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RESEARCH ARTICLE

DIVERSITY OF DRAUGHT RESISTIVE HERBS AND SMALL SHRUBS IN GONDIA DISTRICT OF EAST VIDARBHA

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Abstract

Drought acceptance is the ability to which a plant maintains its biomass production during arid or drought conditions. Some plants are naturally modified to dry conditions, existing with defense mechanisms such as drought tolerance, detoxification, or restore of xylem disorder. It affects the plant morphological, physiological, biochemical and molecular attributes with adverse impact on photosynthetic capacity. Growth pattern and structural arrangement, decrease in transpiration loss through altering stomata conductance and distribution, leaf rolling, root to shoot ratio dynamics, root length growth, accumulation of well-matched solutes, and enhancement in transpiration efficiency, osmotic and hormonal regulation, and delayed senescence are the strategies that are adopted by plants under water insufficiency. The sophisticated adjustment that improves the water stress tolerance and adaptation in plants for the biodiversity richness even in summer are briefly discussed during the study. Total 26 herbs including small shrubs were listed out of which 13 are seasonal/ annual, 03 are annual to perennial and 10 are perennial. Total 13 plants out of 26 are useful as forage even in month of summer. Some seasonal plants start to germinate in month of February -March and grow in climax during month of May- June and bloomed in very short period of time.

Introduction:-

In the present study, responses of various drought resistive herbs and small shrubs of this region were examined to make clear the growth under progressive drought stress. One of the most common and damaging environmental stress is soil drought. The soil drought characteristics may vary from intervals of water scarcity and water depletion without rain fall in summer. Hence, the drought practiced by plants biodiversity likes deserts. The random nature of the drought is dependent upon various factors such as uneven and undependable distribution of rainfall, evaporation, and water holding capacity around the rhizosphere (Passioura J.B. & Angus J.F. 2010and Devincentis A.J. 2020).

Global climate change is probable to accelerate in the future because of the nonstop rising of air temperature and atmospheric CO_2 levels that ultimately alters the rainfall patterns and its distribution (Yang H. *et al*., 2019). Draught resistive plants utilized the atmospheric CO_2 in photosynthesis and maintain greenery even in adverse condition and some of them utilized by animals as fodder. Although deficient water input from rainfall is usually the main driver

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for drought stress, the loss of water from soils through evaporation, which is driven by high temperature events, high light intensity and dry wind, can further build up an existing drought stress event (Cohen I. *et al*., 2021).
Less than optimal water availability use in the rhizosphere hampers the plant growth, thereby inhibiting the plant nutrient uptake. To cope against the water deficit, the osmotic adjustment of stressed plants is maintained through an increase in sugar content of roots and leaves, and relatively greater growth in roots compared to shoots has been observed in plants subjected to drought stress in the past (Miranda M.T., *et al*., 2020). Certain metabolic changes and gene expressions may enable the plants to survive under these circumstances (Mostofa M.G., *et al*., 2018 and Ahanger M.A. *et al*., 2017). mechanisms like osmotic adjustment, antioxidant security mechanism, solute accumulation, metabolic and biochemical dynamics of stomatal closure and increment in root shoot ratio are other common strategies that allow plants to tolerate the adverse effect of drought stress.

The microorganisms also enter into a vital role in reducing the adverse effects of drought stress. For example, Azospirillumlipoferum increase accumulation of soluble sugar, free amino acids and proline which affect the growth of root length (Hussain M.B., *et al*., 2014). Thus, investigating the plants' ability to cope with water limitation is of great value and should continue to receive attention in the near future, especially in arid and semi-arid environments (Sobhanian H. *et al*., 2010).

Table 1:- Draught resistive plants with botanical names, families, habit and habitat.

