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BIOSTATISTICAL ESTIMATION OF WEEDS SURVEYED IN BAGALKOT KARNATAKA

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ABSTRACT
The current study encountered with 120 species under the 101 genera belonging to 36 families. Among 36 families, Asteraceae, Poaceae and Fabaceae were dominated with highest number of species. Among 36 families, Asteraceae, Poaceae and Fabaceae were dominated with 20, 17 and 13 respectively. A few species, including Amaranthus polygonoides, Tridax procumbens, and Parthenium hysterophorus, were determined to be the most regenerative and dominant species in the research region out of all the species. Based on our findings, we have concluded that the study area offers an environment that is conducive to the growth and development of the weed species. Additionally, it is advised that researchers figure out how to get rid of or manage these weeds in the agricultural ecosystem.

INTRODUCTION

Weeds are unwanted undesirable plants. They flourish in agricultural areas and obstruct access to water and major crops. In addition to harming plant productivity, weeds often pose health risks to both people and animals. Additionally, they have a significant impact on biodiversity (Bhan & Sushilkumar, 1998, Ramalakshmana *et al*., 2023). Weeds in cropland compete with the primary crop for nutrients, water, and light; this results in a decrease in the intended crop's yield and quality (Das and Verma, 1997, Kalita and Vishram, 2017). There is no credible research on the extent of the damage caused by weeds globally, although it is widely accepted that weed losses are the highest of any category of agricultural pest losses, including those caused by insects, nematodes, diseases, rodents, *etc.* (Rawat, 1987, Zhang and Wu, 2021). Out of total annual loss of agriculture products from various pests in India was account for 45%, Insects 30%, Diseases 20%, and other 5%.Depending on the crop, level of weed infestation, weed species, and management techniques, potential yield losses from weeds can reach as high as roughly 65 percent (Yaduraju *et al*., 2006, Gharde *et al*., 2018).

The annual cost of managing weeds in India is estimated to be over 20 million tonnes and 100 billion rupees. Weeds are responsible for the loss of food crops because they have higher nutrient levels than crop plants, develop more quickly, and absorb nutrients more effectively, which reduces the amount of nutrients available to crop plants (Prayaga Murty and Venkaiah, 2011, Chauhan *et al*., 2017).

Even though these weeds do a great deal of harm in a variety of ways, there are a number of benefits that have been attributed to them. Weeds have a variety of advantageous qualities, including the ability to be used as food and fodder, medicines, aromatics, phyto-remediation, industrial resources, soil and water conservation resources, and more (DWSR, 2011, Singh *et al*., 2023). Most weeds are the result of the survival of the fittest. Annuals, biennials, and perennials are the three main categories used to categorise weeds according to their life cycles. Both grasses and broad leaf weeds can be found in each group (Rao, 2000, Shinde and Borkar, 2018). It is common knowledge that domestic animals, birds, and wild animals all contribute to the spread of weeds, primarily through their seed grains. Some harmful weeds reproduce by themselves and spread via vegetative means such as stolons, rhizomes, tubers, roots, and bulbs (Rawat, 1987, Seema and Thoi Devi, 2014).

Given this context, an effort has been undertaken in the current research to produce the weeds assessment data for the Bagalkot Tahsil of Karnataka. The following objectives of the study were set forth: survey, collection, documenting of the weed flora, and quantitative analysis of the species.

Study area

The study area is located in the northern part of Karnataka state, and falls within the northern maiden region. It is situated in the interior of the Deccan plateau of India. The Bagalkot district positioned at WikiMiniAtlas16°122 N75º452 E ÿþ / ÿþ16.200ºN 75.750ºEÿþ / 16.200; 75.750 and covers an area of 6593 km² according to the central statistical organization of the Government of India. The district is bounded in the north by Vijayapur district, on the west by part of Belagavi district, and east by part of Vijayapur and Raichur districts, south by Koppal and Gadag districts.

The district drained by three major rivers namely the Krishna, Ghataprabha and Malaprabha, and over lied by deep black soil in major portion of the district, and other part of the district soil is medium black and mixed red soil, alluvial are also mixed with these soils.

