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Evaluation of F₁ progenies for growth and yield of okra (*Abelmoschu esculentus* (L.) Moench)

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Abstract

The present investigation entitled "Evaluation of F₁ progenies for growth and yield of okra (*Abelmoschus esculentus* (L.) Moench)" was carried out during *kharif* season, 2016-2017, at the Instructional cum-Research-Farm, Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani. The experiment was laid out in a Complete Randomized Block Design with 8 treatments and three replications. The experiment consisted of eight different treatments viz; T₁ (Parbhani Kranti [checks]), T₂ (Pusa-A4 x Parbhani Bhendi), T₃ (Parbhani Bhendi x Phule Utkarsha), T₄ (Pusa A4 x BO-2), T₅ (BO-2 x Kashi Pragati), T₆ (Pusa-A4x Phule Utkarsha), T₇ (BO-2 x Phule Utkarsha), T₈(Hybrid No. 10 [Check]). The observation on growth attributes viz. plant height (cm), girth of stem. (cm), number of branches per plant, number of nodes per plant, inter nodal length (cm), leaf area, days to first flowering, days to 50% flowering, length of pod (cm), diameter of pod (cm), number of pods per plant, average weight of pod (g), number of seed per pod, seed yield per pod, fruit yield per plant (g), fruit yield per plot, fruit yield per hectare (q/ha), number of picking, keeping quality (shelf life), fruit borer incidence (%) and YVMV incidence (%) were recorded. Significantly maximum height of plant (104.33 cm), stem girth (3.32 cm), number of branches per plant (4.0), number of nodes per plant (15.6), inter nodal length (6.43 cm) and leaf area (492.53 cm²) were recorded by treatment T₂. The minimum days to first flowering, days to 50% flowering were recorded by treatment T₂. The maximum length of pod (cm), diameter of pod (cm), number of pods per plant, average weight of pod (g), weight of seed per fruit and seed yield were obtained in treatment T₂. Minimum incidence of pest and diseases was recorded by treatment T₂. Present investigation indicated that, the highest yield (q/ha) with good quality of okra fruit should be obtained by treatment T₂.

Keywords: Okra, growth parameter, yield attributes & pest & diseases

Introduction

The total commercial production of Okra in the world was estimated at 4.8 million tons, with India and Nigeria being the predominant producers. Other minor producers include Pakistan, Ghana, Egypt, Ethiopia, Iran, Japan and USA. Worldwide production of the Okra as a fruit vegetable is estimated at 6 million tonnes per year. In West Africa, it is estimated at 500,000 to 600,000 tonnes per year. In Nigeria, there are two distinct seasons of Okra, the peak and the lean seasons. During the lean season Okra fruits are produced in low quantities, scarce and expensive to get (Bamidele and Oke, 2003) in the peak season, it is produced in large quantities much more than what the local populace can consume. To the total production of 4.8 million ton pods of okra in the world, India contributes 70%, Nigeria 15%, Pakistan 2%, Ghana 2%, Egypt 1.7% and Iraq 1.7%. (Gulsen *et al.* 2007). To the total production of 4.8 million ton pods of okra in the world, India contributes 70%, Nigeria 15%, Pakistan 2%, Ghana 2%, Egypt 1.7% and Iraq 1.7%. (Gulsen *et al.*, 2007)

Materials and Methods

The present investigation entitled "Evaluation of F₁ progenies for growth and yield of okra (*Abelmoschus esculentus* (L.) Moench)" was undertaken at Experimental Farm, Department of Horticulture, College of Agriculture, Latur, Vasant Rao Naik Marathwada Krishi Vidyaapeeth, Parbhani with the object to evaluate F₁ progenies for growth and yield of okra and to study the correlation for different characters of F₁ progeny. The study involved six genetically diverse F₁ of okra viz. Pusa-A4 x Parbhani Bhendi, Parbhani Bhendi x Phule Utkarsha, Pusa-A4 x BO-2, BO-2 x Kashi Pragati, Pusa-A4 x Phule Utkarsha, BO-2 x Phule Utkarsha. The six F₁'s were evaluated along with two checks Parbhani Kranti and Hybrid No.10 during *kharif*-2016 in Randomized Block Design with three replications.