Sr. No.	Botanical Name	Family	Habit	Habitat
1	*Argemone mexicana*(L.)	Papaveraceae	Prickly seasonal to annual herb	Along roadsides, barelands, cultivated lands, riverbanks, disturbed areas and on floodplains
2	*Corchorus olitorius* (L.)	Malvaceae	An erect, stouty annual, or perennial shrub	Abandoned fields, grassland, and disturbed or cultivated areas
3	*Urena lobata* (L.)	Malvaceae	Tender perennial shrub or subshrub	Grazing land and waste ground
4	*Astragalus propinquus*(Schischkin.)	Fabaceae	An erect, poded perennial herb or shrub	Partial shade to full sun, sandy and well-drained soil.
5	*Alysicarpus vaginalis* (L.) DC.	Fabaceae	Annual or perennial herb	Waste areas, deserted fields and roadsides
6	*Mimosa pudica* (L.)	Fabaceae	Prickly, long-lived perennial, herb or shrub	Plantation crops, disturbed sites, grazing land, waste areas, parks, lawns, gardens etc.
7	*Tephrosia purpurea* (L.) Pers.	Fabaceae	An erect annual legume shrub	Wasteland weed
8	*Rouya polygama* (Desf.) Coincy	Apiaceae	Small seasonal to annual herb	Grazing land and dry rice field
9	*Anacyclusvalentinus*(L.)	Asteraceae	Small seasonal to annual herb	Grazing land and dry rice field
10	*Blumeaeriantha*(DC.)	Asteraceae	An erect, unbranched annual herb, strong odor	Degraded forests and field
11	*Cynara cardunculus* (L.)	Asteraceae	Upright perennial herb	Scrub area of barren land, river banks and woodland
12	*Parthenium hysterophorus*(L.)	Asteraceae	Much branched, upright annual herb	Wastelands, forest lands, flood plains, agricultural areas, urban areas, overgrazed field, industrial areas, roadsides, and railway tracks

13	*Sphaeranthus indicus* (L.)	Asteraceae	Profusely branched small seasonal to annual herb	Around dry irrigation ditches and rice fields
14	*Taraxacum officinale* (L.) Weber.	Asteraceae	Rosette like and fast spreading perennial herb	Lawns, gardens, degraded grazing land, vacant lots, sunny areas along roads and railways
15	*Tridaxprocumbense*(L.)	Asteraceae	Prostrate to ascending annual to perennial herb	Grazing land, croplands, disturbed areas, lawns, and roadsides
16	*Vicoa indica* (L.) DC.	Asteraceae	An erect seasonal to annual herb	Weed of cultivated ground and open places mostly outside the high-forest areas
17	*Hemidesmus indicus* (L.) R.Br.	Apocynaceaee	Twining perennial shrub	Occasional in plains on scrub jungles and on hill slopes
18	*Heliotropium indicum* (L.)	Boraginaceae	An erect, branched seasonal to annual herb	Waste places and settled areas
19	*Heliotropiumeuropaeum*(L.)	Boraginaceae	Hairy or bristly seasonal to annual herb	Cultivated, fallow grounds, waste ground and roadsides
20	*Evolvulusalsinoides*(L.)	Convolvulaceae	Small prostrate perennial herb	Exposed rocky soil, sandy soil, human altered environments like yards and roadsides
21	*Solanum virginianum* (L.)	Solanaceae	Prickly diffused perennial herb	Abundant by road sides and wastelands
22	*Verbascum virgatum* (Stokes.)	Schrophulariaceae	Seasonal to annual herb	Dry banks, water reservoirs, walls, field margins, rough grassland, grazing and sheltered land
23	*Barleriaprionitis*(L.)	Acanthaceae	Branched perennial small shrub	A weed of waterways, open woodlands, roadsides, waste areas and overgrazed pastures
24	*Justicia brandegeana*(Wassh. & L. B**.)**	Acanthaceae	Evergreen small perennial shrub	Best in well-drained sandy or loamy soil and shade loving
25	*Chrozophorarottleri*(Geis.) Juss ex Spr.	Euphorbiaceae	An erect densely woolly seasonal to annual herb	Paddy fields and reservoir banks
26	*Euphorbia hirta*(L.)	Euphorbiaceae	An erect or sprawling, hairy, short annual herb	Roadsides, fields and yards

Methods:-

Study for drought resistive plants was conducted between March and June 2022 in villages of 8 taluka in Gondia district. Descriptive statistics were used to present the data after identification in Department of Botany at the institute of researchers. The morphological observations for drought resistance, xerophytes characters and usefulness as forage was carried out. Quantitative analysis of data was done using reliability level and information compromise factor.