MATERIALS AND METHODS

Selection of sampling points

The study area consisting Bagalkot district comprises nine tehsils Badami, Bagalkote, Bilagi, Hunagund, Ilkal, Jamakhandi, Guledgudda, Mudhol and RabkaviBanhatti. According to Panse and Sukhatme, (1985) around 90 sampling points were selected using random numbers for evaluating the diversity and distribution of the weed components of the cultivated ecosystem. These points were surveyed for three season's *viz*. monsoon, winter and summer.

Collection of specimen and herbarium preparation

An extensive and intensive survey throughout the study area was undertaken periodically during 2021 to 2022. Regular field visits were made to collect the plants (in duplicate) in different seasons. The field data such as habit, habitat, flower colour, odour and distribution was recorded. The collected specimens were then pressed in blotting or newspapers. All the collected specimens were identified carefully and processed as per the conventional methods of drying, poisoning, mounting and labelling (Jain and Rao, 1977).

Plant identification

The collected specimens were identified by referring to various available regional and state Floras (Saldanha, 1984; Singh, 1988; Saldanha, 1996, Kotresha and Kambhar, 2016). Precautions were taken to protect herbarium specimens from damage. Insect repellent such as Paradichlorobenzene (Lawrence, 1951) kept in small quantities in herbarium cabinet and sprayed a weak solution of Mercuric Chloride (0.1% $HgCl_2$) on the specimens to control the fungal attack (Ravindranath & Premnath, 1997). The processed herbarium specimens were deposited in the Herbarium at Department of Botany, The specimens were deposited in the Herbarium Department of Botany, J.S.S. Arts, Science and Commerce College, Gokak, Belagavi, Karnataka. The families are arranged primarily as per the classification given by Bentham and Hooker (1862-1883).

Quantitative assessment

Phytosociological data were recorded by quadrate method by laying quadrats of 1x1 m^2 for herbs (including few climbers). The density, frequency and abundance or dominance relative frequency, relative density and Importance Value Index (IVI) were calculated for every species were calculated by using formulae given by Curtis and1 McIntosh (1950), Curtis (1959) and Odum (1971).The quadrats were laid in the sampling sites to determine the frequency, density, dominance for all the species. Finally the importance values of each species were computed by adding percentage value of relative frequency, relative density and relative dominance.

$$\text{Density} = \frac{\text{Total no.of individuals of a species in all quadart}}{\text{Total no.of quadrat studied}}$$

$$\text{Frequency} = \frac{\text{No.of quadrat in which species occurred}}{\text{Total no.of quadrat studied}} \text{X100}$$

$$\text{Abundance} = \frac{\text{Total no.of individuals of a species in all quards}}{\text{Total no.of quards in which the species occuredd}}$$

Curtis and McIntosh Quantitative Analysis

The important quantitative analysis such as density, frequency and abundance of herbs species were determined as per Curtis & McIntosh (1950). Important Value Index (IVI). This index is used to determine the overall importance of each species in the community structure. In calculating this index, the percentage values of the relative frequency, relative density and relative dominance are summed up together and this value is designated as the Importance Value Index or IVI of the species (Curtis, 1959).

$$\text{Relative density} = \frac{\text{No.of individuals of the species}}{\text{No.of individuals of the all the quadrats}} \text{X100}$$

$$\text{Relative frequency} = \frac{\text{No of occurrence of the species}}{\text{No.of individuals of the all the species}} \text{X100}$$

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RESULTS AND DISCUSSION

Weeds are a major issue in agriculture because they compete with crop plants for resources like water, minerals, nutrients, space, and light, greatly reducing the productivity of agricultural lands (Monteiro and Santos, 2021). New crop varieties with high yields require a proportionally greater amount of water and fertilizer. The likelihood of luxuriant weed growth and the emergence of new weed communities rise under favourable conditions of high fertility and plentiful soil moisture (Mahgoub, 2021). In general, weeds are aggressive. They produce a lot of seeds that are healthy and ready for spreading. These features

