CHAPTER IV

Effect of associated vegetation on growth of *O. corniculata* and *O. latifolia*.

INTRODUCTION

The relative fitness of individuals in many plant communities is influenced mainly by the activity of other organisms, particularly neighbouring plants (Hartnett & Bazzaz 1985). The interference from the associated species as reported by Dwivedi and Tripathi (1980) exercise a strong influence on the ecological niches of Alysicarpus monilifer and Indigofera enneaphylla in restricting their growth to a smaller hyper-volume. Several studies have shown that the growth, survivorship and reproductive capacity of individual plants are determined, in large part, by the number, position and growth of neighbours (Putwain & Harper 1970, Mack & Harper 1977, Fowler 1984, Goldberg & Werner 1983, Yadav & Tripathi 1983, Hartnett & Bazzaz 1985, Goldberg 1987). The structure of a plant community therefore is determined to a large extent, by the relative suppresive effects of species on each other (Aarssen 1988).

Various workers have studied the relationship of a 'target' species to a group of other species in natural communities (Sagar & Harper 1961, Putwain & Harper 1970, Pinder 1975, Dwivedi & Tripathi 1980, Goldberg 1980, Gross 1980, Fowler 1981, Yadav & Tripathi 1984). Moreover, growth forms of the neighbouring species also affect the 'target' species. Werner (1977) analysed the effect of both individual species and growth forms (grasses, perennial dicots, shrubs) on the success of Dipsacus sylvestris experimentally sown into eight natural communities and found that success of Dipsacus is mainly

linked with growth forms rather than abundance of individual species. Dwivedi & Tripathi (1980) found that the aboveground yield and seed production of Alysicarpus monilifer and Indigofera enneaphylla were reduced considerably in the presence of grasses than in the presence of dicots. In view of the vital role of associated vegetation in the life of a 'target' species, a field study involving the effect of selective removal of associated plant species on the growth and biomass allocation of O. corniculata and O. latifolia HBK. was undertaken.

MATERIALS AND METHODS

The study was conducted on the campus of the School of Life Sciences, North-Eastern Hill University, Shillong. The experiment started in January 1988 and continued till December 1988.

Thirty six permanent quadrats of 50 x 50 cm size were marked in the field having uniform density of Oxalis spp. The areas was then properly fenced to prevent any disturbance and the following treatment plots were maintained.

(i) O. corniculata grown alone.

(ii) O. latifolia grown alone.

(iii) The two Oxalis species grown together (all other plant species removed).

(iv) O. corniculata grown with grasses (all non-graminaceous species removed).

(v) O. latifolia grown with grasses (all non-graminaceous species removed).

(vi) Oxalis spp. grown with all other plant species.

Three replications were maintained for each treatment. The plant samples of Oxalis spp. were taken for growth measurement from each treatment plot after 8 and 12 months, hereinafter referred to as H_1 and H_2 respectively. Leaf area, number of leaves, stolon/bulbs, flowers and seeds and dry matter yield per plant were determined. For dry weight estimation, the plants were thoroughly washed to remove the soil particles adhering to the roots. Plant parts were sorted out and oven-dried at 80°C to constant weight.

RESULTS

The associated plant species greatly influenced the growth of O. corniculata and O. latifolia. When the Oxalis spp. were allowed to grow free from competition by other plant species, they produced greater number of leaves, stolons, bulbs and flowers (also number of seeds in case of O. corniculata), leaf area and dry matter yield as compared to other treatment plots. Although the growth of Oxalis was reduced by all the associated plant species, the grasses played a major role in limiting the growth (Table 4.1, 4.2, Fig. 4.1 and Fig. 4.2).

In O. corniculata, allocation to roots was not affected by the presence of associates whilst allocation to stolon was greatly reduced specially by the presence of grasses. Allocation to leaves

TABLE 4.1. GROWTH OF *O. corniculata* AS AFFECTED BY VARIOUS ASSOCIATES IN FIELD CONDITION (± STANDARD ERROR).

