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Weed Flora of Tea Plantation of Golaghat, Assam with Special Emphasis on Life Form Classification

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Weeds are one of the main production constraints in agriculture. A life form is an important physiognomic character that have been widely used in vegetation studies of any area. This study was performed to find out the weed flora of tea plantations in Dergaon, Assam which have negatively affect the crop quality and yield. A total of 85 plant taxa were found as weeds in tea plantations. Out of the recorded taxa 67 are dicots and 18 are monocots. Total 15 different genera were recorded under monocots and 55 genera were recorded under dicots. The most commonly growing weeds in tea plantations in this area were *Axonopus compressus*, *Cynodon dactylon, Ageratum conyzoides*, *Melastoma malabathricum.* Therophytes (40%) are the dominant life form followed by hemicryptophytes (33%), chamaephytes (10%), phanerophytes (9%) and cryptophytes (8%).

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1. INTRODUCTION

Tea, *Camellia sinensis* (L.) O. Kuntze, belonging to family *Theaceae* is the most popular non-alcoholic beverage plantation crop in the world. Tea is mostly cultivated as monocrop in Southern region and North Eastern states of India. But now-a day's inter cropping is found in the tea plantations of Assam as well as in other tea growing regions of India. India is considered as the second-largest tea producer and consumer in the world by producing 1365.23 million kg of tea. Amongst the tea producing states, Assam acquires first position with the production of 688.70 million kg from an area of 3.48 lakh Ha (Tea Board of India, 2022).

Weeds are one of the main production constraints in all types of horticultural crops. Weeds are unwanted and unattractive plants which negatively impact human welfare by interfering with the use of land and water resources. Weeds account for 45% of the entire yearly loss in agricultural produce (Singh et al., 2023). Uncontrolled weed growth in tea cultivation can cause a loss of production to the extent of 10-50% (Deka & Barua, 2015). Weeds are counted as one of most important critical factors limiting optimum productivity in tea plantations. Uncontrolled weed growth can cause a loss of productivity to the extent of 50-70% in tea (Deka & Barua, 2015). From tea productivity point of view the period between April to September is very critical because of high rainfall and high temperature which provides a very favourable condition for weed growth (Basu, 1972). The weeds not only affect the tea plant by competing with them for necessary requirements but also act as alternative host for various pathogen and pests. Weeds are adaptable to adverse climatic conditions and therefore if we not controlled these weeds in time then they can outgrow crop plants in very short time. Weeds such as *Mikenia scandens, Ipomea learii, Hedyotis neesiana, Commelina benghalensis* etc are capable of suppressing the growth of the tea bushes by making them stunted in growth with poor bush frames, making the foliage yellowish and inducing defoliation, unless removed completely by manual uprooting (Peiris & Nissanka, 2016). Kundu et al. (2020) reported about the efficacy of herbicides on weed control, rhizospheric micro-organisms, soil properties and leaf qualities in tea plantation. According to them there was no long-term adverse effect of the applied herbicides on the microbial population in soil rhizosphere and on soil available nutrients.

A life form is an important physiognomic character that have been widely used in vegetation studies of any area. Raunkiaer (1934) used it as descriptive tool for classifying plant in different life forms based on the position and degree of perennating buds. According to this system, plant species can be grouped into five main classes: Phanerophytes, Chamaephytes, Hemicryptophytes, Cryptophytes and Therophytes. The percentage of various life form classes put together is known as the biological spectrum. Raunkiaer (1934) constructed a normal biological spectrum that act as a standard model against which different life form spectra could be compared.

However, weeds of tea gardens along with their life forms are not studied till now in Dergaon, Golaghat, Assam. Therefore, this study has been carried out to record the weed species of tea plantation of Dergaon, Assam along with their life form.