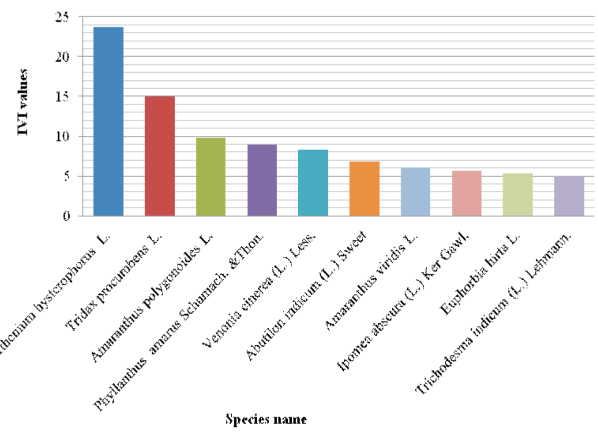

Figure 1. First ten dominant species with their IVI value

Table 1: List of plant species with their family name, density, abundance, frequency and IVI

Sr. No	Species Name	Family	Coll. No	Dn	Ab	Fr. (%) (%)	RDn (%)	RFr (%)	RAb	IVI
1.	*Abutilon indicum* (L.) Sweet	Malvaceae	55	0.39	0.06	7	2.41	1.96	2.41	6.77
2.	*Abutilon ramosum* (Cav.) Guill. & Perr.	Malvaceae	97	0.04	0.04	1	0.25	0.28	0.25	0.77
3.	*Acalypha indica* L.	Euphorbiaceae	33	0.14	0.03	5	0.86	1.4	0.86	3.13
4.	*Acanthospermum hispidum* DC.	Asteraceae	105	0.07	0.04	2	0.43	0.56	0.43	1.42
5.	*Achyranthes aspera* L.	Amaranthaceae	131	0.26	0.07	4	1.6	1.12	1.6	4.33
6.	*Aerva lanata* (L.) Juss. ex Schulf.	Amaranthaceae	16	0.08	0.08	1	0.49	0.28	0.49	1.27
7.	*Ageratum conyzoides* L.	Asteraceae	104	0.07	0.04	2	0.43	0.56	0.43	1.42
8.	*Alternanthera pungens* Kunth.	Amaranthaceae	125	0.15	0.08	2	0.93	0.56	0.93	2.41
9.	*Alysicarpus bupleurifolius* (L.) DC.	Fabaceae	96	0.11	0.03	4	0.68	1.12	0.68	2.48
10.	*Alysicarpus vaginalis* (L.) DC.	Fabaceae	120	0.06	0.02	3	0.37	0.84	0.37	1.58
11.	*Amaranthus polygonoides* L.	Amaranthaceae	100	0.61	0.08	8	3.77	2.23	3.77	9.77
12.	*Amaranthus viridis* L.	Amaranthaceae	18	0.36	0.06	6	2.22	1.68	2.22	6.12
13.	*Apluda muctica* L.	Asteraceae	135	0.14	0.07	2	0.86	0.56	0.86	2.29
14.	*Aristida setacea* Retz.	Poaceae	53	0.16	0.05	3	0.99	0.84	0.99	2.81
15.	*Bidens biternata* (Lour.) Meer. & Sherff.	Asteraceae	21	0.1	0.03	3	0.62	0.84	0.62	2.07
16.	*Blainvillea acmella* (L.) Philip.	Asteraceae	134	0.01	0.01	1	0.06	0.28	0.06	0.4
17.	*Blumea lacera* (Burm.f.) DC.	Asteraceae	103	0.03	0.02	2	0.19	0.56	0.19	0.93
18.	*Boerhavia diffusa* L.	Nyctaginaceae	174	0.06	0.06	1	0.37	0.28	0.37	1.02
19.	*Boerhavia verticillata* Poir.	Nyctaginaceae	1	0.15	0.05	3	0.93	0.84	0.93	2.69
20.	*Brachiaria ramosa* (L.) Stapf.	Poaceae	34	0.3	0.08	4	1.85	1.12	1.85	4.82
21.	*Cardiospermum helicacabum* L.	Sapindaceae	121	0.21	0.04	5	1.3	1.4	1.3	3.99
22.	*Cassia absus* L.	Caesalpiniaceae	32	0.15	0.08	2	0.93	0.56	0.93	2.41