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The data was recorded on five randomly selected plants for the characters viz. Plant height (cm), stem girth (cm), number of branches per plant, number of nodes per plant, inter nodal length (cm), leaf area, days to first flowering, days to 50% flowering, length of pod (cm), diameter of pod (cm), number of pods per plant, average weight of pod (g), number of seed per pod, seed yield per pod, Fruit yield per plant (g), fruit yield per plot, fruit yield per hectare (q/ha), number of picking, keeping quality (shelf life), fruit borer incidence (%) and YVMV incidence (%).

Results and Discussion

Various Growth and yield attributes showed significant differences for various Okra varieties.

Growth parameters

Plant growth is measured in terms of plant height, Girth of stem, number of branches per plants, all these parameters showed significant difference among various cultivars. Plant height (cm) at harvest the data showed in Table 1 in respect of height of plant revealed that maximum height of plant was recorded in treatment T₂ (104.33) which was followed by treatment T₄ (98.07) and treatment T₆ (96.27) respectively. However T₄ was at par with T₆. The minimum height of plant was recorded in treatment T₁ (76.91) which was followed by treatment T₈ (81.86) and treatment T₇ (84.86) respectively. However treatment T₁ was at par with treatment T₈. Rest of the treatments were intermediate. Girth

of stem at harvest the data showed in Table 2 in respect of girth of stem revealed that maximum girth of stem was recorded in treatment T₂(3.32) which was followed by treatment T₄ (3.14) and treatment T₆(3.1) respectively. However T₂ was at par with T₄. The minimum girth of stem was recorded in treatment T₁ (2.86) which was followed by treatment T₇ (2.92) and treatment T₅ (2.94) respectively. However treatment T₁ was at par with treatment T₇ and T₅. Rest of the treatments were intermediate.

Anwanobong and Brisibe (2015) [3] reported that hybrid of okra LD88 was recorded maximum plant height (128 cm) while minimum in Local variety (49.75 cm). Kumar *et al.* (2015) found that okra VRO- 6 recorded maximum plant height (140.70 cm) while minimum in IHR-53 (83.27 cm).

Number of branches per plants at harvest the data showed in Table 1 in respect of number of branches per plant revealed that maximum number of branches were recorded in treatment T₂ (4.0) which was followed by treatment T₄ (3.34) and treatment T₆ (2.47) respectively. The minimum number of branches were recorded in treatment T₇ (1.33) which was followed by treatment T₁ (1.80) and treatment T₅ (2.07) respectively. However treatment T₁ was at par with treatment T₅. Rest of the treatments were intermediate. Kumar *et al.* (2015) reported that hybrids of okra IC-14600 recorded maximum number of branches (4.30) while minimum in IC-90219 (1.12). Maheshwari *et al.* (2016) reported that genotypes of okra Sonal recorded maximum number of branches (13.53) while minimum in Harita (9.87).

Table 1: Plant height (cm), stem girth (cm) and number of branches per plant of different hybrids of okra

Tr. No.	Treatment	Plant height (cm)	Stem girth(cm)	No. of branches/ plant
T ₁	Parbhani Kranti	76.91	2.86	1.8
T ₂	Pusa- A4x Parbhani Bhendi	104.33	3.32	4.0
T ₃	Parbhanni Bhendix Phule Utkarsha	94.03	2.98	2.1
T ₄	Pusa- A4 xBO-2	98.07	3.14	3.34
T ₅	BO-2X Kashi pragati	92.70	2.94	2.07
T ₆	Pusa- A4x Phule Utkarsha	96.27	3.10	2.47
T ₇	BO-2X Phule Utkarsha	84.86	2.92	1.33
T ₈	Hybrid No.-10	81.86	2.99	2.46
	SE	1.83	0.07	0.12
	CD 5%	5.56	0.21	0.38

Number of nodes per plant at harvest the data showed in Table 2 in respect of number of nodes per plant revealed that maximum number of nodes was recorded in treatment T₂ (15.6) which was followed by treatment T₆ (15.56) and treatment T₄ (15.03) respectively. However T₂ was at par with T₆ and T₄. The minimum number of nodes was recorded in treatment T₁ (11.72) which was followed by treatment T₈ (12.56) and treatment T₇ (13.53) respectively. Rest of the treatments were intermediate. Hamed *et al.* (2003) [8] found that okra genotype Balady Green recorded the maximum number of nodes per plant (11.31). Maheshwari *et al.* (2016)

reported that genotypes of okra Sonal recorded maximum number of node (15.67) while minimum in Harita (6.67).

