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PN Sonavane
Department of Horticulture, AICVIP, Vegetable Science, MPKV, Rahuri, Maharashtra, India

MN Bhalekar
Department of Horticulture, AICVIP, Vegetable Science, MPKV, Rahuri, Maharashtra, India

SS Survase
Department of Horticulture, AICVIP, Vegetable Science, MPKV, Rahuri, Maharashtra, India

DS Mali
Department of Horticulture, AICVIP, Vegetable Science, MPKV, Rahuri, Maharashtra, India

Corresponding Author:
PN Sonavane
Department of Horticulture, AICVIP, Vegetable Science, MPKV, Rahuri, Maharashtra, India

To study the chemical composition and nutritive significance of sponge gourd [*Luffa cylindrica* (*Roem*) L.]

PN Sonavane, MN Bhalekar, SS Survase and DS Mali

Abstract
Luffa cylindrica contribute minerals, vitamins, sugars, protein and fiber to the diet. Tender fruits of sponge gourd are popular and well known culinary vegetable in India with good nutritive value and high yield potentials. Dietary fiber help to prevent dietary constipation similarly protein, sugars play a vital role nutritionally act as protective food for balanced diet also act as antioxidant properties.
The sponge gourd is a alternative source for living during food shortage and in draught condition. All organism obtain nutrients from the environment to live and these nutrients is essential for the maintenance of biological functions including metabolism and growth.
The heterosis and combining ability studies with eight parental lines of sponge guard with diallel crosses (without reciprocals) were conducted for to study the translocation of nutrients in Sponge gourd [*Luffa cylindrica* (*Roem*) L.] in different genetically divergence genotypes or crosses. Which is useful in dietary during food starvation, biotic & abiotic stress condition. It is one of the most important cucurbitaceous vegetable crops grown extensively throughout the tropical and sub-tropical regions of the world.
Minerals are naturally occurring inorganic substances with a definite chemical composition and essential of diet for normal metabolic activities of body tissues. Regarding nutrition vitamin 'A', vitamin 'C' protein, reducing, non-reducing and total sugar, crude fiber significantly recorded highest percentage by the parents by Phule Prajkta, Pusa Chikni, HASG-5, PSG-9, and PSG-100 and in cross combinations crosses P_1 x P_2, P_2 x P_6, P_2 x P_8, P_4 x P_5, P_4 x P_7, P_4 x P_8, P_6 x P_7, P_7 x P_8 in large extent in *Kahrif* & summer season in this study.

Keywords: Biochemical parameter, vitamin, protein, crude fiber, sugars, sponge gourd *Kahrif*, summer

Introduction
Sponge gourd [*Luffa cylindrica* (*Roem*) L.] is one of the most important cucurbitaceous vegetable crops grown extensively throughout the tropical and sub-tropical regions of the world. Tender fruits of sponge gourd are popular and well known culinary vegetable in India with good nutritive value and high yield potentials (Seshadri, 1986) [11]. It is good source of carbohydrates, vitamins A and C and minerals. *Luffa cylindrica* is a source of food, medicinal substances and have other traditional application.
Luffa sponge is a lignocelluloses material composed mainly of cellulose, hemicelluloses and lignin (Rowell *et al*., 2002).The fibers are composed of 60% cellulose, 30% hemicelluloses and 10% lignin (Mazali and Alves, 2005) [10]. Samples of *L. cylindrica* were analyzed for proximate composition and mineral contents (Mg, Ca, Na, K, Fe, Cu, Zn and Mn), Tannin, oxalate, phytin, phosphorus and phytic acid. The results obtained indicated the potential in its use as a source of vegetable protein in animal and human nutrition (Dairo *et al*., 2007) [4].
The sponge gourd is a alternative source for living during food shortage and in draught condition. All organism obtain nutrients from the environment to live and these nutrients is essential for the maintenance of biological functions including metabolism and growth.
In oriental medicine, *L. cylindrica* has effect on the treatment of fever, enteritis and swell etc. The extracts from vines alive are used as an ingredient in cosmetics and medicine (Lee and Yoo, 2006) [8]. They are used for bathing, removing toxins and regenerating the skin. They help varicose veins and cellulite by stimulating circulation. Immature fruit is used as vegetables, which is good for diabetes (Bal *et al*., 2004) [3]. Its vegetable is useful for patients of malaria and fevers because easily digestible. Species of *Luffa* are domesticated and indigenous in tropical Asia. Asiatic region, especially India and Malaya may be the origin of *Luffa* (Marklots, 1972) [9]. The current study has been undertaken to obtain information having a potential source in dietary & medicinal formulation.