23.	*Cassia senna* L.	Cesalpiniaceae	180	0.08	0.04	2	0.49	0.56	0.49	1.55
24.	*Catharanthus roseus* (L.) G.Don.	Apocynaceae	95	0.16	0.08	2	0.99	0.56	0.99	2.53
25.	*Celosia argentea* L.	Amaranthaceae	15	0.23	0.05	5	1.42	1.4	1.42	4.24
26.	*Centella asiatica* (L.) Urban	Apiaceae	175	0.05	0.01	4	0.31	1.12	0.31	1.73
27.	*Chenopodium album* L.	Chenopodiaceae	56	0.14	0.14	1	0.86	0.28	0.86	2.01
28.	*Chloris virgata* Sw.	Poaceae	196	0.1	0.1	1	0.62	0.28	0.62	1.51
29.	*Chlorophytum* sp.	Liliaceae	176	0.04	0.04	1	0.25	0.28	0.25	0.77
30.	*Chrozophora rottleri* A. Juss.	Euphorbiaceae	23	0.08	0.04	2	0.49	0.56	0.49	1.55
31.	*Chrysopogon fulvus* (Spreng.) Chiov.	Poaceae	112	0.09	0.03	3	0.56	0.84	0.56	1.95
32.	*Cleome gynandra* L.	Cleomaceae	94	0.11	0.04	3	0.68	0.84	0.68	2.2
33.	*Cleome viscosa* L.	Cleomaceae	140	0.07	0.02	3	0.43	0.84	0.43	1.7
34.	*Clitoria ternatea* L.	Fabaceae	35	0.31	0.08	4	1.91	1.12	1.91	4.94
35.	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	177	0.06	0.03	2	0.37	0.56	0.37	1.3
36.	*Comellina bengalensis* L.	Commelinaceae	52	0.07	0.02	3	0.43	0.84	0.43	1.7
37.	*Commelina* sp.	Commelinaceae	192	0.16	0.03	5	0.99	1.4	0.99	3.37
38.	*Convolvulus arvensis* L.	Convolvulaceae	2	0.19	0.05	4	1.17	1.12	1.17	3.46
39.	*Conyza bonariensis* (Kunth) Sch.	Asteraceae	102	0.08	0.04	2	0.49	0.56	0.49	1.55
40.	*Cryptostegia grandiflora* R.Br.	Asclepidiaceae	60	0.28	0.07	4	1.73	1.12	1.73	4.57
41.	*Cucumis callosus* (Rottler) Cogn.	Cucurbitaceae	178	0.03	0.02	2	0.19	0.56	0.19	0.93
42.	*Cucumis sativus* L.	Cucurbitaceae	14	0.01	0.01	1	0.06	0.28	0.06	0.4
43.	*Cyanotis axillaris* (L) D.Don ex Sweet	Commelinaceae	113	0.11	0.06	2	0.68	0.56	0.68	1.92
44.	*Desmodium triflorum* (L.) DC	Fabaceae	93	0.06	0.06	1	0.37	0.28	0.37	1.02
45.	*Digera muricata* (L.) Mart.	Amaranthaceae	29	0.2	0.04	5	1.23	1.4	1.23	3.87
46.	*Dipteracanthus prostratus* (Poir.) Nees	Acanthaceae	136	0.16	0.08	2	0.99	0.56	0.99	2.53
47.	*Echinochloa colonum* (L.) Link	Poaceae	98	0.06	0.02	3	0.37	0.84	0.37	1.58
48.	*Eclipta prostrata* (L.) L.	Asteraceae	179	0.02	0.02	1	0.12	0.28	0.12	0.53

Table 1:Continue...