Result and Discussion:-

Draught resistive plants complete their life cycle within short period of time, such 13 plants are as seasonal rather than annual out of 26 surveyed in summer of 2022. Other 13 plants are found as biennial and perennials (Table-1). These plants are belonging to total 12 angiosperm families with different distribution (Fig-1). Among the 13 seasonal plants 12 plants blooming earlier in short period of growth (Table-2). To break away from the harmful effects of drought stress on plant productivity, some plants utilize mechanisms involving rapid plant development and shortening of the life cycle, self-reproduction, and seasonal growth before the beginning of the driest part of the year (Álvarez S. *et al*., 2018). Such plants Among these mechanisms, early flowering is may be the best possible escape adaptive mechanism in plants. Although this mechanism can involve a considerable reduction in the length of the plant growing period and the final plant productivity in some cases.

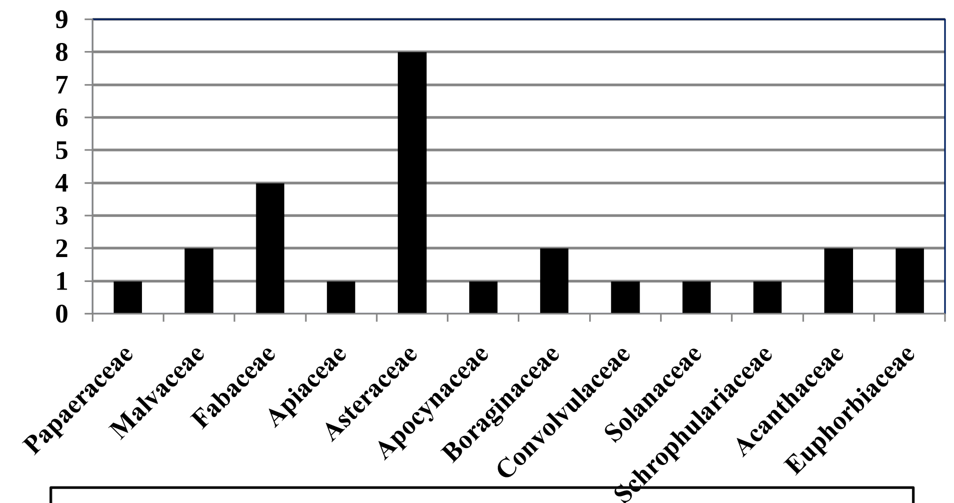

Fig- 1 Number of draught resistive plant belongs to different families

Leaf sizes (1cm -5cm, length and diameter) are find very small in 14 plants with oval, ovate, obovate, oblong and lanceolate shape of lamina, other 12 plants of study also exhibit xerophytic characters with pinnatified, lobed, hairy, prickly and thistle leaves. By having such leaf characteristics and presence of some unusual chemicals in them total 13 draught resistive plants are not useful as forage for grazing (Table-2). On the other hand, an adaptive tolerance mechanism at the photosynthetic machinery level includes reductions in the plant leaf area and limitations in the expansion of new leaves. Similarly, trichomes production on either side of the leaves are exomorphic attributes that allow the plant to tolerate water deficits in dry environments. Xeromorphic uniqueness such as the presence of hairy leaves and cuticles may help to maintain high water potentials in plant tissues (Boulard T. *et al*., 2017)

Draught resistive plants are surviving mostly on unfruitful land not in cultivations area as weeds, where penetration of roots is not easy because soil texture remain compact without intertillage (Table-2). These structures reduce the leaf temperature by increasing the rate of light reflection in the leaf and also by adding another extra layer of resistance to the water loss. Hence the rate of water loss through leaf transpiration is reduced. However, it is broadly accepted that changes in the root system, including root size, density, length, proliferation, expansion and growth rate, represent the main strategy for drought-tolerant plants to cope against water deficits (Tzortzakis N. *et al*., 2020).

