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A CONTRIBUTION TO THE AUTECOLOGY OF *CAPPARIS DECIDUA* (FORSK.) EDGEW. II. EFFECT OF EDAPHIC AND BIOTIC FACTORS ON GROWTH AND ABUNDANCE.

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Abstract

Soil samples were collected at surface and subsurface levels from several sites of occurrence of *Capparis decidua* (Forsk.) Edgew. The community associates and community dominants of *C. decidua* were recorded. Soil was analyzed for texture, structure, consistency, maximum water holding capacity, wilting coefficient and hydrogen ion concentration. In angular blocky soil growth was found to be the best and the abundance was low, while in granular and crumb soil highest abundance with poor growth was found. In sub-angular blocky soil structure intermediate growth and abundance were observed. Best growth was found in clay loam followed by sandy clay loam soils but the abundance was less in these soils. The highest abundance coupled with poor growth was found in sand while sandy loam and loamy sand soils occupied an intermediate position between clay loam and sandy clay loam soils for these features.

Growth and abundance of *C. decidua* were also correlated with maximum water holding capacity and wilting coefficient of all the soils studied. High maximum water holding capacity and high wilting coefficient were found to be good for growth while low values of these soil moisture constants were better for abundance of the plant. The abundance of *C. decidua* was highest in the soils having the sub-surface soil pH range of 7.2-8.2 while the growth was better in a pH range of 6.7-7.6 in the sub- surface soil.

When *C. decidua* was found growing with the climatic climax species the growth was observed to be the best but there was low abundance. When it was found associated with *Lycium europaeum* Linn. and *Cordia rothii* R. & S. as first community dominants, good abundance with poor growth was observed. *C. decidua* has a wide ecological amplitude as it was found growing with a large number of community associates.

Introduction

Capparis decidua is very widely distributed in all the warmer parts of West Pakistan and occurs as a dominant species in several areas of southern region and all the sandy tracts of West Pakistan. Very little is known about the autecology of this dominant species except Qaiser & Qadir (1971) who studied the seed germination, and effect of topography on the growth, abundance and sociability and have shown that topography has a marked influence on this plant.

Some synecological studies have been carried out in the past which throw some light on the ecology of this species. Joshi (1957), while studying the vegetation in Jaipur division, has shown that *Capparis decidua* has a wide ecological amplitude and grows with large number of associates. *C. decidua* comes as a subclimax in the succession on the arid flat areas and its bushes give shelter to the seedlings of *Salvadora oleoides* and *Prosopis spicigera* (Chaudhri, 1960, 1966). Monsi & Khan (1960) calculated that *C. decidua* came in as an important constituent species of the plant associations in Thal region. It had 8.1% and 5.9% coverage at Bhawalpur and Khanewal respectively, thus showing that it is a main species of Thar and Trans Indus plains. Wright (1964) surveyed Nagar Parkar peninsula and showed that this species grows sparsely on skeletal soil, while on sandy loam and coarse-textured alluvial soils it grows in the form of scattered bushy shrubs and small trees, on eolian fine sand it occurs as dense shruby thickets alongwith *Salvadora oleoides*. In coarse-textured brown earth to medium-textured brown earth, it grows sparsely or in a scattered manner. According to Hussain (1964) in Nagar Parkar where the moisture conditions are slightly better, the growth of *C. decidua* is good, on foot hills it is rare and on the hills this species is almost absent. In alluvial plains where the moisture conditions are better, *C. decidua* appears with slight increase of alkalinity and becomes a codominant; remains shruby in south, but due to the lesser force of the wind and thus greater protection it attains the size of a medium sized tree towards the east. Greig-Smith & Chaudwick (1965) studied the *Capparis—Acacia* community in Sudan and showed that it forms an open community in Nile alluvium (clay or sandy clay). Chaudhri & Chuttar (1966) reported that in Thar desert the frequency index and percentage abundance is 3 and 0.046, respectively, while in valleys and plains it is 24 and 0.1063, respectively. On rock hills the species is almost absent. According to Qadir *et al* (1966) it forms an open community with *Prosopis spicigera* on sand dunes in Karachi University Campus (eolian fine sand—loamy sand). Gupta & Saxena (1968) studied the vegetation of Mount Abu in Rajisthan and showed that on alluvial plains it grows either in mixed xeromorphic thorn forest with *Acacia arabica*, *Salvadora persica* and *Zizyphus nummularia* in deep to very deep soils, sandy loam non-calcarious above and calcarious below, or in thorny scrub forest with *Acacia leucophloea*, *Zizyphus nummularia* and *Euphorbia caducifolia* in deep, shallow, mostly sandy, gritty, loam soils.

In the present study an attempt has been made to find out various edaphic and biotic factors and correlate with the growth and abundance in nature, particularly in the southern region of West Pakistan.

Geology, physiography and the climate of the study area have already been dealt with by Qaiser & Qadir (1971).

Pithawala (1946) has divided the soils of Karachi according to their mode of origin into:

i) Residual soils derived from the underlying limestones and sand-stones which are greatly weathered;

ii) Drift of soil which occupy dry river valleys (alluvial);

iii) Soils derived from desert deposit in which sand dunes predominate (eolian).

Materials and Methods

Methods of evaluating growth, abundance and sociability of *C. decidua* have been described earlier (Qaiser & Qadir, 1971).