49.	*Eleusine indica* (L.) Gaertn.	Poaceae	36	0.02	0.02	1	0.12	0.28	0.12	0.53
50.	*Enicostemma axillare* (Lam.) Raynal	Gentianaceae	62	0.05	0.05	1	0.31	0.28	0.31	0.9
51.	*Euphorbia dracunculoides* Lamk.	Euphorbiaceae	184	0.02	0.02	1	0.12	0.28	0.12	0.53
52.	*Euphorbia heterophylla* L.	Euphorbiaceae	3	0.25	0.05	5	1.54	1.4	1.54	4.48
53.	*Euphorbia hirta* L.	Euphorbiaceae	180	0.34	0.09	4	2.1	1.12	2.1	5.31
54.	*Euphorbia thymifolia* L.	Euphorbiaceae	13	0.26	0.07	4	1.6	1.12	1.6	4.33
55.	*Evolulus alsinoides* (L.) L.	Convolvulaceae	189	0.02	0.02	1	0.12	0.28	0.12	0.53
56.	*Foeniculum vulgare* Mill.	Apiaceae	111	0.1	0.01	7	0.62	1.96	0.62	3.19
57.	*Fagonia indica* Burm.f.	Zygophyllaceae	187	0.02	0.02	1	0.12	0.28	0.12	0.53
58.	*Gomphrena celosioides* Mart.	Amaranthaceae	186	0.06	0.03	2	0.37	0.56	0.37	1.3
59.	*Hibiscus trionum* L.	Malvaceae	28	0.07	0.07	1	0.43	0.28	0.43	1.14
60.	*Indigofera glabra* L.	Fabaceae	190	0.13	0.07	2	0.8	0.56	0.8	2.16
61.	*Indigofera lanifolia* (L.f.) Retz.	Fabaceae	48	0.29	0.1	3	1.79	0.84	1.79	4.42
62.	*Indigofera linnaei* Ali	Fabaceae	110	0.03	0.03	1	0.19	0.28	0.19	0.65
63.	*Indoneesiella echioides* (L.) Sreem	Acanthaceae	137	0.04	0.04	1	0.25	0.28	0.25	0.77
64.	*Ipomea abscura* (L.) Ker Gawl.	Convolvulaceae	197	0.32	0.05	6	1.98	1.68	1.98	5.63
65.	*Ipomoea pes-tigridis* L.	Convolvulaceae	4	0.06	0.03	2	0.37	0.56	0.37	1.3
66.	*Lactuca sativa* L.	Asteraceae	188	0.23	0.06	4	1.42	1.12	1.42	3.96
67.	*Leucas aspera* L.	Lamiaceae	101	0.08	0.03	3	0.49	0.84	0.49	1.83
68.	*Ludwigia perennis* L.	Onagraceae	173	0.06	0.02	3	0.37	0.84	0.37	1.58
69.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	170	0.13	0.07	2	0.8	0.56	0.8	2.16
70.	*Merremia gangetica* (L.) Cufod	Convolvulaceae	38	0.06	0.06	1	0.37	0.28	0.37	1.02
71.	*Neptunia triquetra* (Vahl) Benth.	Mimosaceae	163	0.02	0.02	1	0.12	0.28	0.12	0.53
72.	*Ocimum tenuiflorum* L.	Lamiaceae	61	0.07	0.04	2	0.43	0.56	0.43	1.42
73.	*Orthosiphon thymiflorus* (Roth.) Roxb.	Lamiaceae	138	0.08	0.04	2	0.49	0.56	0.49	1.55
74.	*Oxalis corniculata* L.	Oxalidaceae	11	0.04	0.04	1	0.25	0.28	0.25	0.77
75.	*Parthenium hysterophorus* L.	Asteraceae	156	1.24	0.04	30	7.65	8.38	7.65	23.69
76.	*Paspalidium geminatum* (Forssk.) Stapf.	Poaceae	92	0.08	0.08	1	0.49	0.28	0.49	1.27
77.	*Penatropis capensis* (L.f.) Bullock	Asclepidiaceae	27	0.05	0.03	2	0.31	0.56	0.31	1.18
78.	*Pentanema indica* L.	Asteraceae	109	0.01	0.01	1	0.06	0.28	0.06	0.4
79.	*Pergularia pallida* (Roxb.) Wight & Arn.	Asclepidiaceae	154	0.16	0.04	4	0.99	1.12	0.99	3.09
80.	*Phyllanthus amarus* Schumach. &Thon.	Euphorbiaceae	45	0.54	0.07	8	3.33	2.23	3.33	8.9
81.	*Phyllanthus maderaspatensis* L.	Euphorbiaceae	139	0.05	0.03	2	0.31	0.56	0.31	1.18
82.	*Physalis minima* L.	Solanaceae	39	0.21	0.05	4	1.3	1.12	1.3	3.71
83.	*Plumbago zylanica* L.	Plumbaginaceae	91	0.1	0.05	2	0.62	0.56	0.62	1.79
84.	*Polycarpaea aurea* Wight & Arn.	Caryophyllaceae	106	0.06	0.06	1	0.37	0.28	0.37	1.02
85.	*Polygala arvensis* Willd.	Amaranthaceae	5	0.06	0.06	1	0.37	0.28	0.37	1.02
86.	*Portulaca oleracea* L.	Portulaceae	12	0.23	0.08	3	1.42	0.84	1.42	3.68
87.	*Portulaca pilosa* L.	Portulaceae	152	0.07	0.04	2	0.43	0.56	0.43	1.42
88.	*Pulicaria wightiana* C.B.Clarke	Asteraceae	89	0.07	0.07	1	0.43	0.28	0.43	1.14
89.	*Rhynchelytrum repens* (Willd.) L.E.Hubb.	Poaceae	141	0.07	0.07	1	0.43	0.28	0.43	1.14
90.	*Rhynchosia minima* (L.) DC.	Fabaceae	107	0.05	0.03	2	0.31	0.56	0.31	1.18
91.	*Rostellularia crinita* Nees	Acanthaceae	149	0.05	0.05	1	0.31	0.28	0.31	0.9
92.	*Ruellia tuberosa* L.	Acanthaceae	24	0.07	0.01	5	0.43	1.4	0.43	2.26
93.	*Rungia repens* (L) Nees.	Acanthaceae	108	0.08	0.03	3	0.49	0.84	0.49	1.83
94.	*Schowia arabica* (Vahl) A. P. TIC.	Brassicaceae	160	0.11	0.04	3	0.68	0.84	0.68	2.2
95.	*Sehima suclatum* (Hack) A.Camus.	Poaceae	83	0.15	0.04	4	0.93	1.12	0.93	2.97
96.	*Setaria intermedi* Roem & Schult.	Poaceae	155	0.16	0.08	2	0.99	0.56	0.99	2.53
97.	*Setaria pumila* (Poir.) Roem & Schult.	Poaceae	40	0.03	0.03	1	0.19	0.28	0.19	0.65

