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Yield and alkaloid content of *Clitoria ternatea* L. as influenced by shaded and open conditions

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Abstract : Six selected high yielding accessions of butterfly pea (*Clitoria ternatea* L.) were evaluated under shaded and open conditions for their comparative performance with respect to pod yield and alkaloid content. Production of pods was found to be more under open condition. Although seed yield was higher under open condition, the per cent seed alkaloid content did not vary significantly between the shaded and open conditions.

Key words : *Clitoria ternatea*, Butterfly pea, Seed alkaloid, Shade

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Clitoria ternatea L., commonly known as butterfly pea, is an evergreen leguminous creeper having ornamental as well as medicinal value. Almost all parts of this plant are reported to be medicinally valuable. Its root is regarded as a good brain tonic and is an ingredient of 'Medhyarasayana' (Ajith, 1993). According to Chopra *et al*. (1949), seeds in powdered form constitute a more useful and safer medicine than roots. Seeds possess anthelminthic, laxative and diuretic properties (Drury, 1873; Duke, 1986; Mesa, 1945). The present study was carried out to study the effect of shaded and open conditions on pod characteristics of *Clitoria ternatea* L. *viz*., number of pods, number of seeds per pod, pod length, fresh weight of pods and dry weight of pods.

RESEARCH METHODS

Six selected high yielding accessions of *C. ternatea viz*., MP-73 (Thiruvattar White), MP-74 (Vattiyoorkavu Blue), MP-76 (Vattiyoorkavu White), MP-81 (Vellayani Blue Double), MP-83 (Thirumala Blue) and MP-85 (Thirumala White) were chosen for a comparative performance evaluation with respect to pod yield, under shaded condition (in a nineteen year old coconut garden) and under open condition. The experiment was conducted at the College of Agriculture, Vellayani during June-December 2000. The location is situated at an altitude of 29m above the mean sea level and enjoys a humid tropical climate. Soil of the experimental site was red loam belonging to Vellayani series.

The experiment was laid out in RBD with three replications separately for shaded and open conditions. Forty five plants of each accession were maintained in each plot of size 5.4 x 3.0 m at a spacing of 60 x 60 cm. The land was thoroughly prepared by digging and powdered cowdung was incorporated at the rate of 3 kg per square metre. Seeds were sown in polythene covers filled with sand and watered daily. Seedlings were transplanted three weeks after sowing. Staking was done using casuarina poles one month after transplanting. Three plants per plot per replication were taken as observation plants. Pods were harvested at seed formation (135 days after sowing) and seed maturation (180 days after sowing) stages from observation plants and number of pods per plant, number of seeds per pod, pod length, pod fresh weight and pod dry weight were recorded. The seed alkaloid content was estimated gravimetrically. Powdered

seed material (10 g) was eluded with lime solution. The solution was filtered and the filtrate was taken in a separating funnel. About 80 ml of ether (organic solvent) was added to the filtrate. The solvent layer was retained in the funnel and was treated with dilute sulphuric acid (1:4 dilution) to get the alkaloid precipitated. This was then filtered through Whatman No. 41 filter paper. A light brown precipitate was obtained and it was dried until consistent weights were obtained. Percentage seed alkaloid content was worked out.

RESEARCH FINDINGS AND DISCUSSION

Significant difference was observed in the number of pods and the number of seeds per pod, among the accessions under shaded as well as open condition (Table 1).

Under shade condition, at seed formation stage, maximum number of pods per plant was recorded by MP-76 (14.78). MP-81 (6.45) recorded the least. In open, MP-73 (61.67) recorded the maximum number of pods per plant, followed by MP-76 (54.22). Least number of pods was recorded by MP-81 (20.78). At seed maturation stage, under shade condition, MP-76 (27.11) recorded the highest number of pods, closely followed by MP-73 (25.78). MP-81 (17.78) recorded the least number of pods per plant. Under open condition, MP-73 (82.11) was found to be superior in terms of number of pods per plant. MP-81 (51.78) recorded the least number of pods per plant.

Production of pods was more under open condition. This may be due to the more efficient and profuse flowering under open condition as reported by Sunitha (1996).