Parameters	Treatment Plots							
	OC - all species		OC + OL		OC + G		OC + all species	
	H_1	H_2	H_1	H_2	H_1	H_2	H_1	H_2
No.of leaves/Plant	25.42±5.12	43.22±6.31	20.33±9.75	38.75±7.41	7.5±0.70	15.0±0.49	10.5±0.70	20.0±2.52
No.of stolons/Plant	15.12±4.81	22.0 ±3.52	10.0 ±3.7	18.75±3.47	3.0±0.17	4.66±1.47	4.0±1.41	10.0±1.41
No.of flowers/Plant	4.13±1.53	10.02±2.31	1.66±1.08	4.75±1.19	0	0.5 ±0.25	0.5±0.23	2.0±0.70
No.of seeds/Plant	150.0±9.32	318.0±10.55	103.5±3.50	209.0±16.7	0	0	0	120.0±2.8

OC - *Oxalis corniculata*

OL - *O. latifolia*

G - Grasses

TABLE 4.2. GROWTH OF O. latifolia AS AFFECTED BY VARIOUS ASSOCIATES IN FIELD CONDITIONS (±STANDARD ERROR).

Parameters	Treatment Plots							
	OL - all the species		OL + OC		OL + G		OL + all the species	
	H_1	H_2	H_1	H_2	H_1	H_2	H_1	H_2
No.of leaves/Plant	4.0±1.32	5.3±1.21	3.25±0.28	4.5±0.33	1.0±0.26	1.0±0.32	2.0±0.14	3.0±0.23
NO.of daughter bulbs/ Plant	2.0±0.50	5.12±1.53	1.5 ±0.70	3.5±0.33	0	1.13±0.20	0	2.33±0.40
No.of flowers/Plant	0	0	0	0	0	0	0	0

OL - O. latifolia

OC - O. corniculata

G - Grasses

Fig. 4.1 Leaf area per plant of *O. corniculata* and *O. latifolia* when grown with different associated species under field situation. ■——■, *O. corniculata* or *O. latifolia* grown alone; ○——○, *Oxalis* species grown with each other; ●——●, each of the *Oxalis* species grown with grasses and ▲——▲, each of the *Oxalis* spp. grown with all the species.

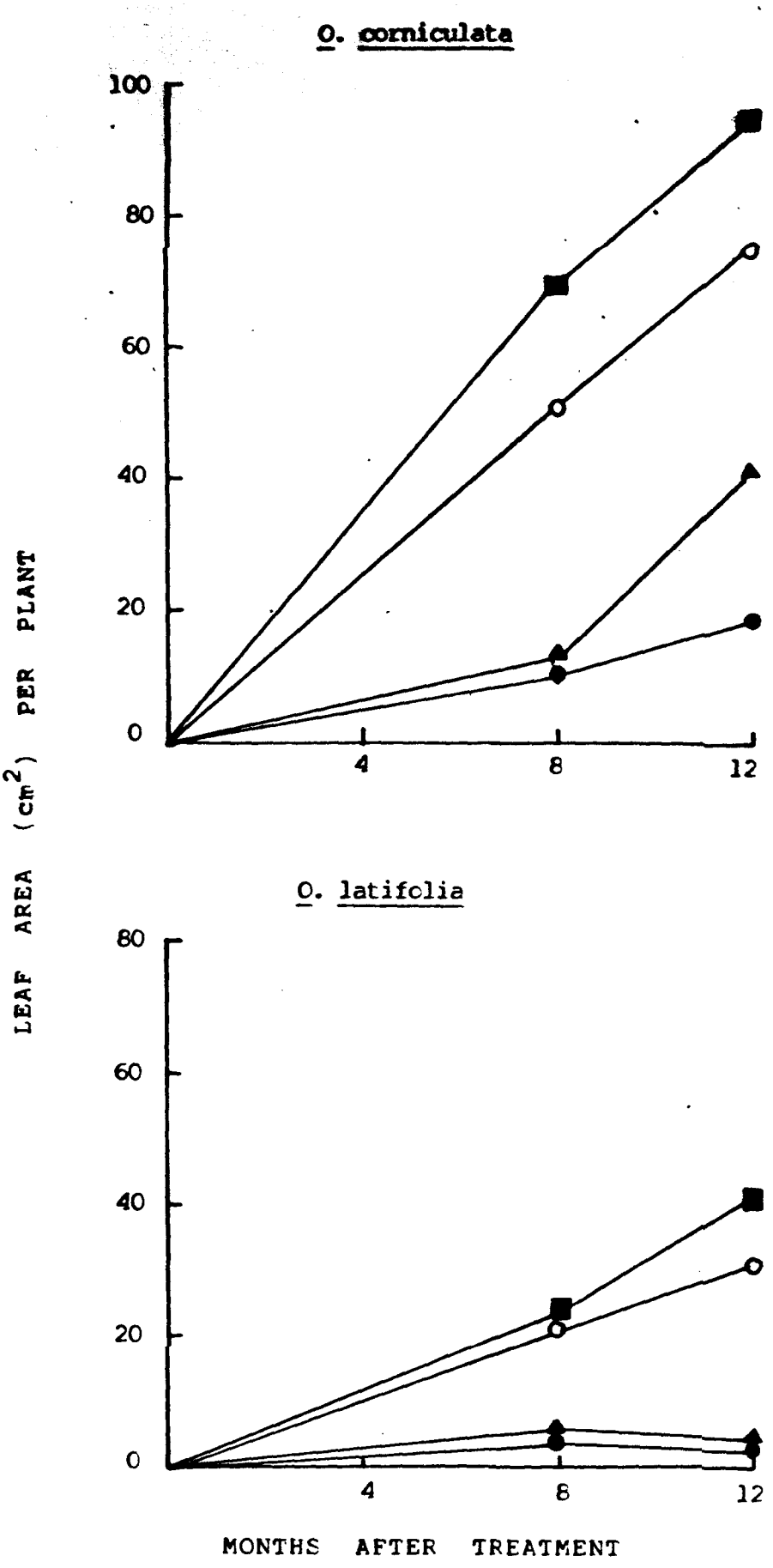
O. corniculata
100
80
60
40
20
0
4
8
12
LEAF AREA (cm²) PER PLANT
O. latifolia
80
60
40
20
0
4
8
12
MONTHS AFTER TREATMENT

