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Genetical and morphological characterization of butterfly pea (*Clitoria ternatea* L.) germplasm under arid ecosystem of Kachchh

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Introduction

Butterfly pea, (*Clitoria ternatea* L.) is a highly palatable and preferred by livestock over other legumes due to thin stem, large leaves and non toxic which make it ideal for forage and hay making. It's vigorous growth, tolerance to dry periods and heavy grazing pressures make this suitable for arid grassland ecosystem and rangeland development. It is well adapted to a variety of soil types (pH 5.5-8.9) including calcareous soils and surviving in both the extended rainfall regions and prolonged periods of drought. The seed is very high in protein (15-25%) hence increasing the nitrogen levels in run-down cultivated paddocks. After just two years of establishment, the butterfly pea planted into run-down cultivated paddocks, the soil fertility returns to its original level and Grass growing due to the higher soil nitrogen levels. In view of these characteristics and potential of this species, twenty butterfly pea accessions were evaluated during 2008-2010 at Regional Research Station, CAZRI, Kukma, Kachchh, and Gujarat.

Materials and Methods

Twenty accessions of *Clitoriaternatea* L. (butterfly pea) were collected from CAZRI, Jodhpur, Rajasthan and IGFRI, Jhansi, Uttar Pradesh for evaluated in the arid ecosystem of Kachchh, Gujarat. All the accessions studied are conserved and curated at the CAZRI, Regional Research Station, Kachchh, where mean annual rainfall measured 97mm (year 2008-09) to 980.5 mm (year 2010-11) with highly erratic distribution pattern. The experiments were conducted with Completely Randomized Block Design (CRBD) with three replications and recommended dose of fertilizers (40N-80P-0K). Irrigations were not applied at all, during whole cropping season to provide the natural growing environment as in pasture lands and on the waste lands. Statistical analysis was done using Genes (Cruz 2006) software.

Results and Discussion

Mean performance of phenological, reproductive and forage yield attributing traits observed among twenty accessions are exploited in Table 1. The range of considerable variability observed among the accessions for eleven phenotypic descriptors are reflected by wide ranges for these characteristics under Table 2. Principal components analysis exploited the total variability among butterfly pea accessions based on the phenotypic descriptors. The first four principal components had Eigen-values (Table 2) greater than 1.0, and together they explained 77.56 % of the total variation for the groups of phenological, reproductive and forage yield traits. The graphical representation of the scores of the principal components based on the traits evaluated is presented in Figure 1 Six conglomerates were formed where the greater divergence of the genotypes No. 10, 16, 17, 18, 19 and 20 in relation to the others was confirmed. Moreover, the occurrence of superposition and close proximity between many genotypes evidenced the narrow genetic base in butterfly pea accessions from which the cultivars developed. In germplasm collections it is common to find similar accessions with different registration. The situation was true for the accessions 6 and 15. Which show that registered accession CAZRI 1439 (6) would be sample of local (15) cultivar.

Table 1: Phenological, reproductive, and forage yield attributing traits of *Clitoria ternatea* L. evaluated from 2008 to 2010

S. No.	Accessions No.	Origen	Phenological				Reproduction				Forage Yield		
			Plant height (cm^2)	Number of branches/ Plant	Green canopy Area/ Plant (cm^2)	Length of longest branch /Plant (cm)	Days to 50% flowering	Days to first pod maturity	seeds/ m^2(gm)	1000 - seed wt. (gm)	Number of leaves /Plant	Green fodder yield (kg/ha)	Dry fodder yield (kg/ha)
1.	CAZRI466	**CAZR**	71.39	6.15	899.74	96.04	55.00	84.70	11.26	48.40	297.05	4621.21	2590.51

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2.	CAZRI 468	-	71.92	5.98	1058.12	66.02	60.33	81.30	13.02	49.98	405.97	5554.92	2762.08
3.	CAZRI752	-	66.24	7.55	1646.23	81.42	54.67	91.70	26.64	50.18	476.04	5987.46	3484.18
4.	CAZRI1428	-	67.29	6.52	2005.53	69.32	49.00	97.00	27.04	50.88	379.84	5299.94	3008.37
5.	CAZRI1433	-	63.28	6.74	789.22	73.73	49.00	80.30	23.11	52.36	281.56	5408.11	2827.20
6.	CAZRI 1439	-	72.12	5.97	1099.36	74.91	62.00	100.00	8.52	51.46	240.17	5001.06	2542.73
7.	CAZRI1440	-	60.28	6.28	1587.33	74.42	59.33	90.30	6.68	49.32	326.91	6310.16	3318.27
8.	CAZRI1441	-	71.15	5.64	1477.92	70.29	61.67	89.30	13.93	53.36	288.82	5223.14	3014.11
9	IGFRI 23	**IGFRI**	73.21	5.32	1589.94	87.38	58.67	99.70	30.88	51.98	321.30	5790.60	3259.18
10	IGFRI 73	-	107.57	6.96	1215.19	83.89	64.00	81.00	10.82	51.52	310.37	4942.87	2687.69
11	IGFRI 94	-	68.87	6.43	1114.36	71.99	58.67	91.30	10.44	51.82	327.42	6611.30	3512.06
12	IGFRI 173	-	65.37	5.46	1068.76	84.37	56.33	88.30	18.02	52.26	248.68	5990.69	3571.27
13	JHC 94	-	70.10	6.04	759.69	76.38	50.00	77.30	10.70	52.00	244.04	5406.90	3442.76
14	ECI 531-1	-	68.18	6.09	781.14	65.99	63.00	86.30	14.09	51.34	213.86	5715.32	3149.82
15	Local	-	69.93	6.40	844.18	73.76	56.00	88.00	13.64	52.02	296.76	4845.75	2795.46
16	Butterfly Pea (Bulf)	-	70.90	9.31	1329.29	81.36	65.00	-	-	51.44	371.41	6831.69	3975.75
17	ILO 1531-1	-	69.41	6.97	1089.14	80.16	59.00	-	-	50.04	277.61	7369.14	4163.24
18	IL 173-1	-	67.42	6.73	715.22	87.20	47.33	-	-	50.20	290.57	6563.51	3745.10
19	IL 468	-	69.91	8.52	1054.45	88.00	52.00	-	-	51.74	357.67	7700.96	4561.59
20	Butterfly White		73.34	5.42	1031.72	80.76	54.00	-	-	52.02	243.38	6607.13	3482.17
	Mean		70.89	6.52	1157.83	78.37	56.75	88.43	15.92	51.22	309.97	5889.09	3294.68
	SE(±)		2.015	0.219	76.078	1.750	1.158	1.728	1.867	0.260	13.974	185.992	118.401
	C.V. (%)		13.04	15.38	30.15	10.25	9.36	7.84	47.02	2.33	20.69	14.49	16.49