Under these study By heterosis breeding it is to evaluate the % of nutrition activated in different crosses which is beneficial for to develop new lines in further breeding programme.

Material and Methods

Eight promising parental lines varieties of diverse origin of sponge gourd selected, namely P1 (Phule prajkta), P2 (Pusa chikni), P3 (Malkapur local), P4 (VR-1), P5 (PSG-100), P6 (PSG-110), P7 (PSG-9), P8 (HASG-5) and 28 F_{1s} hybrids obtained by crossing them in half diallel (without reciprocals), in *Summer*-2012. The performance of the parents and 28 F_{1s} hybrids with one standard check was assessed in a randomized block design (RBD) with two replications at AICVIP, Vegetable farm, Department of horticulture, M.P.K.V, Rahuri. Distance between rows was kept 150 cm and plants were spaced at 100 cm apart within row. Observations were recorded of bio-chemical parameters of luffa cylindrica such as vit-A, vit-C (mg./100g), sugar content, protein content, crude fiber according to NRI spectrometer by laboratory analysis.(A.O.A.C 1984)

Result and Discussion

Luffa cylindrica contribute minerals, vitamins, sugars, protein and fiber to the diet. Minerals are naturally occurring inorganic substances with a definite chemical composition and essential of diet for normal metabolic activities of body tissues. Dietery fibre help to prevent dietery constipation similary protein, sugars play a vital role nutritionally act as protective food for balanced diet also act as antioxidant properties.

Regarding the biochemical parameters vitamin 'A', vitamin 'C' protein content, reducing, non-reducing and total sugar, crude fibre analyzed similar parameters significantly recorded highest percentage by parents by Phule prajkta, Pusa Chikni, HASG-5, PSG-9, and PSG-100 and in cross combinations crosses P_1 x P_2, P_2 x P_6, P_2 x P_8, P_4 x P_5, P_4 x P_7, P_4 x P_8, P_6 x P_7, P_7 x P_8 in large extent. Similar findings reported by Kochhar *et al*. (2006) [7], Hanif *et al.* (2006) [6], Amoo *et al.* (2008) [2], Gohari *et al.* (2011) [5].

Mean performance of parents & crosses for bio-chemical parameters in 8 x 8 half diallel of sponge gourd Table 1**:** revealed that;

Vitamin 'A'

Highest vitamin 'A' content was recorded in the parent Phule prajkta (128.05) followed by the parent Pusa Chikni (120.00), Malkapur local (118.80) and HASG-5 (115.65) which are statistically at par with each other during *kharif* season.

In summer season parent Phule prajkata recorded highest vitamin content (127.80) followed by parent HASG.5 (126.45), and Pusa Chikni (125.15) respectively.

In *Kharif* season among all the cross combinations, the cross P_4 x P_8 (131.45) recorded significantly highest vitamin A followed by the cross P_6 x P_7 (129.7) and P_5 x P_6 (128.25) which are statistically at par with each other, however in summer season the cross P_2 x P_8 (133.75) recorded highest vitamin 'A' followed by cross combination P_5 x P_8 (133.15) and P_4 x P_7 (132.85).

Vitamin 'C' (mg/100 gm)

In *kharif* season the parent HASG-5 recorded significantly highest vitamin 'C' content (12.89) which are statistically at par with the parent Phule Prajkta (12.46), PSG-9 (11.90) and Pusa Chikni (11.90). Whereas in summer season Parent Phule prajkta (13.50) recorded significantly highest vitamin 'C' content followed by PSG.9 (12.81) and Pusa Chikni (12.71).

In the cross combination the cross P_7 x P_8 (13.90) recorded significantly maximum vitamin 'C' content followed by the cross P_6 x P_8 (13.38) and cross P_4 x P_5 (13.20).The cross combination P_4 x P_5 (14.49) recorded significantly highest vitamin 'C' content than cross P_4 x P_7 (14.29) and P_5 x P_7 (13.81)

Protein content (%)

During *Kharif* season parents VR-1 (24.74, 24.99), HASG-5 (24.56, 24.97), Phule prajkta (24.20, 24.88) and PSG-100 (24.12, 24.49) recorded significantly highest percentage of protein content in both *kharif* and summer respectively.

Among the hybrids, cross combinations maximum protein content recorded by the cross combination P_4 x P_8 (25.68) followed by crosses P_1 x P_2 (25.00), P_7 x P_8 (24.89) P_4 x P_5 (24.40), P_5 x P_8 (24.37), P_6 x P_7 (24.25), P_2 x P_7 (24.12), P_1 x P_7 (24.06) and P_1 x P_8 (24.06) in *Kharif* season and cross combination P_1 x P_2 (25.65) recorded maximum protein content followed by crosses P_7 x P_8 (25.56), P_4 x P_8 (25.37), P_2 x P_8 (25.18), P_5 x P_6 (24.69), P_4 x P_7 (24.59 and P_1 x P_8 (24.55) in summer season.