1. SOIL ANALYSIS:—The soil samples from surface and sub-surface levels were collected with soil auger and analysed for:

i) Soil colour:—The colour of the soil samples were noted by visual observation in dry and wet conditions.

ii) Aggregate stability:—The aggregate stability was determined by Sekera & Brunners' quick test (1942).

iii) Soil consistence:—Soil consistence was determined in dry and moist conditions by the method outlined in the "Manual of Soil Survey" of U.S.D.A. (1951).

iv) Soil structure:—The structure was determined by the method outlined in the "Manual of Soil Survey" of U.S.D.A. (1951).

v) Texture:—The soil was mechanically analysed by pipette method. The approximate amount of organic matter present in the sample was also determined by treating the soil with H_2O_2 and the amount of $CaCo_3$ present in the sample was also calculated by finding out reduction in weight of the soil sample after treating the sample with 10% HCI.

vi) Maximum Water Holding Capacity:—The maximum water holding capacity of the soils was determined by the method of Keen (1931) as described by Kramer (1945).

vii) Wilting coefficient:—The wilting coefficient of the soils was determined by the method of Briggs & Shantz (1912) using sun-flower, as described by Kramer (1945).

viii) *pH:*—pH was determined by Cambridge Pye pH meter.

ix) Carbonate determination:—Carbonates were determined by volumeteric method, by treating 10 ml of soil solution with known normality of HCI. Ten gms of the oven dried soil were treated with 50 ml of 0.5N HCI, warmed up for five minutes and the whole solution was titrated with 0.25N NaOH using phenophthalein as an indicator.

2. BIOTIC FACTORS:—Community dominants in relation to *Capparis decidua* and community associates in each stand were noted down.

Results and Discussion

I. Edaphic factors:

According to Qadir *et al* (1966) the soils around Karachi are calcarious and azonal. The area has sand as a predominant fraction. Table 1 shows some important physical properties of the soils on which *C. decidua* was found to be growing.

i) Effect of soil structure:

The soil structure has some influence on the growth and abundance of *C. decidua* (Table 2). Best growth was observed in angular blocky type of soil structure (average cover=26.8′; average height=8.9′) while in granular and crumb structures the growth was found to be poor (average cover=18.0′ and 18.4′; average height 6.7′ and 6.8′, respectively). In sub-angular blocky type of soil structure intermediate growth was found (average cover=21.4′; average height=7.08′). The abundance of *C. decidua* was found to be reverse that of growth i.e. on granular and crumb massive soil structures highest abundance ranging from 25-100% was found, while on angular blocky soil structure the abundance was found to be in between 5-20%. In the case of sub-angular blocky soil structure intermediate abundance and growth were observed.

ii) Effect of Soil Texture:

Soil texture is one of the most important factors effecting the growth andabundance of *C. decidua*. Table 3 indicates that the growth of the plant was not good in coarse soil (in sand average cover=15.2′ and average height=7.0′), while in fine soil, i.e. clay loam the growth was found to be the best (average cover=32.6′ and average height=9.2′).In case of sandy clayloam, average height (8.2′) and average cover (21.4′) were lower than in clay loam soil, while in sandy loam (average cover=19.8′; average height=6.9′) and loamy sand soils (average cover=17.2′; average height=6.2′) intermediate type of growth was found. (Fig. 1).

Reverse was true for abundance. In sand highest abundance (average 53.3%) was found while in clay loam and sandy clay loam soils lowest abundance was observed i.e. average 9.1% and 23%, respectively. In sandy loam and loamy sand soil intermediate type of abundance was observed. Qaiser & Qadir (1971) have shown that the seed germination of *C. decidua* was better in sandy soils and poor in fine textured soils. This correlates very well with the findings of abundance on different textural classes.

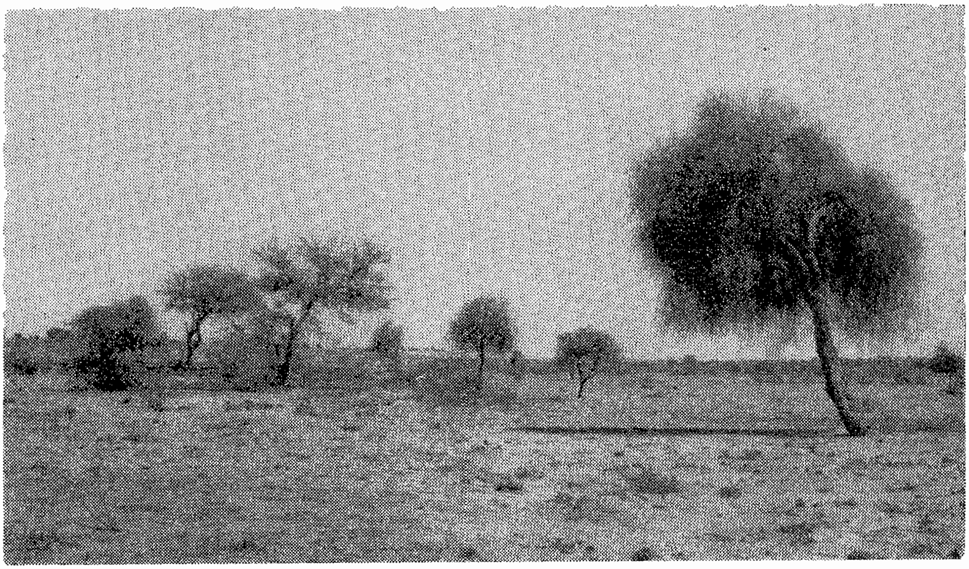

Fig. 1. Tree habit of *Capparis decidua* near Lunglohar on clay loam soil.

