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Heterosis for seed cotton yield and its contributing characters in cotton (*Gossypium hirsutum* L.)

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SUMMARY

A line x tester crossing programme was taken up with three female lines and ten male parents with a view to obtain best heterotic crosses for seed cotton yield and its attributing traits. Heterosis over better parent and standard check were estimated for yield and its contributing characters in 30 cross combinations. The hybrids *viz.,* GSHV 155 x GSHV 112, G. Cot. 20 x BC 68-2, G. Cot. 20 x 76 IH-20, GSHV 01/1338 x GISV 218, GSHV 155 x Surat dwarf, GSHV 01/1338 x BC 68-2 and GSHV 155 x LRA 5166 showed significant positive standard heterosis as well as heterobeltiosis for seed cotton yield per plant, number of bolls per plant and boll weight. The crosses exhibited highest heterosis due to increase in boll number and boll weight was significantly associated with increase in yield and these crosses could be considered for exploitation of hybrid vigour.

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Key words : Heterosis, Heterobetteosis, Seed cotton yield

Cotton (*Gossypium hirsutum* L.) is an important fibre crop and plays a vital role as a cash crop in commerce of many countries such as USA, China, India, Pakistan, Uzbekistan, Australia and Africa. Cotton crop is mainly cultivated for fibre. Development of new variety with high yield and fibre quality is the primary objective of all cotton breeders. In India, all four species *viz., G. hirsutum, G. barbadense, G. herbaceum,* and *G. arboretum* are grown whereas; *G. hirsutum* occupies largest area among the four species grown. India is pioneer country for the cultivation of hybrids on commercial scale. Chinnadurai and Rangaswami (1974) studies heterosis in cotton and indicated tremendous potential for improvement of quantitative and qualitative characters by better commercial exploitation of hybrid vigour in cotton is being exploited successfully since the release of commercial *intra- hirsutum* hybrids *viz*., H-4, DCH 32, JKHY 1 and few others. Since galaxy of hybrids has been released in central and southern zone of country. The present investigation was undertaken to find out the extent of heterosis for seed cotton yield and its contributing traits in upland cotton, which is the prominent cultivated species all over the world.

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MATERIALS AND METHODS

Three diverse parents (G. Cot. 20, GSHV 01/1338, GSHV 155) and ten good combiners *viz*., (GSHV 97/612, GSHV 01/26, GISV 218, GISV 103, GSHV 97/13, B.C. 68-2, Surat Dwarf, LRA 5166, GSHV- 122, 76- IH-20) were taken to generate thirty cross combinations by using line x tester mating design. These thirty crosses along with thirteen parents and one check (G. Cot. Hy. 12) were grown in Randomized Block Design with three replications. One row of each hybrid and parents were sown in a spacing 120 x 45 cm during 2009-10 at Main Cotton Research Station, Surat. Five plants were chosen from each row to record data on seed cotton yield, its contributing traits and fibre properties. Heterosis was estimated over the better parent as per the standard procedure of Meredith and Bridge (1972) and useful heterosis as per standard method suggested by Rai (1978) over the standard check hybrid G. Cot Hy 12.

RESULTS AND DISCUSSION

The analysis of variance indicated that the mean squares due to treatments and hybrids were highly significant for all the characters under study. Variances due to parents vs. hybrids which reflected overall heterosis were significant for all the characters except days to 50 per cent flowering. (Table 1).

Heterosis over better parent and standard check for twelve characters are presented in Table 2. The results indicated that the phenomenon of heterosis was of a general occurrence for almost all the characters, under study. However, the magnitude of heterosis varied with characters. For days to 50 per cent flowering, 9 and 5 hybrids showed significant negative relative heterosis, heterobeltiosis and economic heterosis in desired direction for earliness, respectively. The hybrid GSHV 155 x GSHV 112 manifested the highest significant negative heterobeltiosis and economic heterosis. The results are akin to the findings of Rajan *et al.* (2000), Preetha and Raveendaran (2008), Dukre *et al.* (2009). For plant height GSHV 01/1338 x GSHV 01/26 exhibited positive and significant heterobeltiosis and standard heterosis. For sympodia per plant, the range of standard heterosis lied from -33.47 (G.Cot. 20 x LRA 5166) to 25.22 thereby moderate to high heterosis was observed. Similar result had also been reported by Singh *et al.* (1995) and Khorgade *et al.* (2000).