Sugar content

a) Reducing sugar (%)

In *kharif* season significantly highest reducing sugar was found in parent PSG-9 (3.41) followed by parent HASG-5 (3.35) and PSG-110 (3.32) which are statistically at par with each other while parent VR-1 (3.51) recorded maximum reducing sugar followed by the parents Phule prajkta (3.48), PSG-100 (3.44) and Malkapur local (3.41) during summer season.

Among all the cross interactions the cross P_1 x P_5 (3.81) recorded significantly maximum reducing sugar followed by cross P_4 x P_8 (3.73) and P_3 x P_4 (3.70) statistically at par with each other during *kharif* season, however in summer season the cross P_2 x P_4 (3.71) recorded maximum reducing sugar followed by cross P_4 x P_7 (3.61) and P_2 x P_3 (3.57), P_2 x P_7 (3.57), P_4 x P_5 (3,57) which are statically at par with each other.

b) Non-reducing sugar (%).

The parent HASG-S (7.93) recorded significantly maximum non- reducing sugar in *kharif* season followed by parents PSG-110 (7.72) and VR-1 (6.94), where as in summer season the parent PSG-110 (8.31) recorded significantly maximum non-reducing sugar followed by parent HASG-5 (6.52) and Pusa Chikni (6.35) respectively.

In *kharif* season the cross P_7 x P_8 (7.86) recorded significantly maximum non-reducing sugar followed by the cross P_3 x P_8 (7.42) and P_3 x P_6 (7.31) which are statistically at par with each other. The cross P_6 x P_7 (7.49) recorded maximum non-reducing sugar followed by cross P_3 x P_4 (6.73) and P_3 x P_6 (6.70) in summer season.

c) Total sugar (%)

The parent HASG-5 recorded significantly maximum total sugar with the mean value (11.35) and parent PSG-110 (11.04) which was statistically at par with the parent Malkapur local (10.20) in *kharif* season. However, in summer

season highest total sugar was found significantly in the PSG-110 with the mean value (11.09) followed by the parent HASG-5 (9.83) and Malkapur local (9.73).

Among the cross combinations the cross P_7 x P_8 (11.29) recorded significantly highest total sugar followed by the cross P_3 x P_8 (10.82) and P_3 x P_6 (10.65) in *kharif* season. The cross P_6 x P_7 (10.83) recorded significantly maximum total sugar followed by the cross P_3 x P_4 (10.03) and P_3 x P_8 (9.93) in summer season.

Crude fibre (g)

Significantly maximum crude fibre content was found in parent PSG-110 (0.57) followed by parent PSG-100, PSG-9 and Phule prajkta with the mean values (0.53), (0.53) and (0.52) respectively during *kharif* season. However, in summer season the parent PSG.100 recorded significantly highest crude fibre with the mean value (0.59) followed by the parent Phule prajkta (0.57) and Pusa chikni (0.54).

Among the cross combinations the cross P_3 x P_6 (0.61), P_4 x P_6 (0.61), P_4 x P_7 (0.61) was recorded highest crude fibre in *kharif* however in summer season the cross P_2 x P_6 (0.63) recorded significantly maximum crude fibre followed by crosses P_1 x P_4 (0.62), P_2 x P_5 (0.62) and cross P_7 x P_8 (0.62).

Table 1: Mean performances of parents and crosses for different characters in 8 x 8 half diallel of sponge gourd