iii) Effect of total sand:

No correlation was found between the growth and abundance with fine sand or coarse sand. But a sharp correlation of growth and abundance with total sand content was found. Table 3 indicates that high sand percentage favoured high abundance. When the sand was found in between 68.9-92.09% the abundance range was in between 20-100% with a few exceptions. On the other hand, better growth was observed when the sand content was between 27.1-73.8%.

iv) Effect of clay fraction:

The effect of percentage of clay fraction on the growth and abundance was found to be quite significant (Table 3). High clay percentage (10.2-27.5%) was favourable for the growth while low percentage (with a few exceptions), i.e. below 10% favoured high abundance.

v) Effect of clay and silt fraction:

No sharp correlation of growth and abundance with silt was found. However, when both silt and clay percentages were collectively taken into consideration, it was

Table 1. Physical properties of soils of different stands of *Capparis decidua*

Site No.	Colour of soil 1		Aggregate stability 2		SOIL CONSISTENCE: Dry 3		Moist 4		Wet: Stickiness 5		Wet: Plasticity 6	
	A	B	A	B	A	B	A	B	A	B	A	B
*1.	Brownish Gray	Brownish Gray	—	—	Loose	Loose	Loose	Loose	Non-sticky	Non-sticky	Non-Plastic	Non-Plastic
2.	-do-	-do-	—	—	-do-	-do-	-do-	Friable	-do-	Slightly sticky	-do-	Slightly plastic
3.	Light brown	Light brown	—	—	-do-	-do-	-do-	Loose	-do-	Non-plastic	-do-	Non-plastic
4.	Dark brown	Brownish Gray	—	Very Weak	Soft	Soft	Very Friable	Very Friable	-do-	Slightly sticky	-do-	-do-
5.	Light brown	Dark gray	Very weak	Weak	Soft	Hard	-do-	Firm	Slightly sticky	Sticky	-do-	Slightly plastic
6.	-do-	Light gray brown	—	—	Loose	Loose	Loose	Friable	Non-sticky	Non-sticky	-do-	-do-
7.	Light Gray	Gray Brown	—	Weak	-do-	Slightly hard	Very Friable	-do-	-do-	Slightly sticky	-do-	-do-
8.	Grayish brown	Grayish brown	Very weak	Weak	Soft	Soft	Very Friable	Non-Friable	Slightly plastic	Non-plastic	Non-plastic	Non-plastic
9.	Grayish brown	Dark Grayish brown	Very Weak	Weak	Loose	Soft	Friable	Firm	Slightly sticky	Sticky	Slightly plastic	Plastic
10.	Light Yellow brown	Light brown	Weak	Slightly weak	Soft	Soft	Firm	Firm	Sticky	Sticky	Plastic	Plastic
11.	Brownish gray	Dark brownish gray	Slightly weak	Slightly weak	Slightly hard	Slightly hard	Firm	Firm	Sticky	Sticky	Plastic	Plastic
12.	Grayish brown	Grayish brown	Very weak	Very weak	Slightly hard	Slightly hard	Firm	Firm	Sticky	Sticky	Plastic	Plastic

13.	Light gray	Light gray	Very weak	Very weak	Soft	Soft	Friable	Friable	Slightly sticky	Slightly sticky	Non-plastic	Non-plastic
14.	Light gray	Light gray	Slightly weak	—	Soft	Soft	Firm	Very friable	Sticky	Non-sticky	Slightly plastic	Non-plastic
15.	Light brown	Light brown	Very weak	Very weak	Soft	Soft	Friable	Friable	Slightly sticky	Slightly sticky	Slightly plastic	Slightly plastic
16.	Light brown	Light brown	Very weak	Very weak	Soft	Soft	Very friable	Very friable	Non-sticky	Non-sticky	Non-plastic	Non-plastic
17.	Light Yellow brown	Light brown	—	—	Loose	Loose	-do-	-do-	-do-	-do-	-do-	-do-
18.	Dark brown	Dark brown	—	—	Loose	Loose	Loose	Loose	Non-sticky	Non-sticky	Non-plastic	Non-plastic
19.	Light brown	Light brown	Very weak	Very weak	Soft	Soft	Friable	Friable	Non-sticky	Slightly sticky	-do-	-do-
20.	Light Yellow	Light Yellow	Very Weak	Weak	Soft	Slightly hard	-do-	Firm	Slightly sticky	Sticky	Slightly plastic	Plastic
21.	Light Yellowish brown	Light Yellowish brown	Slightly weak	Moderate	Slightly hard	Hard	Firm	Firm	Very sticky	Very sticky	Plastic	Very plastic
22.	Light Yellowish brown	Yellowish brown	Slightly weak	Slightly moderate	Slightly hard	Slightly hard	Very firm	Very firm	Sticky	Sticky	Plastic	Plastic
23.	Yellowish brown	Yellowish brown	Moderate	Moderate	Hard	Hard	Firm	Firm	-do-	-do-	-do-	-do-
24.	Brownish gray	Brownish gray	—	—	Loose	Loose	Loose	Loose	Non-sticky	Non-sticky	Non-plastic	Non-plastic
25.	Light brown	Light brown	Very weak	Very weak	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-
26.	-do-	-do-	-do-	-do-	Soft	Soft	-do-	-do-	-do-	Slightly sticky	-do-	-do-

A: Surface Soil
B: Sub-surface Soil

*For details of different localities see Qaiser & Qadir (1971).
—Structureless

Table 2. Effect of soil structure on the growth and abundance of *Capparis decidua*.