Table 1:Continue...

98.	*Setaria verticillata* (L.) P.Beauv.	Poaceae	145	0.05	0.05	1	0.31	0.28	0.31	0.9
99.	*Sida rhombiflolia* L.	Malvaceae	150	0.06	0.03	2	0.37	0.56	0.37	1.3
100.	*Sida spinosa* L.	Malvaceae	65	0.17	0.04	4	1.05	1.12	1.05	3.22
101.	*Solanum nigrum* L.	Solanaceae	78	0.11	0.03	4	0.68	1.12	0.68	2.48
102	*Sonchus oleraceus* L.	Asteraceae	6	0.22	0.07	3	1.36	0.84	1.36	3.55
103.	*Striga densifolia* (Benth.) Benth.	Scorphulariaceae	43	0.09	0.02	5	0.56	1.4	0.56	2.51
104.	*Synedrella* nodiflora (L.) Gaertn.	Asteraceae	74	0.13	0.04	3	0.8	0.84	0.8	2.44
105.	*Tephrosia pumila* (Lam.) Pers.	Fabaceae	64	0.11	0.04	3	0.68	0.84	0.68	2.2
106.	*Tephrosia strigosa* (Dalzell) Santapau & Mahashw.	Euphorbiaceae	82	0.04	0.04	1	0.25	0.28	0.25	0.77
107.	*Tetrapogon tenellus* ((Roxb.) Chiov.	Poaceae	25	0.01	0.01	1	0.06	0.28	0.06	0.4
108.	*Tragia plukenetii* L.	Poaceae	69	0.01	0.01	1	0.06	0.28	0.06	0.4
109.	*Tribulus terresris* L.	Zygophyllaceae	7	0.11	0.04	3	0.68	0.84	0.68	2.2
110.	*Trichodesma indicum* (L.) Lehmann.	Boraginaceae	70	0.29	0.06	5	1.79	1.4	1.79	4.98
111	*Trichurus monsonie* (L.f.) Bennet.	Amaranthaceae	31	0.04	0.04	1	0.25	0.28	0.25	0.77
112.	*Tridax procumbens* L.	Asteraceae	81	0.83	0.05	17	5.12	4.75	5.12	15
113	*Triumfelta mulabarica* Voem. ex Roth	Tiliaceae	8	0.04	0.02	2	0.25	0.56	0.25	1.05
114.	*Turnera ulmifolia* L.	Turneraceae	51	0.03	0.03	1	0.19	0.28	0.19	0.65
115.	*Venonia cinerea* (L.) Less.	Asteraceae	41	0.49	0.06	8	3.02	2.23	3.02	8.28
116.	*Vigna radiata* (L.) Wilezek	Fabaceae	80	0.04	0.04	1	0.25	0.28	0.25	0.77
117.	*Waltheria indica* L.	Sterculiceae	10	0.04	0.04	1	0.25	0.28	0.25	0.77
118	*Wattakaka volubilis* (L.f.) Benth. ex Hook.	Asclepidiaceae	44	0.02	0.02	1	0.12	0.28	0.12	0.53
119.	*Withania somni*	Solanaceae *fera* (L.) Dunal.	42	0.08	0.02	4	0.49	1.12	0.49	2.1
120.	*Xanthium indicum*	Asteraceae Koening	9	0.04	0.04	1	0.25	0.28	0.25	0.77
				16.2	**5.31**	**358**	**100**	**100**	**100**	**300**