Regarding the number of seeds per pod, significant difference was observed among the accessions under shaded condition at seed formation and seed maturation stages (Table 1). But the number of seeds per pod showed no significant difference under open condition. At seed formation stage in shade, highest number of seeds per pod was recorded by MP-76 (8.56) which was at par with MP-73 (8.33), MP-83 (8.22) and MP-85 (7.78). Least number of seeds per pod was recorded by MP-81 (6.89). At seed maturation stage in shade, maximum number of seeds per pod was recorded by MP-76 (9.33). It was at par with MP-73 (9.22), MP-83 (9.11) and MP-85 (9.00). MP-81 (8.44) recorded the least number of seeds per pod.

Pod length showed significant difference among the accessions under shade condition at seed formation stage, but there was no significant difference among them under open condition (Table 2). In shade, maximum pod length was recorded by MP-76 (7.08 cm) closely followed by MP-83 (6.90 cm) and they were at par. The lowest pod length was recorded by MP-81 (5.79 cm). At seed maturation stage, accessions differed significantly under both light conditions. Under shade, MP-76 (9.97 cm) recorded the maximum pod length. MP-83 (9.88 cm) and

Table 1 : Number of pods and seeds at seed formation and seed maturation stages

Sr. No.	Accession No.	Seed formation				Seed maturation			
		No. of pods per plant		No. of seeds per pod		No. of pods per plant		No. of seeds per pod	
		Shade	Open	Shade	Open	Shade	Open	Shade	Open
1.	MP-73	10.89	61.67	8.33	9.22	25.78	82.11	9.22	9.67
2.	MP-74	9.56	51.67	7.56	9.22	22.55	69.11	8.78	9.56
3.	MP-76	14.78	54.22	8.56	9.44	27.11	75.11	9.33	9.78
4.	MP-81	6.45	20.78	6.89	9.11	17.78	51.78	8.44	9.33
5.	MP-83	9.34	43.33	8.22	9.22	21.67	65.89	9.11	9.33
6.	MP-85	11.33	34.67	7.78	9.55	24.45	61.55	9.00	9.89
C.D. (P=0.05)	-	3.61	6.67	0.96	NS	1.90	4.60	0.38	NS

NS – Non significant

Table 2 : Pod length of *Clitoria ternatea* accessions at seed formation and maturation stages

Sr. No.	Accession No.	Seed formation (135 DAS)		Seed maturation (180 DAS)	
		Shade	Open	Shade	Open
1.	MP-73	6.67	9.93	9.83	10.05
2.	MP-74	6.61	9.73	9.57	9.91
3.	MP-76	7.08	9.89	9.97	10.01
4.	MP-81	5.79	9.83	9.22	9.88
5.	MP-83	6.90	9.91	9.88	9.88
6.	MP-85	6.55	9.89	9.70	9.97
CD (0.05)	-	0.55	NS	0.15	0.07

NS – Non significant DAS – Days after sowing

Table 3 : Fresh weight and dry weight of pods at seed formation and seed maturation stages

Sr. No.	Accession No.	Seed formation				Seed maturation			
		Fresh weight of pods per plant (g)		Dry weight of pods per plant (g)		Fresh weight of pods per plant (g)		Dry weight of pods per plant (g)	
		Shade	Open	Shade	Open	Shade	Open	Shade	Open
1.	MP-73	14.78	86.48	6.45	33.75	37.53	120.00	9.18	35.33
2.	MP-74	12.93	70.54	6.70	25.63	35.47	103.69	13.31	30.32
3.	MP-76	22.71	75.31	11.25	23.32	37.58	109.25	15.29	32.13
4.	MP-81	8.47	32.86	4.59	12.03	26.22	75.73	14.79	22.04
5.	MP-83	13.98	64.33	8.28	22.65	31.76	96.44	11.78	28.65
6.	MP-85	11.24	53.53	4.72	20.50	34.89	90.65	14.58	26.27
C.D. (P=0.05)		5.78	9.96	-	-	2.75	6.83	-	-
CD for pooled analysis									
For light conditions				5.75				5.39	
For accessions				9.96				NS	
For interaction				14.08				13.21	

NS – Non significant

MP-73 (9.83 cm) were at par with MP-76.In open, MP-73 (10.05 cm) recorded the highest pod length and the lowest (9.88 cm) was recorded by MP-83 and MP-81.