Sl. No.	Site No.	Soil Structure			Growth		Abundance, %
		Type	Grade	Class	Cover, ft.	Height, ft.	
1.	1	Granular	Structure less	Very fine	14.6	6.8	70-80
2.	3	,,	,,	,,	15.2	7.6	40-45
3.	6	,,	,,	,,	19.6	6.8	50
4.	9	,,	Weak	Fine	22.0	7.3	15-20
5.	15	,,	,,	,,	19.3	5.3	2- 5
6.	18	,,	Structure less	,,	16.0	5.8	40-45
7.	25	,,	Weak	,,	18.2	7.6	5-10
8.	26	,,	Very weak	Very fine	19.4	6.4	25-30
9.	2	Crumb	Weak	Fine	14.7	6.6	50-55
10.	16	,,	,,	,,	16.1	6.0	Below 2
11.	17	,,	,,	,,	17.8	4.3	20-25
12.	4	,,	,,	Very fine	20.8	9.3	80-100
13.	5	,,	,,	,,	22.7	8.4	40-50
14.	7	,,	,,	,,	18.0	6.0	50
15.	24	,,	,,	,,	22.8	7.0	35-40
16.	8	Sub-angular blocky	,,	Fine	19.6	8.0	5-10
17.	19	,,	,,	,,	23.7	6.5	30-35
18.	12	,,	Moderate	Medium	18.4	6.8	70-80
19.	13	,,	,,	,,	25.6	7.4	10-15
20.	11	,,	,,	Thick	20.6	6.7	20-25
21.	20	Angular blocky	,,	Medium	20.5	9.0	5-10
22.	10	,,	,,	,,	30.3	13.0	5-10
23.	14	,,	,,	,,	12.5	4.3	Below 2
24.	22	,,	Strong	Thick	28.1	8.8	10-15
25.	23	,,	,,	,,	27.3	7.3	10-15
26.	21	,,	,,	,,	42.3	11.2	5-10

Table 3: Effect of soil texture, sand, clay and silt & clay on the growth and abundance of *Capparis decidua*.

S. No.	Site No.	Texture	Average sand	Clay	Silt & Clay	Growth		Abundance. %
						Cover, ft.	Height. ft.	
1.	23	Clay loam	27.1	25.6	62.0	27.3	7.6	10-15
2.	21	,,	28.7	27.05	67.0	42.5	11.2	5-10
3.	22	,,	30.5	26.5	61.6	28.1	8.8	10-15
4.	20	Sandy clay loam	59.7	26.5	39.6	20.5	9.9	5-10
5.	10	,,	60.1	25.1	35.6	30.3	13.0	10-15
6.	13	,,	60.1	24.8	35.4	25.6	7.4	10-15
7.	*14	,,	67.7	20.5	29.5	12.5	4.3	Below 2
8.	12	,,	68.9	20.5	30.4	18.4	6.8	70-80
9.	9	Sandy loam	65.0	18.9	31.3	22.0	7.3	15-20
10.	5	,,	72.6	14.08	23.1	22.7	8.4	40-50
11.	19	,,	73.8	12.4	20.8	23.7	6.5	30-35
12.	4	,,	75.4	10.2	17.4	20.8	8.3	80-100
13.	17	,,	75.6	13.1	20.3	12.8	4.3	20-25
14.	11	,,	76.6	12.45	22.51	14.7	6.6	50-55
15.	24	,,	77.25	13.1	21.8	22.8	7.0	35-40
16.	26	,,	78.3	10.5	18.7	19.4	6.4	25-30
17.	8	,,	79.0	14.9	24.5	19.6	8.0	5-10
18.	6	,,	77.4	15.0	25.2	19.6	6.8	50
19.	25	Loamy sand	79.0	11.0	18.8	18.2	7.2	5-10
20.	2	,,	79.4	9.7	16.9	14.7	6.6	50-55
21.	15	,,	79.9	8.8	15.1	19.3	5.3	2-5
22.	7	,,	80.5	9.1	18.6	18.0	6.0	50
23.	16	,,	81.2	7.51	14.5	16.1	6.0	Below 2
24.	18	Sand	82.3	6.6	10.07	16.0	5.8	40-45
25.	1	,,	87.3	7.1	12.1	14.6	6.8	70-80
26.	3	,,	92.09	6.3	7.4	15.2	7.6	40-45

*Exception

found that growth and abundance were governed by these two fractions. As is clear from Table 3 that, high percentage of silt and clay favoured the growth but resulted in low abundance (67-20.8%); while below 20% of silt and clay the reveres was found to be true, i.e. low growth and high percentage of abundance.

vi) Effect of maximum Water Holding Capacity (m.w.h.c.):

This soil moisture constant seems to have a great effect on the growth and abundance of *C. decidua* (Table 4). Plant growth was found to be the best in the soils which have high maximum water holding capacity. There were, however, a few exceptions. The relationship of abundance of *C. decidua* with the maximum water holding capacity of soil was found to be the reverse of plant growth. A range of 23.8-37.2% maximum water holding capacity was the best for growth and below 23.8% the abundance of the plant was found to be high.