Dn = Density, **Ab** = Abundance, **Fr (%)** = Frequency, **RDn (%)** = Relative Density, **RFr (%)** = Relative Frequency, **RAb (%)** = Relative Abundance, **IVI** = Important Value Index cause weeds to proliferate swiftly in agricultural areas, where they hinder crop growth by absorbing nutrients from the soil (Khamare *et al.*, 2022). Many of the weeds that are present in cultivated crops are tropical species that were introduced along with the seeds and seedlings of cultivated plants. (Kambhar *et al.*, 2017).

About 120 species of weeds were encountered in the study area under the 101 genera belonging to 36 families. Among 36 families, Asteraceae, Poaceae and Fabaceae were dominated with 20, 17 and 13 respectively. This was followed by Amaranthaceae, Euphorbiaceae contributed 9 sp. each, Malvaceae 6 sp., Acanthaceae, Convolvulaceae contributing 5 sp. each, Asclepidiaceae 4 sp., and Commelinaceae 3 sp each.

These first ten families contribute 80 species with proportion of 69%. The two families represent 3 sp. each, they are Portulaceae and Verbenaceae. Nine families are represented by just 2 species each, they are Chenopodiaceae, Commelinaceae, Convolvulaceae, Cucurbitaceae, Gentianaceae, Menispermaceae, Nyctaginaceae, Scorphulariaceae and, Tiliaceae and 12 families are only represented by a single species (Aizoaceae, Asclepidiaceae, Balsaminaceae, Boraginaceae, Cyperaceae, Lythraceae, Mimosaceae, Orobanchaceae, Oxalidaceae, Papaveraceae, Polygalaceae and Primulaceae).

Diversity is also known as variety or variability. The term "species diversity" refers to the diversity that exists among the many living organisms. Richness and plenty are frequently condensed into a single numerical figure. Therefore, these are known as heterogeneity indexes (Sun *et al.*, 2023). Different combinations of species richness and abundance can produce a given diversity index value. It would be exceedingly challenging to distinguish between the relative importance of species richness and abundance. Therefore, these two indices are frequently employed to indicate the average level of uncertainty in determining to which specific species an individual selected at random from a sample would belong (Kotresha and Kambhar, 2016).

Species Density, Frequency and Abundance

The study area constitutes variety of weed species, various biotic and edaphic factors have played dominant role in determining its growth and their development. The most dominant species in study area was *Parthenium hysterophorus,Tridax procumbens, Amaranthus polygonoides, Phyllanthus amarus., Venonia cinerea, Abutilon indicum,* and *Amaranthus viridis*. The least dominant weed species were *Pentanema indica, Tetrapogon tenellus* and *Tragia plukenetii*.