Table 2:- Draught resistive plants exhibitthier blooming succession, shape of lamina and utility as forage.

Sr. No.	Botanical Name	Blooming	Shape of leaf lamina	Forage
1	*Argemone mexicana*(L.)	Early	Lobed thistle like	-ve
2	*Corchorus olitorius* (L.)	Late	Lanceolet	+ ve
3	*Urena lobata* (L.)	Late	Lobed palmately	+ ve
4	*Astragalus propinquus*(Schischkin.)	Late	Pinnatified	+ ve
5	*Alysicarpus vaginalis* (L.) DC.	Late	Oval	+ ve
6	*Mimosa pudica* (L.)	Late	Pinnatified	+ ve
7	*Tephrosia purpurea* (L.) Pers.	Late	Pinnatified	- ve
8	*Rouya polygama* (Desf.) Coincy	Early	Lobed dissected	+ ve
9	*Anacyclusvalentinus*(L.)	Early	Lobed dissected	+ ve
10	*Blumeaeriantha*(DC.)	Early	Ovate	- ve
11	*Cynara cardunculus* (L.)	Late	Lobed thistle like	- ve
12	*Parthenium hysterophorus*(L.)	Early	Lobed dissected	- ve

13	*Sphaeranthus indicus* (L.)	Early	Thick and spatulate	- ve
14	*Taraxacum officinale* (L.) Weber.	Late	Lobed dissected	+ ve
15	*Tridaxprocumbense*(L.)	Late	Ovate	+ ve
16	*Vicoa indica* (L.) DC.	Early	Ovate and eliptic	+ ve
17	*Hemidesmus indicus* (L.) R.Br.	Late	Linear lanceolate	+ ve
18	*Heliotropium indicum* (L.)	Early	Oblong to ovate	- ve
19	*Heliotropiumeuropaeum*(L.)	Early	Oval	- ve
20	*Evolvulusalsinoides*(L.)	Late	Oblong-ovate and elliptic	- ve
21	*Solanum virginianum* (L.)	Late	Lobed unequaly, dissected	- ve
22	*Verbascum virgatum* (Stokes.)	Early	Obovate, elliptic and larger at base	- ve
23	*Barleriaprionitis*(L.)	Late	Abovate	+ ve
24	*Justicia brandegeana*(Wassh. & L. B.)	Late	Lanceolate	+ ve
25	*Chrozophorarottleri*(Geis.) Juss ex Spr.	Early	Dimond to egg shape	- ve
26	*Euphorbia hirta*(L.)	Early	Lanceolate elliptic	- ve

Conclusion:-

Drought stress affects plants through the life cycle i.e., from germination till maturity. Certain physiological, metabolic and biochemical processes are affected by drought stress that hampers plant productivity. To tackle the adverse effect of the drought stress on plants, certain mechanisms are adopted by the plants which enhance drought tolerance. Thus, there is need to explore the unused adaptation characters in different plants and their incorporation to the genotypes that may tolerate the adverse effect of drought stress in order not to affect its productivity.

Growth pattern and structural arrangement, decrease in transpiration loss through altering stomata conductance and distribution, leaf rolling, root to shoot ratio dynamics, root length growth, accumulation of well-matched solutes, and enhancement in transpiration efficiency, osmotic and hormonal regulation, and delayed senescence are the strategies that can be adopted by plants grown under water deficit. These innovative strategies provide better understanding of and potentially increase plant productivity in dry environments in order to reduce the threat for weak biodiversity.

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