In cotton, the number of bolls/ plant and boll weight is an important yield component which is positively associated with seed cotton yield. Among thirty hybrids, G.Cot. 20 x BC 68-2 (43.91%) and GSHV 155 x GSHV 112 (32.64%) showed highest significant positive heterobeltiosis and standard heterosis, respectively for bolls per plant. Ten hybrids showed significant heterosis over BP and seven hybrids exhibited significant positive heterosis over SC. Such high heterotic response would be useful for obtaining more number of bolls/ plant which ultimately results in higher seed cotton yield (Bhatade and Rajeswar, 1994). Out of thirty hybrids studied for boll weight, only nine hybrids exhibited significant positive heterosis over MP, while seven hybrids over SC. The cross combinations, GSHV 01/1338 x GISV 218 (20.90%) and G.Cot. 20 x BC 68-2 (13.21%) exhibited highest significant positive heterosis over BP and SC, respectively for seed index. Pole *et al.*, (2008) also reported heterosis for seed index. For lint index, heterobeltiosis and standard heterosis ranged from -21.32 (G.Cot. 20 x BC 68-2) to 35.06 per cent (GSHV 155 x GSHV 97/13) and -27.06 (GSHV 155 x GSHV 112) to 22.15 per cent (GSHV 155 x GSHV 97/13), respectively. Similar result also reported by Rajan *et al.*(2000).

The extent of heterosis for seed cotton yield/ plant ranged from -18.30 to 44.20 per cent and -15.48 to 27.70 per cent over BP and SC, respectively. Among thirty hybrids, eleven showed significant positive heterosis over

Table 1 : Analysis of variance for various characters in cotton

Sources of variation	d.f.	Days to 50% flowering	Plant height (cm)	Sympodia / plant	Bolls/ plant	Seed index (g)	Lint index (g)	Boll weight (g)	Seed cotton yield/ plant (g)	Ginning Percentage	2.5% span length (mm)	Micronaire value (mv)	Fibre strength
Replication	2	4.56	11.44	0.61	7.73	0.58	0.12	0.02	10.24	1.94	0.31	0.002	0.004
Treatment	43	66.51**	199.25**	15.33**	85.29**	1.39**	1.10**	0.33**	864.82**	7.45**	4.18**	0.43**	3.81**
Parents (P)	12	51.85**	321.09**	8.82**	29.51**	0.82**	0.74**	0.32**	306.84**	9.57**	2.83**	0.88**	2.71**
Hybrids (H)	29	74.75**	139.10**	15.49**	568.36**	1.34**	1.08**	0.30**	740.54**	5.51**	4.05**	0.19**	4.10**
Parents vs Hybrids	1	3.27	481.37**	88.80**	568.36**	9.68**	6.03**	1.19**	6530.31**	38.43**	24.09**	1.88**	11.28**
Error	84	11.85	25.87	1.08	7.12	0.23	0.11	0.03	103.38	0.91	0.67	0.04	0.35

* and ** indicate significance of values at $P < 0.05$ and 0.01, respectively

Table 2 : Heterosis over better parent and standard check for seed cotton yield and its contributing traits in cotton