The above mentioned results and also the relation of soil texture discussed earlier confirm the observations of Greig-Smith & Chaudwick (1965) who studied *Acacia—Capparis* community in Sudan. Sudanese soils consist of Nile alluvium (clay or sandy clay) covered by a superficial layer of low sand of varying depth. They observed that the seedlings of *C. decidua* tended to become more abundant near larger individuals but there was a regular spacing with the increasing size of individuals forming an open community. This indicates the poor percentage of establishment of the individuals in good soils.

vii) Effect of wilting coefficient of soils:

Table 4 indicates that the growth is proportional to the wilting coefficient that is with the increase of this soil moisture constant, the growth also increases but the reverse is true for abundance.

viii) Effect of organic matter:

No significant effect of organic matter of soil on the growth and abundance of *C. decidua* was found. Roughly it was observed that high organic matter favoured good growth (A range of .005- .082% of organic matter favours growth) while abundance was high with low organic matter percentage. (A range of .006%—.0008% favours abundance).

ix) Effect of soil pH:

No effect of soil pH(surface soil, average of surface and sub-surface soil) on the growth and abundance of *C. decidua* was found (Table 5). But the sub-surface soil pH

Table 4. Effect of soil moisture constants on the growth and abundance of *Capparis decidua*.

Site No.	Maximum water holding capacity %		Wilting Coefficient, Average	Growth		Abundance, %
	Surface.	Subsurface		Height, ft.	Cover, ft.	
9	37.2	45.02	3.9	7.3	22.0	15-20
21	35.9	35.04	5.6	11.2	42.3	5-10
10	35.4	45.1	5.7	30.0	30.3	5-10
22	34.7	36.0	5.2	8.8	28.1	10-15
23	32.3	35.1	5.5	7.6	27.3	10-15
13	31.8	31.4	5.1	7.4	25.6	10-15
8	28.1	28.8	4.5	8.0	19.6	5-10
15	28.1	28.8	2.15	5.3	19.3	2-5
19	27.6	28.2	4.5	6.5	23.7	30-35
17	27.1	23.2	3.95	4.3	17.8	20-25
26	27.1	29.2	2.05	6.4	19.4	25-30
6	25.4	27.2	3.5	6.8	19.6	50
14	24.1	29.1	4.8	4.3	12.5	Below 2
20	23.8	28.5	5.5	9.0	20.5	5-10
5	23.4	24.5	4.4	8.4	22.7	40-50
7	23.3	23.3	3.8	6.0	18.0	50
12	23.3	23.3	4.2	6.8	18.4	70-80
11	23.1	22.9	4.3	6.7	20.6	20-25
1	22.2	25.1	2.69	6.8	14.6	70-80
18	22.2	20.1	2.0	5.8	16.0	40-45
24	21.2	23.6	4.2	7.0	22.8	35-40
25	21.0	21.26	2.05	7.6	18.2	5-10
4	20.8	23.4	3 15	9.3	20.8	80-100
2	20 4	21.2	2.1	6 6	14.7	50-55
3	20.1	21.1	2.35	7.6	15.2	40-45
16	20.0	20.8	2.0	6.0	16.1	Below 2

Table 5. Effect of pH and CaCo3, on the growth and abundance of *Capparis decidua*.

S. No.	Site No.	pH of Sub-surface soil	Calcium carbonate, %		Growth		Abundance, %
			Surface soil	Sub-surface soil	Cover, ft.	Height, ft.	
1.	4	8.2	20.6	20.6	20.8	9.3	80-100
2.	1	8.2	18.4	17.8	14.6	6.8	70-80
3.	3	8.2	18.6	19.9	15.2	7.6	40-45
4.	11	8.2	18.3	18.5	20.6	6.7	20-25
5.	12	8.1	16.5	17.2	18.4	6.8	70-80
6.	26	8.0	18.9	19.4	19.4	6.4	25-30
7.	18	8.0	20.1	18.2	16.0	5.8	40-45
8.	2	8.0	19.6	17.1	14.7	6.6	50-55
9.	22	7.9	15.4	15.6	28.1	8.8	10-15
10.	24	7.8	19.8	18.6	22.8	7.0	35-40
11.	19	7.8	15.8	16.0	23.7	6.5	30-35
12.	17	7.7	18.9	17.5	17.8	7.3	22-25
13.	6	7.6	20.6	21.5	19.6	6.8	50
14.	7	7.6	17.9	17.4	18.0	6.0	50
15.	14	7.5	17.0	17.5	12.5	4.3	Below 2
16.	20	7.5	17.6	18.2	20.5	9.0	5-10
17.	5	7.4	20.1	20.6	22.7	8.4	40-50
18.	23	7.4	20.1	18.2	27.3	7.6	10-15
19.	16	7.2	18.8	18.6	16.1	6.0	Below 2
20.	21	7.2	17.6	18.2	42.3	11.2	5-10
21.	10	7.2	17.4	17.8	30.3	13.2	5-10
22.	13	7.1	19.4	20.2	25.6	7.04	10-15
23.	15	7.1	19.1	17.8	19.3	5.3	2-5
24.	25	7.0	20.1	21.2	18.2	7.6	5-10
25.	9	7.0	19.6	19.5	22.3	7.3	15-20
26.	8	6.7	19.2	18.4	19.6	8.0	5-10

range of 7.2-8.2 favours the abundance; while for cover a pH range of 6.7-7.9 seems to be slightly better but a pH range of 6.7-7.6 is even better for growth i.e. for cover and height both.

x) Effect of calcium carbonate of soil:

No sharp correlation between the growth and abundance was found with the amount of calcium carbonate (Table 5). However, a high percentage of calcium carbonate i.e. a range of 18.4-20.6 favoured high abundance while a range of 14.4-18.3 favoured good growth.

xi) Effect of soil carbonates:

No effect of carbonate of soil (3.5-12.4 %) was found on the growth and abundance of *C. decidua*.