2. MATERIALS & METHODS

The present study has been carried out in Dergaon area (Latitude 26°41'60.00"North and Longitude 93°58'0.01" East) which is a part of Golaghat district (Latitude 26.4584° North and Longitude 93.9828° East) of Assam. Extensive field study was conducted by visiting different tea gardens of Dergaon area of Golaghat district from February 2020 to January 2021, in order to record the floristic composition and life form of weed flora.

All species were assigned a suitable life form according to Raunkiaer's (1934) life form classification such as Therophytes (TH), Chamaephytes (CH), Cryptophyte (CR), Hemicryptophytes (H), and Phanerophyte (PH).

The percentage life form was calculated as follows:

$$\%\ Life\ Form = \frac{Number\ of\ species\ in\ any\ life\ form}{Total\ number\ of\ species\ of\ all\ life\ forms} \times 100$$

Biological spectrum was prepared for the study area and was compared with the Raunkiaer's (1934) normal biological spectrum. Biological spectrum helps to point out which life form characterizes the phytoclimate and the vegetation of the study area.

3. RESULTS AND DISCUSSION

85 weed species under 37 families have been recorded during the survey (Table 1). These weeds were either grown inside the tea sections or in open leftover spaces within the garden territory. Weed flora was represented by 6 monocotyledonous, 31 dicotyledonous and 3 pteridophytic families were also recorded under the dicots. Total 15 different genera were recorded under monocots and 55 genera were recorded under dicots. Survey revealed that 18 species (21%) were monocotyledonous and 67 species (79%) dicotyledonous.

Table 1. List of weed species recorded from the tea gardens of Dergaon area with their Life span and Life form

Sl. No	Botanical Name	Family	Life span	Life Forms
	Monocotyledons			
1	*Colocasia esculenta* (L.) Schott	Araceae	P	Hemicryptophyte
2	*Colocasia affinis* Schott	Araceae	P	Hemicryptophyte
3	*Murdania nudiflora (*L.) Brenam	Commelinaceae	A(S&W)	Chamaephyte
4	*Cyprus compressus* L.	Cyperaceae	A(S)	Chamaephyte
5	*Cyperus rotundus* L.	Cyperacea	P	Hemicryptophyte
6	*Kyllinga bravifalia* Rottb.	Cyperacea	P	Cryptophyte
7	*Dioscorea pentaphylla* L.	Dioscoreaceae	P	Hemicryptophyte
8	*Arundinella benghalensis*	Poaceae	P	Hemicryptophyte
9	*Axonopus compressus*	Poaceae	P	Hemicryptophyte
10	*Chrysopogon aciculatus*	Poaceae	P	Hemicryptophyte
11	*Cynadon dactylon* (L.) Pers.	Poaceae	P	Hemicryptophyte
12	*Digitaria sanguinalis* Scop	Poaceae	A(A&W)	Chamaephyte
13	*Eleusine indica* (L.) Gaertn.	Poaceae	A(A&W)	Therophyte
14	*Lophatherum gracile*	Poaceae	P	Cryptophyte
15	*Paspalum conjugatum* Berg.	Poaceae	P	Hemicryptophyte
16	*Panicum arundinaceum*	Poaceae	P	Phanerophyte
17	*Curcuma aromatica* Salisb.	Zingiberaceae	P	Cryptophyte
18	*Curcuma longa* L.	Zingiberaceae	P	Cryptophyte
	DICOTYLEDONS			
19	*Alteranathera sessilis*(L.) R.Br.	Amaranthaceae	P	Chamaephyte
20	*Amaranthus spinosus*	Amaranthaceae	A(S&W)	Therophyte
21	*Amaranthus viridis* L.	Amaranthaceae	A(S&W)	Therophyte
22	*Chenopodium album* L.	Amaranthaceae	A	Therophyte
23	*Centella asiantica (*L.) Urb.	Apiaceae	P	Hemicryptophyte
24	*Eryngium foetidum*	Apiaceae	P&A	Therophyte
25	*Hydrocotyle sibthorpioides*	Araliaceae	P	Hemicryptophyte
26	*Acmella paniculata* R.K. Jansen	Asteraceae	A	Therophyte
27	*Ageratum conyzoides* L.	Asteraceae	A	Therophyte
28	*Artemisia vulgaris* L.	Asteraceae	P	Hemicryptophyte
29	*Bidens pilosa* L.	Asteraceae	P	Hemicryptophyte
30	*Chromolaena odorata*	Asteraceae	A(S&W)	Therophyte
31	*Crassocephalum crepidioides*	Asteraceae	A	Therophyte
32	*Eclipta alba*	Asteraceae	A	Therophyte
33	*Eclipta prostrata* L.	Asteraceae	A	Therophyte
34	*Eupatorium odoratum*	Asteraceae	P	Hemicryptophyte
35	*Gnaphalium indicum*	Asteraceae	A	Therophyte
36	*Sonchus soleraceus*	Asteraceae	A	Therophyte
37	*Xanthium indicum* Koening.in Roxb	Asteraceae	A(W)	Therophyte
38	*Impatiens balsamina*	Balsaminacea	A(S&W)	Therophyte
39	*Rorippa indica*	Brassicaceae	A(S&W)	Therophyte
40	*Cassia tora L.*	Caesalpinaceae	A(S)	Phanerophyte
41	*Cassia occidentalis*	Caesalpinaceae	A(S)	Therophyte