FIG. 4.1

Fig. 4.2 Dry matter yield (g) per plant of O. corniculata and O. latifolia when grown with different associated species under field condition. Symbols same as in Fig.4.1.

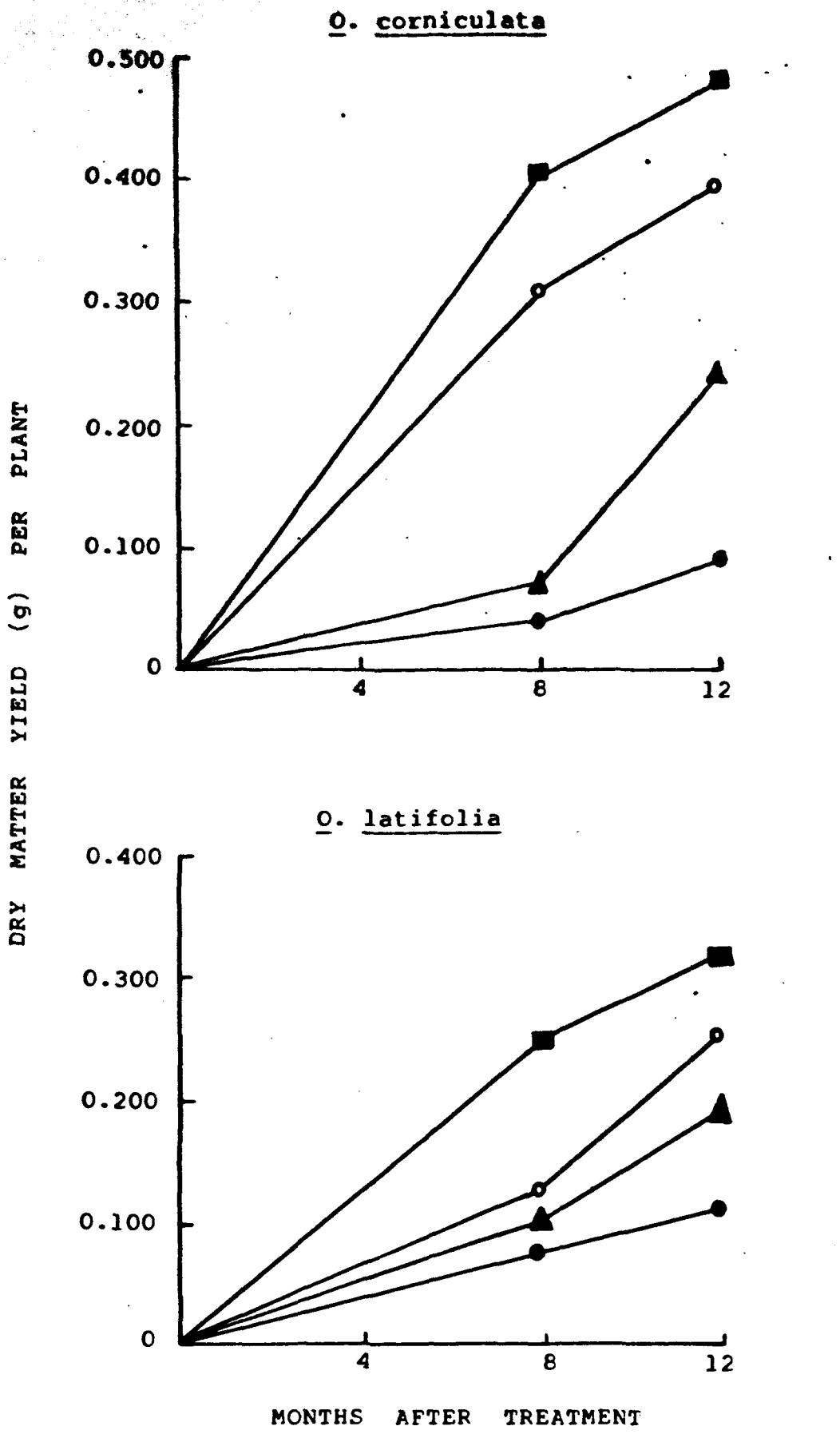
O. corniculata
0.500
0.400
0.300
0.200
0.100
0
4
8
12
O. latifolia
0.400
0.300
0.200
0.100
0
4
8
12
DRY MATTER YIELD (g) PER PLANT
MONTHS AFTER TREATMENT