2. Biotic factors:

i) *Effect of community dominants on the growth and abundance*:

C. decidua (Forsk.) Edgew., comes in the sub-climax stage of succession on inland sand dunes and alluvial plains. Best growth with poor abundance of *C. decidua* was observed in association with the climatic climax dominants *Salvadora oleoides* Decene. and *Prosopis spicigera* L. (Table 6). Similarly with *Acacia arabica* (a physiographic Climax dominant), good growth and very low abundance were observed. When *C. decidua* (Forsk.) Edgew. was present as a community dominant high abundance was observed but growth was not good. Whenever *Euphorbia caducifolia* Haines. was associated as a first community dominant, intermediate growth and low abundance was observed. *Lycium europaeum* L. and *Cordia rothii* B. & R. are succeded by *C. decidua* (Forsk.) Edgew. Where both these plants were present as first and second community dominants good growth and low abundance were observed. When *C. decidua* was present as a first community dominant with *Lycium europaeum* Linn. and *Cordia rothii* B & R. the growth was poor but abundance was high. (Fig. 2)

ii) Community associates and *Capparis decidua* (Forsk.) Edgew. :

C. decidua has a wide ecological amplitude as it has been observed to be associated with a large number of plants in different localities. Table 7 gives a complete list of associates found with *C. decidua*. Among the most common associates are *Euphorbia caducifolia* Haines., *Cordia rothii* R. & S., *Prosopis spicigera* L., *Lycium europaeum* L., *Zizyphus nummularia* (Burm. f.) Wt. & Arn., and *Indigofera oblongifolia* Forsk.

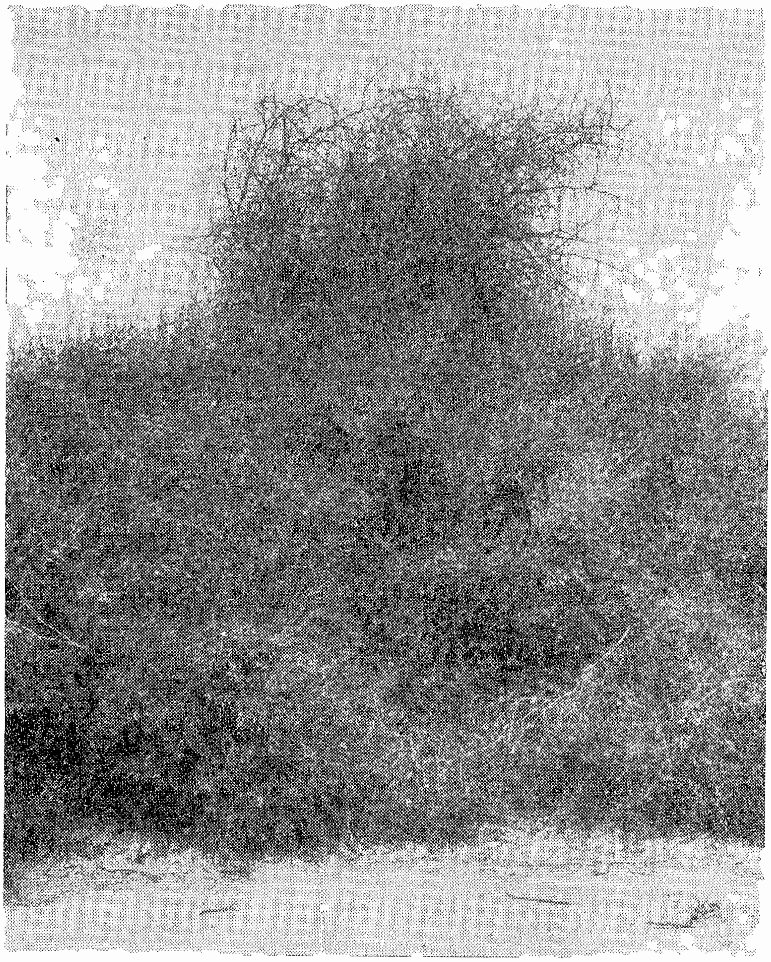

Fig. 2. Capparis decidua being succeded by *Salvadora oleoides*, one of the climax dominant.

Joshi (1957) reported from Bikaner that most common associates of this plant were *Zizyphus nummularia* (Burm. f.) Wt. & Arn., *Aerva tomentosa* Linn., *Gymnosporia montana* Benth. and *Abutilon bidentatum* Hochst. ex A. Rich. Joshi (1957) has also reported from Jaipur that *C. decidua* is mostly associated with *Gymnosporia spinosa*, *Tephrosia purpurea* Pers. and *Ephedra foliata* Boiss. Greig-Smith & Chaudwick (1965) reported from Sudan that it formed an open scrub community with *Acacia ehrnbergiana*.

Table 6. Effect of community dominants on the growth and abundance of *Capparis decidua*.