Sl. No	Botanical Name	Family	Life span	Life Forms
42	*Drymaria cordata*	Caryophyllaceae	A(S)	Therophytes
43	*Euphorbia hirta* L.	Euphorbiaceae	A(W)	Chamaephyte
44	*Heliatrapium indicum* L.	Heliotropaceae	A(S)	Therophyte
45	*Clerodendrum infortunatum*	Lamiaceae	P	Therophyte
46	*Leucus aspera*	Lamiaceae	A(S&W)	Chamaephyte
47	*Leucus plukenetii Roth.*	Lamiaceae	A(S&W)	Therophyte
48	*Leucus sibiricus*	Lamiaceae	A	Therophyte
49	*Ocimum basilicum* L.	Lamiaceae	P(S)	Phanerophyte
50	*Salvia tiliifalia Vahl.*	Lamiaceae	A	Hemicryptophytes
51	*Melastoma malabathricum* L.	Melastomaceae	A	Therophytes
52	*Mimosa pudica* L.	Mimosaceae	P	Therophytes
53	*Boehavia spp.*	Nyctaginaceae	A	Hemicryptophyte
54	*Ludwigia peploides*	Onagraceae	P	Hemicryptophyte
55	*Oxalis corymbosa*	Oxalidaceae	A(S&W)	Hemicryptophyte
56	*Oxalis debilis*	Oxalidaceae	A(A&W)	Hemicryptophyte
57	*Oxalis corniculate* L.	Oxalidaceae	A	Chamaephyte
58	*Crotalaria juncea*	Papillionaceae	A(S)	Chamaephyte
59	*Phytolacca americana*	Phytolaccacea	P	Therophyte
60	*Scoparia dulcis*	Plantaginaaceae	A	Therophyte
61	*Pericaria hydropiper*	Polygonaceae	A(A&W)	Hemicryptophyte
62	*Polygonum chinense L.*	Polygonaceae	A(A&W)	Therophyte
63	*Polygonum hydropiper*	Polygonaceae	A	Therophyte
64	*Polygonum orientale L.*	Polygonaceae	A	Therophyte
65	*Polygonum glabrum*	Polygonaceae	A	Therophyte
66	*Rumex dentatus L.*	Polygonaceae	A	Therophyte
67	*Peperomia pellucida(*L)Kunth	Piperaceae	P	Hemicryptophyte
68	*Piper sylvaticum* Roxb.	Piperaceae	P	Phanerophyte
69	*Barrera articularis*	Rubiaceae	A(A&W)	Chamaephyte
70	*Hedyotis corymbosa*	Rubiaceae	A	Therophyte
71	*Scoparia dulcis*	Scrophulariaceae	A(A&W)	Therophyte
72	*Nicotiana plumbaginifolia*	Solanaceae	A(S)	Hemicryptophyte
73	*Solanum nigrum* L.	Solanaceae	A(S)	Therophyte
74	*Solanum myriacanthum* Dunal	Solanaceae	A(S&W)	Phanerophyte
75	*Solanum torvum* Swartz.	Solanaceae	A(S&W)	Phanerophyte
76	*Houttuynia cordata* Thunb.	Soururaceae	P	Hemicryptophyte
77	*Selaginella eurynota*	Selaginellaceae	P	Cryptophyte
78	*Pouzolizia indica* (L.) Wight	Urticaceae	P	Hemicryptophyte
79	*Cherodendrum viscosum* Vent.	Verberaceae	P	Phanerophyte
80	*Lantana camara* L.	Verberaceae	P	Phanerophyte
81	*Lippia nodiflora* L.	Verberaceae	P	Hemicryptophyte
	PTEROIDOPHYTES			
82	*Pteridium aquilinum* (L.) Kuhn	Dennstaetiaceae	P	Hemicryptophyte
83	*Adiantum lunulatum* Burm.f.	Pteridaceae	P	Hemicryptophyte
84	*Pteris longipes* D.Don	Pteridaceae	P	Hemicryptophyte
85	*Lygodium microphyllum* (Cav.) R.Br.	Schizalaceae	P	Cryptophyte