CAZRI: Central Arid Zone Research Institute, Jodhpur; IGFRI: Indian Grassland and Fodder Research Institute, Jhansi

Table 2: Eigen- values and the proportion of total variability among butterfly pea accessions (2008-2010)

Principal Components	Eigen-Value (variance)	% Variability	% Accumulated variability
1	3.689365	33.53968	33.53968
2	2.043207	18.5746	52.11428
3	1.515392	13.77629	65.89057
4	1.284136	11.67396	77.56453
5	0.923081	8.391647	85.95618
6	0.643853	5.853213	91.80939
7	0.381794	3.470852	95.28025
8	0.233061	2.118737	97.39898
9	0.146739	1.333987	98.73297
10	0.102925	0.935685	99.66865
11	0.036448	0.331345	100

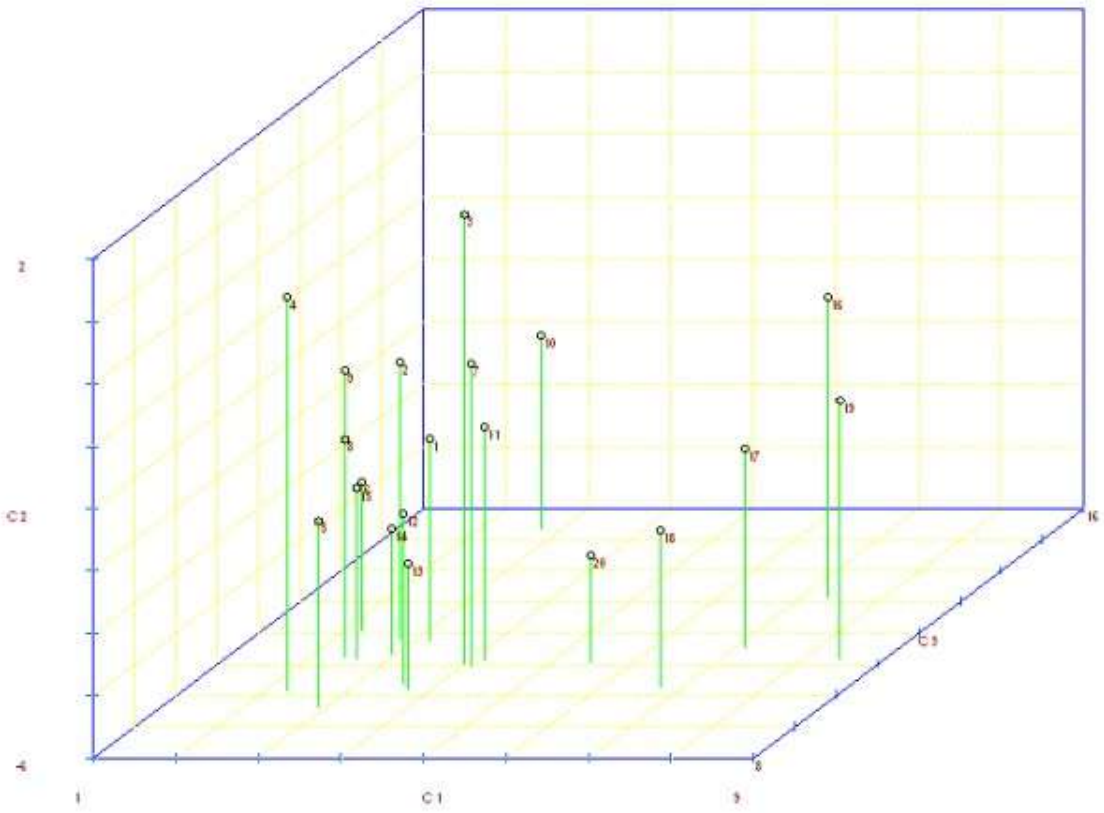

Fig. 1: Tridimensional representation of the results of the principal components analysis of 20 accessions of *Clitoriaternatea* L. based on the scores of 11 phenological, reproduction and forage yields traits.

Conclusion

In spite of the narrow genetic base, the characterization based on the combination of the information derived from phenological, reproductive and forage yield traits is useful in the maximization of the genetic potential of the germplasm under study, since it allowed the discrimination of the accessions, with the identification of very similar duplicate groups (CAZRI 1439 and local) and divergent genotypes (IGFRI 73, Butterfly Pea (Bulf), ILO 1531-1, IL 173-1, IL 468 and Butterfly White). This will be helpful in the identification of the germplasm of the research program to meet the needs of breeder. Therefore, the variability found in the traits forage yields, number of leaves /plant must be exploited in breeding programs.

References

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