Site No.	Community	Growth		Abundace, %
		Cover, ft.	Height, ft.	
19	*Salvadora-Capparis*	23.7	6.5	30-35
10	*Prosopis-Capparis* and *Salvadora*	30.3	13.0	5-10
21	*Prosopis-Lycium* and *Capparis*	42.3	11.2	5-10
23	*Acacia arabica-Capparis*	27.3	7.6	10-15
22	*Acacia arabica-Indigofera* and *Capparis*	28.1	8.8	10-15
3	*Capparis-Prosopis & Commiphora*	15.2	7.6	40-45
11	*Capparis-Zizyphus & Prosopis*	20.6	6.7	20-25
4	*Capparis* (Pure stand)	20.8	9.3	80-100
6	*Capparis-Euphorbia*	19.6	6.8	50
1	*Capparis-Euphorbia & Acacia*	14.6	6.8	70-80
5	*Capparis-Cordia*	22.7	8.4	40-45
7	*Capparis-Cordia & Commiphora*	18.0	6.0	50
2.	*Capparis-Cordia & Lycium*	14.7	6.6	50-55
12	*Capparis-Lycium & Cordia*	18.4	6.8	70-80
13	*Cordia-Capparis & Indigofera*	25.6	7.04	10-15
9	*Lycium-Capparis*	22.0	7.3	15-20
15	*Lycium-Cordia & Capparis*	19.3	5.3	2-5
25	*Euphorbia-Prosopis & Capparis*	18.2	7.6	5-10
20	*Euphorbia-Capparis & Cordia*	20.5	9.0	5-10
24	*Euphorbia-Capparis & Grewia*	22.8	7.0	35-40
26	*Euphorbia-Capparis & Aerva*	19.4	6.4	25-30
17	*Euphorbia-Cordia & Capparis*	17.8	4.3	20-25
8	*Euphorbia-Commiphora & Capparis*	19.6	8.0	5-10
14	*Euphorbia-Acacia senegal-Commiphora*	12.5	4.3	Below 2
16	*Euphorbia (nearly pure stand)*	16.1	6.0	Below 2

Table 7. *Capparis decidua* **(Forsk.) Edgew. and community associates**

Site No.	Community associates
1.	*Euphorbia caducifolia* Haines. *Calotropis procera* (Willd.) R. Br., *Commiphora mukul*, (Hk. f. ex Stocks) Engler, *Cordia rothii* R. & S. *Boerhaavia, verticillata* Poir., *Grewia tenax* (Forsk.) A. & S., *Cassia holosericia* Fres.
2.	*Cordia rothii* R & S., *Lycium europaeum* L., *Commiphora mukul* (Hk. f. ex Stocks) Engler, *Cassia holosericia* Fres., *Cadaba fruticosa* (L.) Druce.
3.	*Prosopis spicigera* L., *Commiphora mukul* (HK. f. ex Stocks) Engler, *Lycium europaeum* L., *Sericostama pauciflorum* Stocks. *Zizyphus nummlaria* (Burm. f.) Wt. & Arn., *Euphorbia caducifolia* Haines, *Acacia arabica* (Lamk.) Willd., *Cordia rothii* R. & S., *Mimosa hamata* Willd. *Grewia tenax* (Forsk.) A & S., *Suaeda monoica* Forsk. ex Gmel.
4.	*Salvadora oleoides* Decene. *Lycium europaeum* L., *Prosopis spicigera* L., *Commiphora mukul* (Hk.f. ex Stocks) Engler., *Leptadenia spartium* Wt., *Pentatropis spiralis* (Forsk.) Decene. and *Periploca aphylla* Decene.
5.	*Cordia rothii* R. & S., *Lycium europaeum* L., *Acacia arabica* (Lamk.) Willd., *Prosopis juliflora* Dc., *P. glandulosa* Torr. and *Zizyphus nummularia* (Burm. f.) Wt. & Arn.
6.	*Euphorbia caducifolia* Haines, *Zizyphus nummularia* (Burm.f.) Wt. & Arn., *Cordia rothii* R. & S., *Lycium europaeum* L., *Salvadora oleoides* Decene., *Prosopis spicigera* L., *Cadaba fruiticosa* (L.) Druce. *Grewia tenax* (Forsk.) A. & S. and *Pentatropis spiralis* (Forsk.) Decene.
7.	*Euphorbia caducifolia* Haines., *Cordia rothii* R & S., *Zizyphus nummularia* (Burm.f.) Wt. & Arn., *Lycium europaeum* L., *Acacia arabica* (Lamk.) Willd. and *Maerua arenaria* (DC.) Hk. f. & T.
8.	*Pentatropis spiralis* (Forsk.) Decene., *Calotropis procera* (Willd.) R. Br., *Leptadenia spartium* Wt., *Fagonia cretica* L. and *Salvadora oleoides* Decene.
9.	*Cordia rothii* R. & S., *Commiphora mukul* (Hk.f. ex Stocks) Engle., *Fagonia cretica* L., *Leptadenia spartium* Wt., *Calotropis procera* (Willd.) R. Br., and *Pentatropis spiralis* (Forsk.) Decene.

10. *Lycium europaeum* L., *Prosopis spicigera* L., *Salvadora oleoides* Decene., *Euphorbia caducifolia* Haines., *Commiphora mukul* (Hk.f. ex Stocks) Engler, *Pentatropis spiralis* (Forsk.) Decene.