Sr. No.	Crosses	Days to 50% flowering		Plant height (cm)		Sympodia/ plant		Bolls/ plant		Seed Index		lint Index	
		BP	SC	BP	SC	BP	SC	BP	SC	BP	SC	BP	SC
1.	G.Cot. 20 x GSHV 97/612	7.94	4.08	1.31	5.35	26.07 *	4.35	10.80	0.66	5.66	5.66	6.17	6.85
2.	G.Cot. 20 x GSHV 01/26	5.45	2.55	0.22	3.88	23.32 **	0.00	19.57 **	3.77	3.77	1.89	5.95	5.34
3.	G.Cot. 20 x GISV 218	20.33 **	11.73 **	2.87	1.34	17.13 *	28.48 **	16.90 *	25.75 **	11.32 *	11.32 *	9.81	11.76
4.	G.Cot. 20 x GISV 103	2.51	1.02	3.52	6.26	2.82	5.00	0.74	1.70	4.06	1.89	8.45	4.62
5.	G.Cot. 20 x GSHV 97/13	3.30	4.08	0.36	3.74	26.89 **	8.70	12.61	2.26	5.66	5.66	12.30	11.04
6.	G.Cot. 20 x BC 68 2	12.18 **	12.76 **	0.68	1.47	20.37 **	11.74 *	43.91 **	24.91 **	13.21 **	13.21 **	35.06 **	7.00
7.	G.Cot. 20 x Surat dwarf	5.09	4.59	0.75	4.81	11.51	14.78 *	23.70 **	7.36	3.40	3.40	4.42	8.01
8.	G.Cot. 20 x LRA 5166	11.54 *	3.57	7.41 *	11.18 **	12.03	33.26 **	22.07 **	32.36 **	5.66	5.66	17.21 *	7.14
9.	G.Cot. 20 x GSHV 112	11.16 **	2.55	6.20	6.63 *	14.36 *	6.52	18.38 **	10.75	10.19 *	10.19 *	20.37 **	16.52 **
10.	G.Cot. 20 x 76 III 20	15.31 **	15.31 **	0.24	1.07	26.87 **	25.22 **	26.09 **	14.43 *	1.13	1.51	24.00 **	13.71 *
11.	GSHV 01/1338 x GSHV97/612	1.05	2.04	0.28	3.50	4.06	5.22	14.32 *	3.96	5.37	3.77	6.85	2.02
12.	GSHV 01/1338 x GSHV 01/26	1.49	4.59	10.80 **	7.22 *	0.95	9.78	9.02	0.85	3.16	7.55	16.47 **	16.96 *
13.	GSHV 01/1338 x GISV 218	11.05 *	7.65	4.20	7.30 *	18.38 **	7.83	32.78 **	20.75 **	20.90 **	11.32 *	20.80 **	18.18 **
14.	GSHV 01/1338 x GISV 103	2.01	3.57	4.76	1.79	6.35	1.74	11.79	9.62	13.28 **	11.32 *	19.39 **	16.02 *
15.	GSHV 01/1338 x GSHV 97/13	15.79 **	12.24 **	3.07	6.20	5.49	13.91 *	12.66	2.45	2.54	8.68	1.73	9.88
16.	GSHV 01/1338 x BC 68 2	12.18 **	11.73 **	1.56	3.66	26.00 **	16.96 **	36.72 **	24.34 **	17.70 **	7.92	31.47 **	20.56 **
17.	GSHV 01/1338 x Surat dwarf	3.17	6.12	1.27	4.47	16.48 **	19.57 **	13.07	2.83	4.64	14.72 **	5.19	13.06 *
18.	GSHV 01/1338 x LRA 5166	3.68	0.51	4.45	1.07	7.64	1.96	7.47	2.26	15.65 **	0.38	9.44	0.36
19.	GSHV 01/1338 x GSHV 112	11.16 **	2.55	5.24	5.67	16.95 **	6.52	0.78	8.49	13.04 **	7.92	5.30	10.39
20.	GSHV 01/1338 x 76 III 20	3.57	3.57	16.82 **	17.91 **	8.37	9.57	7.57	2.17	2.26	1.89	4.01	11.98
21.	GSHV 155 x GSHV 97/612	0.52	1.53	6.51 *	6.28	24.77 **	28.04 **	17.81 **	19.91 **	9.31	1.89	13.46 *	5.19
22.	GSHV 155 x GSHV 01/26	8.42 *	5.61	2.60	2.81	10.91	14.78 **	2.81	5.28	7.51	2.64	8.42	7.79
23.	GSHV 155 x GISV 218	6.70	7.65	0.86	1.07	5.45	9.57	5.32	7.74	7.69	0.38	2.58	4.69
24.	GSHV 155 x GISV 103	14.57 **	13.27 **	17.20 **	17.38 **	13.41 *	8.48	7.37	10	3.69	6.04	6.65	11.11
25.	GSHV 155 x GSHV 97/13	2.58	1.53	4.90	5.11	12.27 *	16.09 **	14.52 *	16.70 **	0.81	7.55	21.32 **	27.06 **
26.	GSHV 155 x BC 68 2	8.63 *	8.16	5.41	5.61	2.50	1.96	11.91	9.06	11.34 *	3.77	5.06	2.60
27.	GSHV 155 x Surat dwarf	10.65 **	1.53	8.28 *	8.48 *	22.35 **	17.83 **	34.17 **	30.75 **	14.57 **	6.79	29.34 **	19.91 **
28.	GSHV 155 x LRA 5166	5.67	4.59	1.47	1.26	18.18 **	13.04 *	23.52 **	20.38 **	17.41 **	9.43 *	25.14 **	16.02 *
29.	GSHV 155 x GSHV 112	23.72 **	16.33 **	7.02 *	7.22 *	28.64 **	23.04 **	21.31 **	32.64 **	16.60 **	11.32 *	16.52 **	22.15 **
30.	GSHV 155 x 76 III 20	4.59	4.59	1.02	0.80	7.27	8.48	8.42	5.66	0.75	1.13	8.79	0.87
	S.E. (d)	2.81	2.81	4.15	4.15	0.85	0.85	2.17	2.17	0.39	0.39	0.27	0.27
	CD (P 0.05)	5.62	5.62	8.31	8.31	1.70	1.70	4.36	4.36	0.78	0.78	0.55	0.55
	CD (P 0.01)	7.48	7.48	11.06	11.06	2.26	2.26	5.80	5.80	1.04	1.04	0.74	0.74