Inter nodal length (cm) at harvest the data showed in Table 2 in respect of internode length revealed that maximum length of internode was recorded in treatment T₂ (6.43) which was followed by treatment T₄ (6.41) and treatment T₈ (6.05) respectively. However T₂ was at par with T₄. The minimum length of internode was recorded in treatment T₅ (5.23) which was followed by treatment T₃ (5.6) and treatment T₁ (5.63) respectively. However T₃ was at par with T₁. Rest of the treatments were intermediate.

Table 2: Number of nodes per plant, Inter nodal length (cm) and leaf area (cm²) of different hybrids of okra

Tr. No.	Treatment	No. of nodes/ plant	Inter nodal length	Leaf area cm ²
T ₁	Parbhani kranti	11.72	5.63	456.15
T ₂	Pusa- A4x Parbhani Bhendi	15.6	6.43	492.53
T ₃	Parbhanni Bhendix Phule Utkarsha	13.59	5.60	445.74
T ₄	Pusa- A4 xBO-2	15.03	6.41	477.05
T ₅	BO-2X Kashi pragati	13.55	5.23	461.41
T ₆	Pusa- A4x Phule Utkarsha	15.56	5.83	480.68
T ₇	BO-2X Phule Utkarsha	13.53	5.99	464.05
T ₈	Hybrid No.-10	12.56	6.05	466.34
	SE	0.20	0.06	8.89
	CD 5%	0.62	0.19	26.98

Leaf area (cm²) At harvest the data showed in Table 2 in respect of leaf area revealed that maximum leaf area was recorded in treatment T₂ (492.53) which was followed by treatment T₆ (480.68) and treatment T₄ (477.05) respectively. Tercula *et al.* (2012) found that leaf area of okra cultivar 47-7 (326.0 cm²) and local (84.0 cm²) had the highest and least leaf area observed in the present study. The result indicated that LD88 (279.0 cm²) and NGO-07 (228.0 cm²) had leaf area that were statistically at par but significantly higher than the local (84.0 cm²). Maheshwari *et al.* (2016) reported that genotype of okra Sahiba recorded maximum leaf area (245.47cm) while minimum in Harita (195.40cm).

Flowering attributes

Days to first flowering: The data presented in Table 3 in

Table 3: Days to first flowering and days to 50 per cent flowering of different hybrids of okra

Tr. No.	Treatment	Days to first flowering	Days to 50% flowering
T ₁	Parbhani kranti	46.46	45.66
T ₂	Pusa- A4x Parbhani Bhendi	43.46	41.33
T ₃	Parbhanni Bhendix Phule Utkarsha.	45.26	43.66
T ₄	Pusa- A4 xBO-2	43.93	42.33
T ₅	BO-2X Kashi pragati	45.06	43.00
T ₆	Pusa- A4x Phule Utkarsha	44.13	42.66
T ₇	BO-2X Phule Utkarsha	44.53	48.66
T ₈	Hybrid No.-10	44.46	44.33
	SE	0.45	1.29
	CD 5%	1.39	3.91

Days to 50% flowering: The data presented in Table 3 in respect of days to 50% flowering revealed that the minimum days required for 50% flowering (41.33) were recorded in the treatment T₂ and was followed by treatment T₄ (42.33) and treatment T₃ (43.66) respectively. However treatment T₂ was at par with treatment T₄, and T₃. The maximum days required for 50% flowering (48.66) were recorded in the treatment T₇ and was followed by treatment T₁ (45.66) and treatment T₈ (44.33) respectively. However treatment T₁ was at par with treatment T₈. Rest of the treatments were intermediate. Saitwal *et al.* (2011) revealed that hybrids of okra Syngenta 016 was recorded minimum number of days to 50 per cent flowering (44.33 days) while maximum in Rashami (51.13 days).