P=Perennial sp, A=Annual sp., S=Summer sp, W=Winter sp

Among monocotyledons, Poaceae and Cyperaceae tops the list with 9 and 3 species respectively (Fig. 1). Similarly, Asteraceae in dicotyledones with 12 species form the dominant family (Fig. 2). Dicotyledonous species were outnumbered the monocotyledonous one but the density of monocotyledonous weeds was greater. Most of the recorded species were found to grow in wide range of habitat, while pteridophytic species were growing under shady or moist area of the tea gardens.

When we study about the life form then we found that out of the 85 species, 34 (40%) species are

belongs to the life form class therophyte, 6 (8%) species to cryptophyte, 28 (33%) species to hemicryptophyte, 9 (10%) species to chamaephyte and 8 (9%) species to phanerophyte. When we compare the biological spectrum of our study (Fig. 4) with Raunkiaer's normal spectrum (Fig. 3), it is found that the value of therophytes is higher in the spectrum of the area studied than the values of this life form in Raunkiaer's normal spectrum. It indicates the deserty nature of the area, since abundance of therophytes is the characteristic of desert climates, with long dry season. But the climate of our study area is not desertic. In our area, therophyte are dominance, may be due to biotic influence of man during agricultural practices, scraping etc. which alter the biological spectrum of the area. The application of Biological spectrum as an indicator of the climate is limited in such area where biotic disturbances are there.