Contd.... Table 2

Table 2 contd....

Sr. No.	Crosses	Boll weight (g) BP	Boll weight (g) SC	Seed cotton yield/ plant BP	Seed cotton yield/ plant SC	Ginning percentage BP	Ginning percentage SC	2.5% span length BP	2.5% span length SC	Micronaire value BP	Micronaire value SC	Fibre strength BP	Fibre strength SC
1.	G.Cot. 20 x GSHV 97/612	3.92	8.41	1.16	8.85	1.89	2.10	2.81	7.01 **	12.23 **	7.58	7.80 **	6.52 **
2.	G.Cot. 20 x GSHV 01/26	13.73 **	8.41	23.84 **	9.36	1.70	3.90	2.45	7.01 **	2.84	9.85 *	5.23 *	1.33
3.	G.Cot. 20 x GISV 218	12.75 **	7.48	3.30	8.91	4.20	2.60	1.10	5.72 *	9.82 **	11.36 **	6.62 **	2.67
4.	G.Cot. 20 x GISV 103	3.64	0.93	18.30 **	8.91	3.16	0.90	6.25 *	1.29	9.66 **	0.76	10.11 **	6.52 **
5.	G.Cot. 20 x GSHV 97/13	22.31 **	12.15 **	17.08 *	6.19	0.20	1.00	1.08	1.87	6.02	5.30	8.09 **	10.81 **
6.	G.Cot. 20 x BC 68-2	12.38 **	10.28 *	44.20 **	27.17**	5.04 *	4.20	2.76	4.44	0.00	0.76	8.06 **	9.19 **
7.	G.Cot. 20 x Surat dwarf	12.75 **	7.48	15.04	1.45	0.50	0.30	4.41	0.47	0.00	0.76	6.77 **	2.81
8.	G.Cot. 20 x LRA 5166	9.80 *	14.02 **	3.42	14.83*	1.11	0.30	1.27	2.34	6.77	7.58	1.64	6.37 **
9.	G.Cot. 20 x GSHV 112	11.43 *	13.08 **	11.66	10.23	2.09	1.90	4.85 *	3.50	6.77	6.06	4.46 *	7.56 **
10.	G.Cot. 20 x 76 IH 20	14.02 **	14.02 **	26.09 **	26.90**	13.10 **	10.69 **	3.56	1.99	0.75	1.52	5.82 *	2.37
11.	GSHV 01/1338 x GSHV97/612	7.83	0.93	1.23	0.59	3.89	4.10	2.44	1.75	0.00	5.30	1.45	0.59
12.	GSHV 01/1338 x GSHV 01/26	17.39 **	11.21 *	9.89	14.74 *	6.14 **	0.80	0.97	5.02 *	3.55	10.61 **	10.01 **	8.15 **
13.	GSHV 01/1338 x GISV 218	2.61	10.28 *	24.96 **	25.78**	5.69 *	1.00	3.65	0.58	9.82 **	11.36 **	3.34	1.33
14.	GSHV 01/1338 x GISV 103	0.00	7.48	18.27 **	8.87	4.99 *	1.00	6.70 **	2.34	0.00	9.85 *	2.32	4.44 *
15.	GSHV 01/1338 x GSHV 97/13	23.14 **	13.08 **	9.21	9.92	4.40	1.90	3.61	0.58	11.76 **	0.76	0.72	3.26
16.	GSHV 01/1338 x BC 68-2	2.61	10.28 *	22.49 **	23.25**	11.58 **	10.39 **	7.59 **	9.35 **	7.56	3.03	8.71 **	10.96 **
17.	GSHV 01/1338 x Surat dwarf	10.43 *	3.74	12.68	13.42	8.70 **	7.39 **	4.87	0.58	9.09 *	0.00	2.90	0.89
18.	GSHV 01/1338 x LRA 5166	7.83	0.93	5.09	4.47	5.42 *	2.90	3.01	4.09	8.40	2.27	1.10	9.33 **