Density and Abundance

The species of *Partheniumhy sterophorus* (Dn= 1.24, Ab= 0.04) have highest density and abundance, followed by *Tridax procumbens*(Dn= 0.83, Ab= 0.05) and *Amaranthus polygonoides* (Dn= 0.61, Ab= 0.08). Other species showing least density and abundance *Blainvillea acmella., Cucumis sativus., Pentanema indica., Tetrapogon tenellus and Tragia plukenetii* (Dn= 0.01, Ab= 0.01) tabulated in Table 1.

Frequency

The species of *Parthenium hysterophorus* (Fr= 30) have highest density and abundance, followed by *Tridax procumbens*(Fr= 17), and *Amaranthus polygonoides*L.(Fr=8). Other species showing least frequency *Tetrapogon tenellus* (Fr= 1) and *Tragia plukenetii*(Fr= 1) tabulated in Table 1.

Higher characteristic variations in percentage of frequency, density and abundance. Higher frequency, density and abundance of their species in black cotton soil may be due to availability of more water and richer micro flora. Such soils are very rich in nutrients also similar kind observations have been made by Dubey (1968) Pätzold *et al.* (2020). Seasonal variations in percentage frequency, density and abundance for the weed crop association of jowar and wheat field have been studied by Pathak (1981), Verma (1981), Adesina *et al.*, (2012). Such variations in % frequency, density and abundance may be attributed to the mechanism of seed germination as also suggested by earlier workers Thurston (1960), Hall (1974), Shivnath and Gupta (1982), Sharma (1984), Punia *et al.* (2017).

Due to differences in climatic regimes and to the formation of many niches in a micro-climate. Dubey (1968) and Pathak (1981) described that there are some common weed in the cultivated field which having many adaptations such as hard seed coat, branched creeping habit, rooting at each node, enable the species to collect moisture and nutrients from a larger area of black cotton soil (Clements and Jones, 2021).

Importance Value Index (IVI)

Importance value index (IVI) combines relative density, relative frequency and relative dominance can be used to indicate the ecological influence of each species in the ecosystem. Species with the greatest importance value are the most dominant of particular vegetation. The importance value indexes of herb species are shown in Table 1.

Analysis of IVI of a species can be used to recognize the pattern of association of dominant species in a community. Based on their higher IVI value, the ten dominant and ecologically most significant species are *Parthenium hysterophorus*, *Tridaxprocumbens*L ,*Amaranthus polygonoides*L, *Phyllanthus amarus Schumach. and Thon*, *Venonia cinerea* (L.) Less., *Abutilon indicum* (L.) Sweet, *Amaranthus viridis* L. *Ipomoea obscura (*L.) Ker Gawl, and *Euphorbia hirta* L. These species might also be the most successful species in regeneration (Figure 1).

The similar kind of publication regarding weed species and its related natural and cultivated fields has been studied by various workers. The weed flora has been recorded in the field site of maize comprised of grasses and sedges and broad leaved weeds, among the broad leaved weed was *Parthenium hysterophorus*, *Commelina benghalensis*, *Portulaca oleracea* (Hajj *et al.*, 2012). Similarly, Angadi *et al.* (2017) recorded 73 species of weeds belonging to 26 families in the Karnataka College Campus, Dharwad. On the other hand, Kambhar *et al.* (2017) evaluated the weed diversity in north east part of Belagavi and represented with 116 weed species under 90 genera belonging to 33 families. Among these 33 families, Asteraceae, Poaceae and Euphorbiaceae were dominant. The species like *Parthenium hysterophorus*, *Cyperus rotundus* and *Euphorbia heterophylla* were most successful regenerative species. With compare to earlier results, it is evaluated that, the Asteraceae, Amaranthaceae and Euphorbiaceae were found dominant in the study area.

CONCLUSION

Weeds are considered dynamic in nature because their number and dominance fluctuate in response to changes in the agro-ecosystem. Based on phytosociological values, it can be stated that the research area contains a dominating weed species such as *Parthenium hysterophorus, Tridax procumbens, Amaranthus polygonoides, Phyllanthus amarus.,Venonia cinerea, Abutilon indicum*, and *Amaranthus viridis*. As a result, it may be assumed that weed species are capable of establishing a major link with the prevailing micro and macro climatic conditions inside the habitat.

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