FIG. 4.2

Fig. 4.3A Percentage dry matter allocation towards roots  , stolon  , petiole  , leaves  , flowers & fruits  of O. corniculata in different treatment plots.

Fig. 4.3B Percentage dry matter allocation towards roots  , parent bulb  , daughter bulbs  , petiole  , & leaves  , of O. latifolia in different treatment plots.

Treatments : a = O. corniculata or O. latifolia grown alone.

b = Oxalis species grown with each other.

c = Each of the Oxalis species grown with grasses.

d = Each of the Oxalis species grown with all the species.

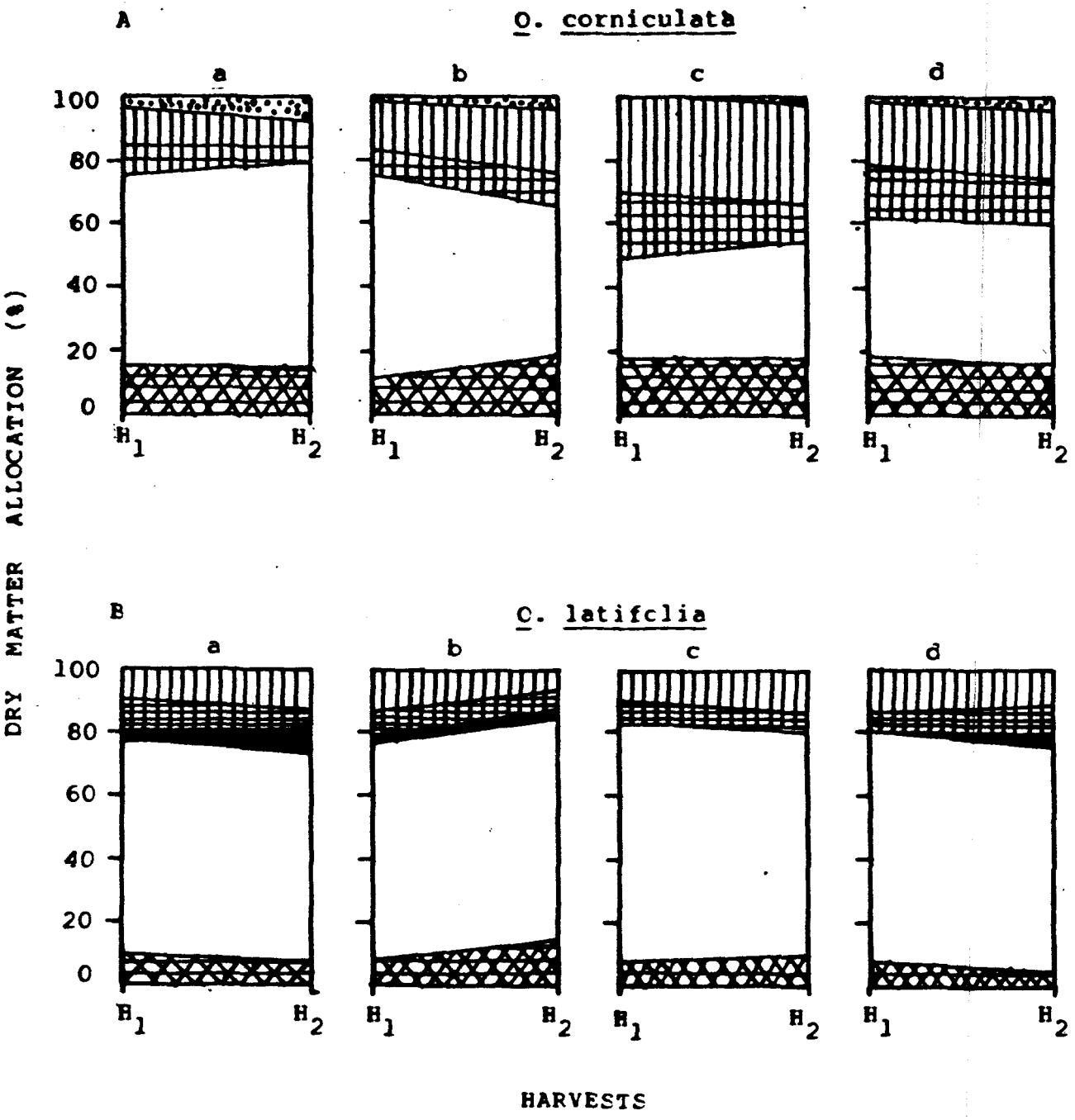
A
O. corniculata
a
b
c
d
100
80
60
40
20
0
H1
H2
B
O. latifclia
DRY MATTER ALLOCATION (%)
HARVESTS