19.	GSHV 01/1338 x GSHV 112	5.22	1.87	19.02 *	20.06*	3.99	4.20	5.44 *	4.09	8.40	2.27	0.14	3.11
20.	GSHV 01/1338 x 76 IH 20	0.87	6.54	3.50	4.18	2.05	4.40	5.46 *	3.86	13.49 **	8.33 *	1.16	3.26
21.	GSHV 155 x GSHV 97/612	3.06	5.61	8.95	15.48*	0.39	2.20	4.64	0.12	0.72	4.55	2.92	4.59 *
22.	GSHV 155 x GSHV 01/26	9.18	0.00	9.38	1.54	0.66	6.39 **	5.38 *	9.58 **	2.84	3.79	6.56 **	5.04 *
23.	GSHV 155 x GISV 218	11.22 *	1.87	1.91	8.94	7.09 **	0.50	0.37	4.79 *	14.11 **	6.06	3.79	2.22
24.	GSHV 155 x GISV 103	1.82	4.67	2.17	13.92	2.01	2.10	2.69	1.87	13.79 **	5.30	1.46	0.15
25.	GSHV 155 x GSHV 97/13	17.36 **	6.54	2.36	9.36	6.33 **	3.90	0.72	3.62	1.61	7.58	2.31	4.89 *
26.	GSHV 155 x BC 68-2	2.86	0.93	27.54 **	18.41*	3.80	1.30	1.15	0.47	11.29 **	4.55	4.52 *	2.96
27.	GSHV 155 x Surat dwarf	23.47 **	13.08 **	35.33 **	25.63**	7.89 **	10.69 **	2.57	1.99	12.10 **	5.30	6.27 **	4.74 *
28.	GSHV 155 x LRA 5166	25.51 **	14.95 **	31.91 **	22.46*	2.04	4.70 *	2.66	1.64	8.06	1.52	10.68 **	3.41
29.	GSHV 155 x GSHV 112	13.33 **	11.21 *	25.67 **	27.70**	6.33 **	9.09 **	0.71	1.99	15.32 **	8.33 *	8.78 **	6.07 **
30.	GSHV 155 x 76 IH 20	3.74	3.74	5.68	6.36	0.19	2.80	0.71	0.82	9.52 *	4.55	4.52 *	2.96
	S.E. (d)	0.15	0.15	8.30	8.30	0.77	0.77	0.67	0.67	0.16	0.16	0.48	0.48
	C.D. (P=0.05)	0.31	0.31	16.61	16.61	1.56	1.56	1.34	1.34	0.33	0.33	0.98	0.98
	C.D. (P=0.01)	0.41	0.41	22.11	22.11	2.07	2.07	1.78	1.78	0.44	0.44	1.30	1.30

* and ** indicate significance of values at P=0.05 and 0.01, respectively

better parent while nine hybrids indicated significant positive standard heterosis. The cross combinations GSHV 155 x GSHV 112, G. Cot. 20 x BC 68-2, G. Cot. 20 x 76 IH-20, GSHV 01/1338 x GISV 218, GSHV 155 x Surat dwarf, GSHV 01/1338 x BC 68-2 and GSHV 155 x LRA 5166 showed significant standard heterosis and heterobeltiosis in positive direction for seed cotton yield per plant. The results reported in the present investigation are in agreement with earlier workers Pole *et al.* (2008), Preetha and Raveendaran (2008), Rajamani *et al.* (2009), Wankhede *et al.* (2009).

