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ECOLOGICAL STUDIES OF NATURAL POPULATIONS OF *COSMOS CAUDATUS*, H. B. K. WITH SPECIAL REFERENCE TO POLLINATION, SEED BEHAVIOR AND BIOMASS DISTRIBUTION

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ABSTRACT

Under different density dependent mortality situations and degree of intra-specific competition an organism is under positive selection to allocate a greater protection of its resources to reproductive or vegetative parts. Populations with density dependent regulation i.e., those which are better able to tolerate competition will be selectivity favored to allocate a greater proportion of resources to vegetative activities. The theoretical Notion Related with this problem is R and K selection. Keeping all this in view the studies were planned to investigate energy allocation situated and ecological strategies within species cosmos caudatus, H.B.K. the species exhibit a determinate growth as the apical meristems are converted into flower recepticles.

INTRODUCTION

Cosmos caudatus, commonly known as 'Ulam Raja' by the locals, belongs to the botanical family Asteraceae. The plant is traditionally used in Malaysia for many beneficial claims such as for reducing body heat, as an anti-aging agent, improving blood circulation, promoting fresh breath, strengthening bone marrow and treating infections associated with pathogenic microorganisms [1-3]. The central concept of R and K selection is that populations living in an environment imposing high density independent mortality will be selectively favored to allocate a greater proportion of resources to reproductive activities at the cost of their capabilities to propagate under crowded condition [4-6]. He found that there was a significant increase in seed weight from herbs and grasses through shrubs and trees7. The young shoots of *Cosmos caudate*, as a leafy herb, are freshly consumed as a good source of natural antioxidants, minerals and vitamins B1, B2 and C. It is recommended in traditional medicine for blood circulation and healthy bones. Being a less known herb, not much is known about its antioxidant activity in relation to fertilizer application [8-10].

Similarly they tended to increases seed weight in plants from drier areas in general, the average seed weight of the plants decreased with increasing altitude [1. This trend was also present in the altitudinal population of penstemon. These authors found that average seed weight remains constant even with increased altitude although the number of seed decreased [12]. They reviewed the relationships of shapes and sizes of seeds and noted that perennial and woody species have low values of reproductive effort and therefore fit in the K species [13]. A greater part of their available energy is directed towards vegetative organs. Thus conferring on them the advantages in long term competition in crowded resource limited stable environments. The variation in density may give upto six times changes in mean seed weight [14]. Ecologically larger seed number, small seed size and better dispersability are characteristic of colonizing species of early phase of succession. Such species need little food reserves in seed than those in closed and shaped communities [15].Conversely larger and fewer seeds give greater seedling aggressiveness, lose despersability,

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develop lower reproductive effort and increase vegetative reproduction [16-18]. Even though the leaves of *C. caudatus* are used for various medicinal treatments, to our knowledge no literature exists on its toxicity profile. This study therefore designed to evaluate the acute and subacute toxicity effects of the ethanolic leaf extract of *C. caudatus* especially on haematological parameters [19-21].

MARERIAL AND METHODS

Impact of Soil Depths

The seeds of *Cosmos caudatus*, H.B.K. brought from Amarkantak were scattered in different depths within Model Science campus. The different plant characteristics like plant height, shoot weight, root weight, seed number, seed size, seed weight, were noted against the depths of soil from which the plants were taken out.

Impact of Intraspecific Competition

The seeds of cosmos caudatus, H.B.S. were sown in prepared beds. The beds were in different density classes i.e. 1 cm, 3cm, 5cm, 7cm, 9cm, 11cm, and 13cms. Each density classes had three replicates. They were periodically watered on the tenth day a newly sprouted plant was taken out from each bed, washed and according to its density class and replicate number packed and labeled. These were kept in the oven to dry at 60^0 C for 24 hours. The dried material was weighed in the physical balance. The weights were noted according to their density classes and replicate numbers.

Comparing Accumulation of Biomass in Two Different Seasons

The biomass of shoot, in the rainy and dry season was determined. The weight of shoot of the two seasons was compared to ascertain whether the biomass accumulation was in the rainy season or dry season.

Pollination and Seed Studies

Ten buds of cosmos caudatus, H.B.K. were sealed in perforated polythene bags to check cross pollination by insect or wind. The bags were perforated so as to ensure the aeration of flowers. Ten other buds were tagged and kept in natural condition to develop when the seeds were ripened the sealed and unsealed flowers seeds were compared for their number, sizes and weights to know the significant difference between self pollinated and the cross pollinated flowers.