FIG. 4.3

was greater when O. corniculata was allowed to grow with grasses than when it grew alone, or with O. latifolia or with all other associated plant species. When grown alone, O. corniculata showed greater reproductive allocation and when grown with grasses, reproductive allocation was greatly reduced (Fig. 4.3a).

In O. latifolia, allocation to bulbils or daughter bulbs was reduced when grown with associated vegetation. However, allocation to parent bulb and leaves remained unaffected by the presence of associates (Fig. 4.3b). In O. latifolia, flower and seed production did not occur either when grown alone or with associates (Table 4.2). O. corniculata, however, showed flowering at the time of second harvest, but the seed production was absent when it was grown with grasses (Table 4.1). In general, the overall performance of O. corniculata in presence of the associates was better than O. latifolia, indicating that in field situation the former is less severely affected by the competition from the associated plant species.

DISCUSSION

The growth and reproduction of Oxalis corniculata and Oxalis latifolia are greatly affected as a result of competition from neighbouring species. Of the associated species, the grasses seem to play a major role in regulating the growth of Oxalis species. The supressive effect of grasses on reproduction is in agreement with the findings of Tripathi and Dwivedi (1978) who found a 90.7% reduction in seed output of Alysicarpus monilifer when grown with grasses. The drastic reduction in growth of other species caused by the competition from grassed has also been reported by Sagar & Harper (1961) and Putwain and Harper (1970). Sagar (1970) reported that the chance of a seed producing a seedling or an established adult plant in case of Plantago lanceolata was greatly increased in grass-free plots.

Gupta and Tripathi (1979) reported that when Bothriochloa pertusa was introduced to already established population of Dichanthium annulatum, it showed reduced yield and complete suppression in reproductive growth. Flowering in Oxalis latifolia was totally absent when it grew in competition with grasses.

In O. corniculata, biomass allocation to roots did not change much due to the presence of associates. Greater allocation to leaves and decreased reproductive allocation in the presence of associates indicates that under competitive situations, the plant seems to concentrate more on vegetative growth.

In O. latifolia, allocation to parent bulb and leaves was not affected by the associates, but flowering did not occur and allocation to bulbils or daughter bulbs was greatly reduced, which indicates that greater emphasis is laid on the vegetative growth than on reproductive structures and this may be helpful in resource capture by this weed.

The study suggests that inter-specific competition is more crucial than intraspecific competition for both the species. The grasses have been found to exert strong suppressive effects on the vegetative and reproductive growth of the field population of O. corniculata and O. latifolia. As argued by Dwivedi & Tripathi (1980), the restrictions in the fundamental niches of the plant species in presence of associates may largely be attributed to the resource competition amongst various species populations. However, as revealed by the data, the two species respond to competition from the associates by concentrating more on vegetative growth. This is a useful strategy under competitive stress as it enables them to exploit the natural resources efficiently.

A comparison of the reactions of the two Oxalis species to the presence of the associated vegetation suggests that O. corniculata is a better competitor than O. latifolia.