11. *Prosopis spicigera* L., *Salvadora oleoides* Decene., *Euphorbia caducifolia* Haines., *Acacia arabica* (Lamk.) Willd. *Zizyphus nummularia* (Burm.f.) Wt. & Arn., *Grewia tenax* (Forsk.) A. & S. and *Lasiurus hirsutus* (Forsk). Boiss.

12. *Lycium europaeum* L., *Cordia rothii* R. & S., *Prosopis spicigera* L., *Salvadora oleoides* Decene., *Acacia arabica* (Lamk) Willd., *Pentatropis spiralis* (Forsk.) Decene. and *Ephedra foliata* Boiss.

13. *Indigofera oblongifolia* Forsk., *Cordia rothii* R. & S., *Acacia arabica* (Lamk.) Willd. *Gymnosporia montana* Wt. & Arn., *Salvadora oleoides* Decene and *Grewia tenax* (Forsk.) A. & S.

14. *Acacia senegal* Willd., *Salvadora oleoides* Decene., *Commiphora mukul* (Hk.f. ex Stocks) Engler, *Euphorbia caducifolia* Haines. and *Grewia villosa* Willd.

15. *Aerva javanica* (Burm.f.) Juss., *Calotropis procera* (Willd.) R.Br. *Lycium europaeum* L., *Lasiurus hirsutus* (Forsk.) Boiss. and *Euphorbia caducifolia* Haines.

16. *Euphorbia caducifolia* Haines, *Acacia senegal* Willd., *Inula grantioides* Boiss., *Pulicaria hookeri* Jafri, *Grewia villosa* Willd. and *Commiphora mukul* (Hk.f. ex Stocks) Engler.

17. *Euphorbia caducifolia* Haines, *Rhus mysurensis* Heyne., *Ephedra foliata* Boiss., *Indigofera oblongifolia* Forsk., *Grewia tenax* (Forsk.) A.S., *Lycium europaeum* L. and *Cassia holosericea* Fres.

18. *Acacia arabica* Willd., *Salvadora oleoides* Decene., *Prosopis spicigera* L., *Lycium europaeum* L., *Leptadenia spartium* Wt. and *Fagonia cretica* L.

19. *Salvadora oleoides* Decene., *Prosopis spicigera* L., *Acacia arabica* (Lamk.) Willd., *Lycium europaeum* L. *Grewia tenax* (Forsk.) A. & S. and *Euphorbia caducifolia* Haines.

20. *Euphorbia caducifolia* Haines, *Cordia rothii* R. & S., *Lycium europaeum* L., *Indigofera oblongifolia* Forsk., *Grewia tenax* (Forsk.) A. & S., *Maerua arenaria* (Dc.) Hooker and *Zizyphus nummularia* (Burm. f.) Wt. & Arn.

21. *Prosopis spicigera* L., *Salvadora oleoides* Decene., *Lycium europaeum* L., *Acacia arabica* Willd., *Zizyphus nummularia* (Burm. f.) Wt. & Arn., *Rhus mysurensis* Heyne.

22. *Acacia arabica* Willd., *Indigofera oblongifolia* Forsk., *Prosopis spicigera* L., *Lycium europaeum* L., *Salvadora oleoides* Decene, *Cordia rothii* R. & S. and *Euphorbia caducifolia* Haines.

23. *Acacia arabica* Willd., *Prosopis spicigera* L., *Cordia rothii* R. & S. and *Lycium europaeum* L.

24. *Euphorbia caducifolia* Haines, *Grewia tenax* (Forsk) A. & S., *Aerva javanica* (Burm.f.) Juss, *Indigofera oblongifolia* Forsk. *Fagonia cretica* L. and *Cadaba fruticosa* Hk.f. et. T.

25. *Euphorbia caducifolia* Haines., *Prosopis spicigera* L., *Sericostemma pauciflorum* Stocks, *Cassia holosericea* Fers., *Aerva javanica* (Burm.f.) Juss.

26. *Euphorbia caducifolia* Haines., *Aerva javanica* (Burm.f.) Juss. *Panicum antidotale* Retz., *Lasiurus hirsutus* (Forsk.) Boiss., *Calotropis procera* (Willd.) R.Br. and *Indigofera oblongifolia* Forsk.

It was observed that a number of species prefer the microcliamate of *C.decidua*. The seedlings of *Euphorbia caducifolia* Haines., *Salvadora oleoides* Decene., *Prosopis spicigera* L. and *Lycium europaeum* L. were found to be growing in the microclimate of the plant. The zigzag and dense branching of *Capparis* offers good protection to the seedlings of these species.

iii) Effects of animals:

a) *Birds:* The berries of *C. decidua* seem to be favourite fruit of the birds. The birds attack the ripened fruits and eat all the seeds and the succulent parts of the fruit. The birds and mammals are beneficial as well as harmful to the plant. The seeds and fruits are dispersed over great distances through animal excretions. On the other hand, they also hamper the regeneration of the plant by destroying a great quantity of seeds and fruits.

b) *Lizards:* Large numbers of holes of lizards (*Uromastix*) were observed in the microclimate of the plant. It was observed that under such cases the growth of *C. decidua* was found to be adversely affected.

c) *Cattles:* The plant is often over-grazed by sheep and goats. They retard the growth and regeneration of the plant.

d) *Effect of human activities:* Man is the other biotic factor in disturbing and hampering the growth and regeneration of plant by activities like indiscriminate cutting for fuel purposes or plucking the fruits for making pickles, etc.

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