Three kinds of experiments were done

- Those related with seed size, seed weight and seed number in relation to pollination, depth of soil and plant height.
- Those related with the distribution of root and shoot biomass in relation to soil depth and height of the plant, and
- Those related with the distribution of above ground biomass in relation to cropping density for the two, the wet and the dry season.

Table 1. Seed weight, seed number, seed size and root/shoot weight in relation to the depth of soil.

S. no.	Soll deptH Cms. No.	Average plant height (cms.)	Shoot weight (gms.)	Root weight (gms.)	Root/ Shoot	Seed number	Seed Size (cms.)	Seed Weight (mg.)
1.	221	40.00	2.50	1.5	0.6	20	3.2	9.5
2.	253	75.00	21.00	5.0	0.21	25	3.2	10.0
3.	282	86.25	23.00	5.0	0.21	25	3.1	10.0
4.	301	115.50	41.00	19.0	0.46	23	3.2	10.0
5.	351	110.00	38.10	10.0	0.26	24	3.5	9.9
6.	37 2	150.00	96.00	37.0	0.38	28	3.1	10.0
Total	177	576.75	221.50	79.5	0.35	145	19.4	59.2
Mean	29.58±0.88	96.12±5.75	36.91±4.88	13.25±1.98		24.16± 0.41	3.2± 0.07	9.8± 0.2
^{t}Cal		2.10	1.75	1.68		2.22	2.22	2.21
^{t}Table		2.5	2.5	2.5		2.5	2.5	2.5

Table 2. Tabulation of results of insect exclusion experiments on seed size, seed weight and seed number

S.No	Seed number		Seed size(m)		Seed weight (mg)	
	Excluded	Natural	Excluded	Natural	Excluded	Natural
1	6	23	2.1	2.4	9.5	12.0
2	7	24	1.0	2.1	5.0	12.0
3	13	30	1.9	2.3	10.25	11.2
4	4	22	2.4	2.4	10.25	11.0
5	8	31	1.9	2.0	9.5	10.2

6	8	22	1.8	1.9	10.0	11.1
7	7	25	2.0	2.0	11.0	10.8
8	12	27	2.7	2.1	11.0	11.2
9	10	30	2.1	1.9	11.2	11.1
10	9	23	2.2	1.8	10.2	11.8
Total	84	257	20.3	20.9	98.05	112.4
Mean	8.4	25.7	2.03	2.09	9.8	11.24
Standard error	0.25	0.33	0.04	0.01	0.17	0.05

DISCUSSION AND CONCLUSION

Flower

The flower of the species shows disc as well as ray florets. The ray flowers consisted of pink three fid ligulate corolla. The central disc floret was yellow and outer involucres bracts had hispid margins. Because of pink cooler and surface presentation of rollen at the top of the disk floret the species seems to be adopted for pollination by the bees. These bees include both honey bees as well as megachile bees. The narrow tubular flowers of disc florets make them ideally adopted for the butterflies (Table 1).

Pollination Phenomena

The visitors to the flowers of the plant included species of butterflies like *Venessa cardui, Hypolimanas missipus, Terias hecable and Ddelias encharius.* The common bees which visited the flowers included the honey bees *Apis indica, Apis florae, Helictus senisens and Megachile hera.* Infrequent visitor to the flower included *Athophora fimbriata, Athophora zonata, and Xylocopa fenestrate.*

Pollination and Insect Exclusion in the Seed Characteristics

The data presented in table-2 shows that there is a significant difference in seed number in relation to insect exclusion. The numbers of seed were found to be more in plants with natural pollination. Seed weights also showed significant difference between natural and insect excluded populations. However, no such difference could be seen in the mean seed size, which remained same for insect excluded as well as natural populations.

Seed Characteristics

The data presented in table-II show that the seed characteristics such as number, weight and size is not influenced by the size of the plant or the depth of the soil. The t values for these characteristics are lower than the calculated values in each case. Similarly the values for root and shoot, weight also seem to be independent of soil depth. However root-shoot ratio as data reveals seems to be influenced by the soil depth indicating the poor depths of soil promotes better root growth for establishment where as better depths promote extensive development of shoot systems.

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