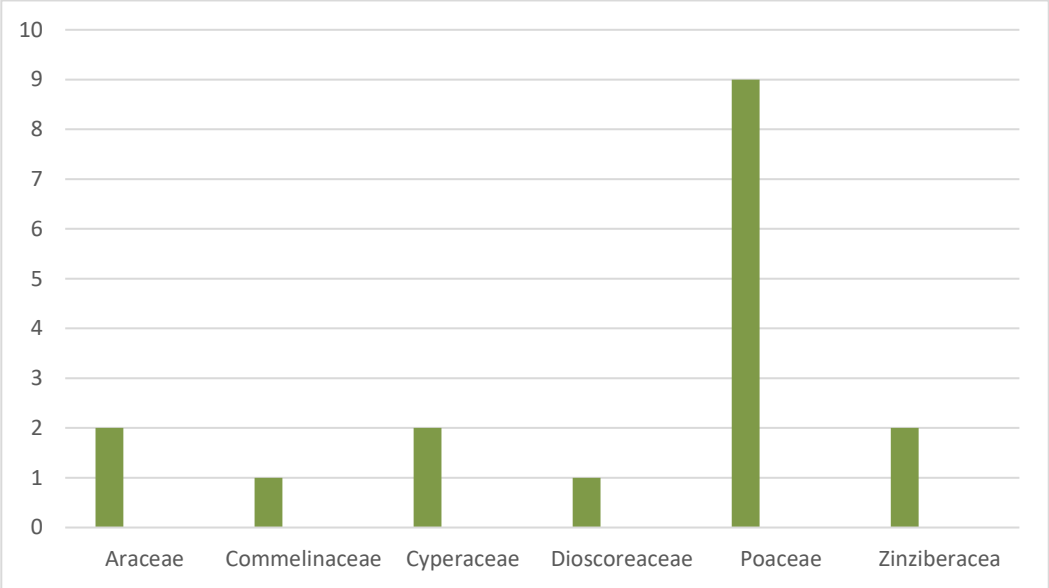

Fig. 1. Species level distribution of different monocotyledonous families of weed recorded from the tea garden of Dergaon area

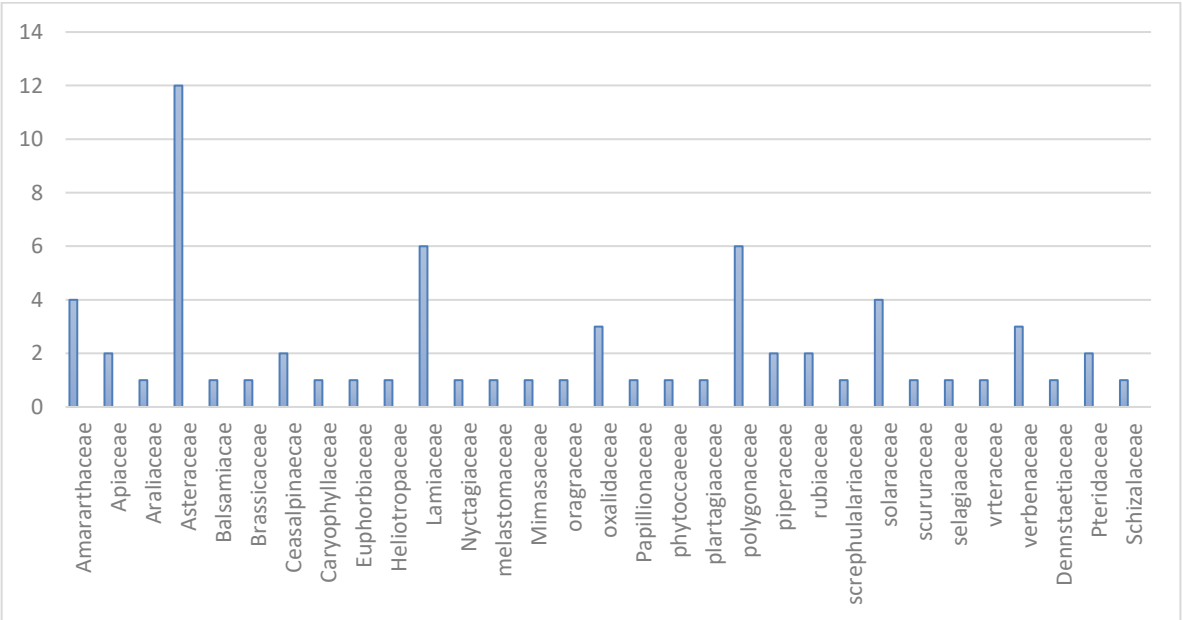

Fig. 2. Species level distribution of different dicotyledonous families of weed recorded from the tea gardens of Dergaon Area