The heterotic expression for ginning percentage ranged from -7.09 to 13.10 per cent over BP and -4.40 to 10.69 per cent over SC in G.Cot. 20 x 76 IH-20 and GSHV 155 x GSHV 97/13, respectively. Preetha and Raveendaran (2008) also reported varying magnitude of heterosis for this character. In cotton 2.5% span length is a new criteria for measurement of fibre length. In present study, the hybrid GSHV 01/1338 x B.C.68-2 (7.59%) exhibited the highest significant positive heterosis over better parent and standard check (9.35%). The results are in conformity with Rajamani *et al.* (2009).

Micronaire value is an important fibre quality trait in judging lint quality of cotton. The decrease in micronaire value is an indication of fibre fineness. The heterosis estimates ranged from-14.11 (GSHV 155 x GISV 218) to 15.32 (GSHV 155 x GSHV 112) per cent over mid parent. Out of thirty crosses, six crosses showed significant negative heterosis over better parent and none of the crosses showed negative and significant heterosis over standard check for micronaire value. Rajamani *et al.* (2009) reported the findings of similar nature. Among the thirty hybrids, ten and eleven crosses exhibited significant heterosis over better parent and standard check, respectively for fibre strength, while the cross combinations G.Cot. 20 x GISV 103 (10.11%) and GSHV 01/1338 x BC 68-2 (10.96%) exhibited highest significant and positive heterobeltiosis and standard heterosis, respectively. Similar results were reported by earlier workers like Rajamani *et al.* (2009).

In the present investigation, the cross combinations *viz.,* GSHV 155 x GSHV 112, G. Cot. 20 x 76 IH-20, GSHV 01/1338 x GISV 218 and GSHV 155 x LRA 5166 appeared to be more promising for seed cotton yield per plant. The crosses exhibited highest heterosis due to increase in boll number and boll weight was significantly associated with increase in yield and these crosses could be check stability performance of these crosses before exploitation of hybrid vigour for commercial cultivation.

REFERENCES

Bhatade, S.S. and Rajeswar, S.R. (1994). Heterobeltiosis and standard heterosis for yield and quality characters in some *G. hirsutum* L. crosses. *Madras Agric. J.,* **81** (1): 34-35.

Dukre, V.B., Burghate, S.K. and Patil, S.P. (2009). Diallel analysis for heterosis studies in upland cotton. *J. Cotton Res. Dev.*, **23** (2): 217-221.

Khorgade, P.W., Satange, L.V. and Pillai, Beena (2000). Heterosis for cotton yield and its components in American cotton. *Agril. Sci. Digest.,* **20** (2): 131-132.

Meredith, W.R. and Bridge, R.R. (1972). Heterosis and gene action in cotton *Gossypium hirsutum* L. *Crop Sci.,* **12**: 304-310.

Preetha, S. and Raveendran, T. S. (2008). Combining ability and heterosis for yield and fibre quality traits in line x tester crosses of upland cotton. *Internat. J. Plant Breeding & Genetics*, **2** (2): 64-74.

Rai, B. (1978). *Heterosis Breeding.* Agro Biological Publications, New Delhi

Rajamani, S., Rao, C.M. and Naik, R. K. (2009). Heterosis for yield and fibre properties in upland cotton (*G. hirsutum* L.). *J. Cotton Res. Dev.*, **23** (1): 43-45.

Rajan, S.G.A., Khandasamy, G., Vanniarajan, C. and Rajaravindran, G. (2000). Study of heterosis in American cotton. *Indian J. Agric. Res.,* **34** (3): 156-159.

Singh, H., Singh, S. and Om Prakash (1995). Measurement of heterosis for yield and its component characters in American cotton. *J. Cotton Res. Dev.,* **9** (1): 1-6.

Wankhede, S.N., Patil, S.P., Burghate, S.K. and Chikhale, N.J. (2009). Heterosis for seed cotton yield and its quantitative characters of *G. hirsutum* L. *J. Cott. Res. Dev.*, **23** (1): 27-31.

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