Parents/ Crosses	Vitamin A (mg/100gm)		Vitamin C (mg/100gm)		Protein content (%)		Reducing sugar (%)		Non-reducing sugar (%)		Total sugar (%)	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
P_1	128.05	127.80	12.46	13.50	24.20	24.88	3.27	3.48	4.94	5.19	6.26	8.68
P_2	120.00	125.15	11.90	12.71	23.99	23.97	3.15	3.34	5.53	6.35	8.68	9.69
P_3	118.80	119.85	11.42	11.30	23.17	22.88	3.26	3.41	6.94	6.32	10.20	9.73
P_4	108.20	113.60	10.96	12.03	24.74	24.99	3.31	3.51	4.80	5.63	8.11	9.17
P_5	100.95	121.90	11.46	12.53	24.12	24.49	3.24	3.44	5.46	5.15	8.70	8.59
P_6	115.10	119.15	11.45	12.25	23.59	24.37	3.32	3.14	7.72	8.31	11.04	11.09
P_7	111.95	123.60	11.90	12.81	23.33	24.68	3.41	3.37	6.08	6.04	9.50	9.41
P_8	115.65	126.45	12.89	12.43	24.56	24.97	3.35	3.31	7.93	6.52	11.35	9.83
P. mean	114.83	122.18	11.80	12.44	23.96	24.40	3.29	3.37	6.17	6.19	9.23	9.52
	Hybrids											
1x2	118.40	120.75	12.15	12.66	25.00	25.65	3.44	3.42	3.91	5.73	7.42	9.18
1x3	117.30	126.70	11.90	13.49	21.65	21.85	3.43	3.51	6.03	5.54	9.51	9.06
1x4	119.65	127.90	11.39	12.26	22.78	22.69	3.20	3.25	5.91	6.11	9.17	9.37
1x5	117.30	120.85	10.42	12.85	23.18	23.27	3.81	3.48	3.69	6.32	7.52	9.77
1x6	119.40	127.75	10.95	11.40	23.10	23.60	3.42	3.25	5.43	5.75	8.90	8.96
1x7	122.35	127.95	11.43	12.36	24.06	24.31	3.27	3.51	5.54	5.42	8.86	8.93
1x8	123.95	125.30	10.95	12.76	24.06	24.55	3.51	3.55	5.61	5.71	9.12	9.26
2x3	125.75	123.35	11.94	12.76	22.27	22.70	3.43	3.57	6.76	5.94	10.14	9.51
2x4	125.35	126.50	11.90	13.60	23.31	24.27	3.39	3.71	5.01	5.09	8.40	8.80
2x5	125.25	124.45	11.93	12.92	23.60	23.28	3.48	3.56	5.28	5.45	8.78	9.01
2x6	118.55	121.15	12.41	12.12	22.71	21.12	3.43	3.51	5.71	5.10	9.14	8.62
2x7	122.05	127.35	12.43	13.30	24.12	24.28	3.32	3.57	5.16	5.20	8.48	8.78
2x8	124.60	133.75	12.93	13.67	23.21	25.18	3.51	3.42	6.05	5.92	9.56	9.38
3x4	130.80	124.70	11.40	12.33	21.87	23.10	3.70	3.30	5.77	6.73	9.57	10.03
3x5	113.15	126.55	10.95	12.85	23.13	22.40	3.35	3.48	6.47	5.54	9.82	9.02
3x6	119.75	125.55	12.37	12.37	22.05	22.60	3.30	3.39	7.31	6.70	10.65	10.10
3x7	118.75	123.20	10.92	13.43	21.65	23.00	3.30	3.56	6.59	5.22	9.89	8.78
3x8	118.70	131.45	10.94	12.51	22.25	22.76	3.40	3.40	7.42	6.50	10.82	9.93
4x5	123.40	128.70	13.20	14.49	24.40	24.25	3.51	3.57	5.76	5.42	9.25	8.99
4x6	127.30	122.25	12.38	12.94	22.54	23.58	3.31	3.45	5.40	5.61	8.71	9.09
4x7	121.00	132.85	11.90	14.29	23.77	24.59	3.32	3.61	5.31	4.74	8.63	8.35
4x8	131.45	126.30	12.37	13.45	25.68	25.37	3.73	3.42	5.11	6.19	8.84	9.61
5x6	128.25	125.00	11.90	13.35	23.39	24.69	3.24	3.43	5.97	5.42	9.22	8.85
5x7	127.25	125.95	12.14	13.81	24.06	24.36	3.25	3.47	6.06	5.61	9.31	9.08
5x8	126.90	133.15	11.90	12.44	24.37	23.83	3.35	3.36	5.45	6.46	8.78	9.82
6x7	129.70	115.10	12.42	11.25	24.25	24.20	3.35	3.33	7.16	7.49	10.52	10.83
6x8	117.60	120.95	13.38	11.46	22.93	22.86	3.45	3.14	7.24	6.04	10.65	9.19
7x8	124.95	127.30	13.90	11.61	24.89	25.56	3.43	3.52	7.86	6.04	11.29	9.56
H. mean	122.81	125.81	11.95	12.81	23.08	23.48	3.41	3.45	5.89	5.82	9.32	9.28
Std.ch.	122.35	124.95	14.11	12.64	23.62	25.00	3.29	3.39	7.77	5.79	11.06	9.22
G. mean	121.04	125.00	11.92	12.44	23.50	23.89	3.38	3.43	5.95	5.90	9.30	9.33
S.E.±	1.08	0.88	0.05	0.10	0.50	0.39	0.01	0.02	0.06	0.03	0.07	0.08
C.D.at5%	3.11	2.54	0.14	0.28	1.45	1.12	0.05	0.08	0.18	0.10	0.20	0.25

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