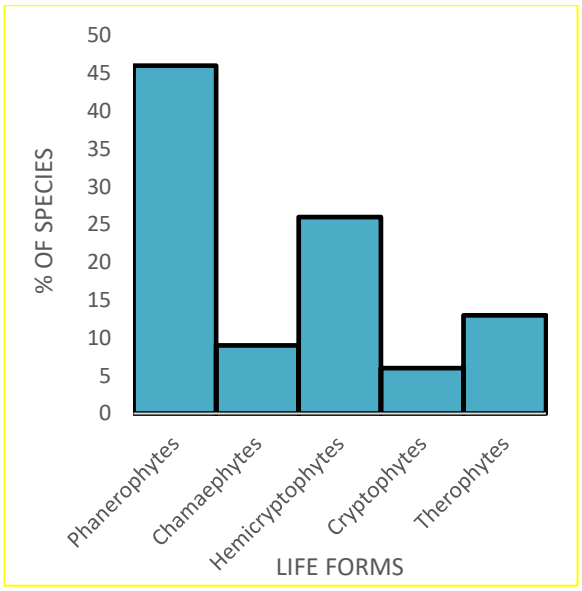

Fig. 3. Raunkiaer's normal biological spectrum (Percentage of different life forms) for the world's phanerogamic flora

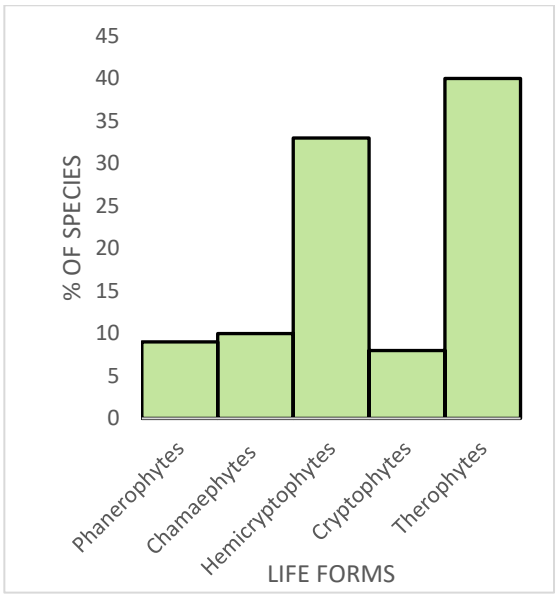

Fig. 4. Biological spectrum (Percentage of different life forms) of studied area

Distribution pattern of different weed species showed greater number of occurrences during the summer season than winter. It was observed that the number of weed species increases with the rise in temperature from February onwards. The critical period of weed competition starts from April to September, the period concurs with high temperature and rainfall which provides a very favourable condition for weed growth and hence utmost care is needed to be taken to control the weed during this period so that the productivity should not affected.

Both young tea sections and mature tea sections are found to be dominated by *Axonopus compressus*, *Cynodon dactylon, Ageratum conyzoides*, *Melastoma malabathricum.* The study infers that diversity of dicotyledonous weeds in the study areas is more than monocotyledonous weeds. *Ageratum conyzoides* is the most noxious weed, which unintentionally added to harvested shoots of young tea plant and negatively affected the tea quality.

In spite of their negative impacts on crop production, weeds may also have positive socioeconomic and other effects, because most of them are source of useful and serve as non-crop resources (Srithi et al., 2017). Most of the weeds which are found in tea gardens are widely consumed as a vegetable or as medicine in Assam as well as different parts of the world. Sen et al., (2016) reported that local khasi tribal people use some weed species as folk medicine against various diseases. Saikia, (2024) reported 47 tea weed species from North Lakhimpur of Assam that used in local medicinal practices.

4. CONCLUSION

The weeds not only affect the growth of tea plant by competing with them for necessary requirements but also act as alternative host for various pests and pathogens. This study opens the wide research areas such as detail phenological studies, seasonal dynamics of the weed population etc. and will be helpful for formulation of better weed management in Tea gardens of Dergaon area. Presen study will be also helpful for the reserchers involved in exploring the weeds of difference agro-ecosystem as well as ethnobiology of different region.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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