11,66,903.00	27.06	61.19
7	*Plantago lanceolata*	1,20,000.00	10.68	60.00	10.34	9,91,062.50	22.98	35.01
8	*Plantago major*	6,000.00	00.08	20.00	03.45	1,570.00	00.03	03.56
9	*Poa patense*	90,000.00	01.26	20.00	03.45	2,260.80	00.05	04.76
10	*Ranunculus acris*	32,000.00	00.44	20.00	03.45	9,812.50	00.23	04.12
11	*Rumex nepalensis*	14,000.00	00.19	40.00	06.89	23,173.20	00.54	07.63
12	*Taraxacum officanale*	16,000.00	00.22	60.00	10.34	1,008.72	00.02	10.59
13	*Trifolium pratense*	17,40,000.00	24.40	40.00	06.89	3,94,070.00	90.14	40.44
14	*Trifolium repens*	20,70,000.00	29.03	60.00	10.34	10,44,050.00	24.21	63.59

*Importance Value Index

[1]The values are in percentage (%)

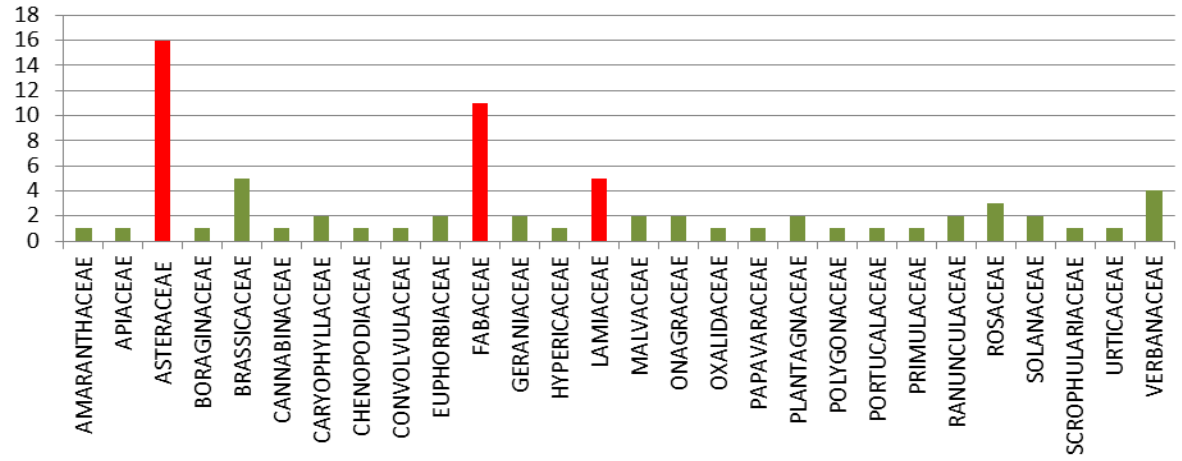

Fig. 1: Distribution of dicot species in each family

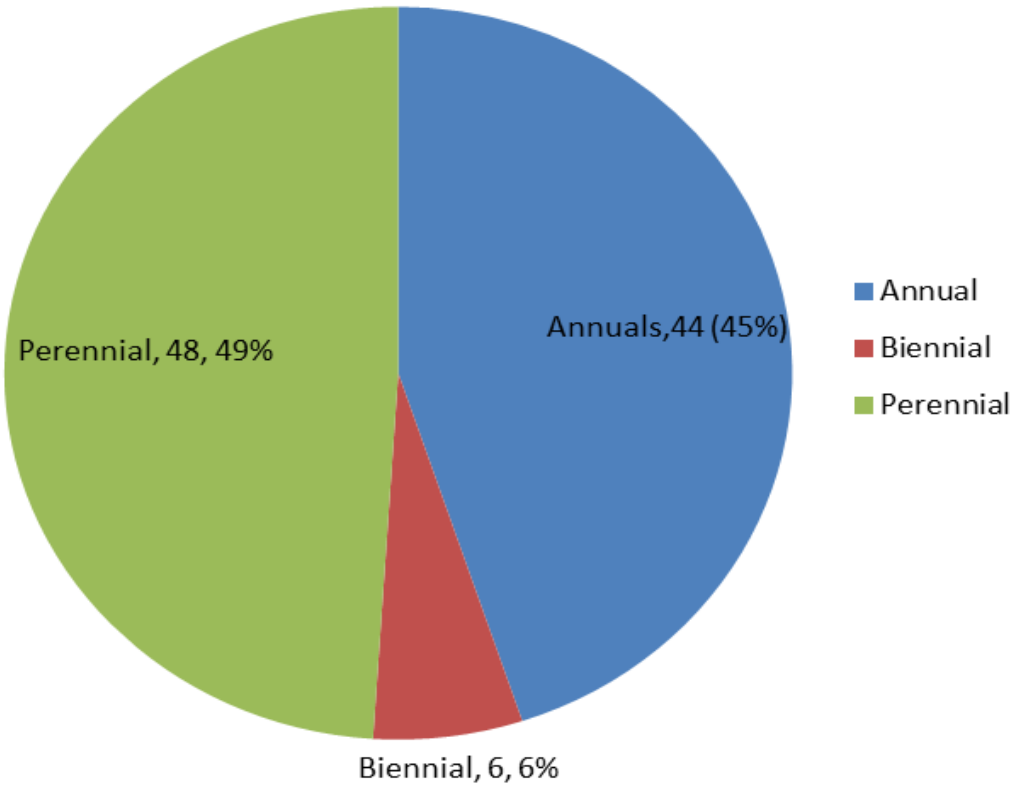

Fig. 2: Species categorised on the basis of life cycle

CONCLUSION

The findings of the present study can be kept in mind for weed management, as cheaper weedicides like 2,4-D (selective against broadleaved weeds) can be applied during spring for effective eradication of dicot weeds. Concerted efforts are required to evolve a good insight into the problem and for that these findings can be taken as a base data to generate new hopes among the local farmers for easy and fruitful mulberry culture for a sustainable sericulture in Jammu & Kashmir.

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