Pod length varied among the accessions in accordance with characteristic genetic make up. This is in justification with the reports of Nair (1966) regarding pod length in cowpea. Relatively higher pod length was recorded under open condition. This may be attributed to the increased general vigour of the plants under open condition due to the abundant and continuous availability of solar radiation.

The accessions showed significant difference in fresh weight of pods among them at seed formation stage, under shade as well as open conditions (Table 3). In shade, MP-76 (22.71 g) recorded the highest value and MP-81 (8.47 g) recorded the lowest. In open, MP-73 (86.48 g) recorded the highest value followed by MP-76 (75.31g). As in shade, the lowest fresh weight was recorded by MP-81 (32.86 g) under open condition. At seed maturation stage also, all the six accessions differed significantly among them in shade as well as in open. In shade, highest value was for MP-76 (37.58 g) which was at par with MP-73 (37.53 g), MP-74 (35.47 g) and MP-85 (34.89 g). MP-81 (26.22 g) recorded the lowest value. MP-76 (109.25 g) and MP-74 (103.69 g) were at par. MP-81 (75.73 g) recorded the lowest value for pod fresh weight.

Pooled analysis indicated significant difference in pod dry weight between shaded and open conditions as well as among the accessions at seed formation stage (Table 3). In shade, MP-76 (11.25 g) recorded the highest dry weight and the lowest was recorded by MP-81 (4.59 g). In open, MP-73 (33.75 g) recorded the highest value and it was at par with MP-74 (25.63 g). MP-81 (12.03 g) recorded the lowest value for pod dry weight. The accessions MP-74, MP-85, MP-83 and MP-73 exhibited significantly higher pod dry weights under open condition.

At seed maturation stage also when pooled analysis was carried out, significant difference in pod dry weight was noticed between shade and open conditions. But, accessions showed no significant difference among them. In shade, MP-76 (15.29 g) recorded the highest pod dry weight closely followed by MP-81 (14.79 g) and MP-85 (14.58 g). MP-73 (9.18 g) recorded the lowest pod dry weight. In open, MP-73 (35.33 g) recorded the highest value followed by MP-76 (32.13 g). The lowest dry weight of pods was recorded by MP-81 (22.04 g). In open, pod dry weights were significantly higher for MP-76, MP-74, MP-83 and MP-73 when compared to those under shade condition.

It can be assessed that the pod yield varied according to the number of pods per plant. It was observed that the accessions which showed good vegetative growth gave higher pod yield also. This may be attributed to the overall genetic superiority of these accessions over the others.

Table 4 : Crude alkaloid content (per cent) in seeds of *Clitoria ternatea*

Sr. No.	Accession No.	Crude alkaloid content (%)	
		Shade	Open
1.	MP-73	0.40	0.43
2.	MP-74	0.39	0.36
3.	MP-76	0.40	0.39
4.	MP-81	0.25	0.32
5.	MP-83	0.33	0.41
6.	MP-85	0.35	0.42
C.D. (P=0.05)	-	0.02	0.04

Fresh weight and dry weight of pods were superior under open condition as reported by Sunitha (1996).

Maximum number of pods per plant under shade condition was recorded for MP-76 (27.11) whereas under open condition, MP-73 recorded the maximum (82.11). As far as number of seeds per pod is concerned, MP-76 (9.33) ranked first under shade. But under open condition, all the accessions were at par.

In shade, maximum seed alkaloid content (0.40 %) was obtained in MP-76 and MP-73 (Table 4). The lowest content was recorded in MP-81 (0. 25 %). In open, MP-73 recorded the highest seed alkaloid content of 0.43 per cent and MP-81 recorded the lowest content (0.32 %).

Seed alkaloid content varied significantly among the accessions under open and shaded conditions. Significant variation in seed alkaloid content in *C. ternatea* when grown under shade in a coconut garden was earlier reported by Nair (1966). Although seed yield was higher under open condition, the per cent seed alkaloid content did not vary significantly between the open and shaded conditions. This conforms to the finding of Sunitha (1996) that in *C. ternatea*, there was no significant difference in seed alkaloid content irrespective of the fact whether the accessions were raised under open or shaded condition.

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