Fruit Characters:

Length of pod (cm) at harvest the data showed in Table 4 in respect of length of pod revealed that maximum length of pod was recorded in treatment T₂(13.83) which was followed by treatment T₄ (13.32) and treatment T₇ (13.00) respectively.

respect of number of days required for flowering revealed that the minimum number of days required for flowering (43.46) were recorded in the treatment T₁ and was followed by treatment T₄ (43.93) and treatment T₆ (44.13) respectively. However treatment T₂ was at par with treatment T₄, and T₆. The maximum number of days required for flowering (46.46) were recorded in the treatment T₁ and was followed by treatment T₃ (45.26) and treatment T₅ (45.06) respectively. However treatment T₁ was at par with treatment T₃. Rest of the treatments were intermediate. Saitwal *et al.* (2011) revealed that hybrids of okra Syngenta 016 recorded minimum average number of days for flower initiation (41.43).

However T₂ was at par with T₄. The minimum length of pod was recorded in treatment T₁ (10.72) which was followed by treatment T₈ (10.93) and treatment T₅ (11.93) respectively. However T₁ was at par with T₈. Rest of the treatments were intermediate. Kumar *et al.* (2015) reported that hybrids of okra IHR-128 recorded maximum fruit length (12.05 cm) while minimum in Pusa Sawani (9.04 cm).

Diameter of pod at harvest the data showed in Table 4 in respect of diameter of pod revealed that maximum diameter of pod was recorded in treatment T₂(3.33) which was followed by treatment T₆ (3.22) and treatment T₄ (2.71) respectively. However T₂ was at par with T₆. The minimum diameter of pod was recorded in treatment T₃ (2.48) which was followed by treatment T₁ (2.51) and treatment T₇ (2.54) respectively. However T₃ was at par with T₁ and T₇. Rest of the treatments were intermediate. Maheshwari *et al.* (2016) reported that genotypes of okra Sonal recorded maximum diameter of fruit (3.44 cm) while minimum in Harita (2.41cm).

Table 4: Length of pod (cm), diameter of pod (cm), number of pods per plant and average weight of pod of different hybrids okra

Tr. No.	Treatment	Length of pod (cm)	Diameter of pod (cm)	No. of pods/ plant	Average wt. of pod
T ₁	Parbhani Kranti	10.72	2.51	8.43	6.43
T ₂	Pusa-A4x Parbhani Bhendi	13.83	3.33	11.0	10.0
T ₃	Parbhanni Bhendix Phule Utkarsha	12.43	2.48	9.13	9.93
T ₄	Pusa- A4 xBO-2	13.32	2.71	10.0	9.97
T ₅	BO-2X Kashi pragati	11.93	2.66	9.30	9.13
T ₆	Pusa- A4x Phule Utkarsha	12.90	3.22	10.0	9.0
T ₇	BO-2X Phule Utkarsha	13.00	2.54	8.46	9.93
T ₈	Hybrid No.-10	10.93	2.63	9.50	7.03
	SE	0.23	0.14	0.48	0.52
	CD 5%	0.72	0.45	1.46	1.60

Number of pods per plant at harvest the data showed in Table 4 in respect of number of pod per plant revealed that maximum number of pod was recorded in treatment T₂ (11)

which was followed by treatment T₄ (10) and treatment T₆(10) respectively. However T₂ was at par with T₄ and T₆. The minimum number of pod was recorded in treatment T₁

(8.43) which was followed by treatment T₇ (8.46) and treatment T₃ (9.13) respectively. However T₁ was at par with T₇ and T₃. Rest of the treatments were intermediate.

Average weight of pod (g) at harvest the data showed in Table 4 in respect of weight of pod per plant revealed that maximum number of weight of pod was recorded in treatment T₂(10) which was followed by treatment T₄(9.97) and treatment T₃ (9.93) respectively. However T₂ was at par with T₄ and T₃. The minimum weight of pod was recorded in treatment T₁ (6.43) which was followed by treatment T₈ (7.03) and treatment T₆ (9.0) respectively. However T₁ was at par with T₈. Rest of the treatments were intermediate. Kumar *et al.* (2015) studied on evaluation of okra (*Abelmoschus esculentus*) genotypes for yield and yellow vein mosaic disease and reported that VRO-6 recorded maximum Weight of fruit (13.86 g) while minimum in Arka Abhaya (10.35 g).

Seed character

Number of seed per pod at harvest the data showed in Table 5 in respect of number of seed per pod revealed that maximum

number of seed per pod was recorded in treatment T₂(47.8) which was followed by treatment T₄ (46.8) and treatment T₆(45.4) respectively. However T₂ was at par with T₆. The minimum number of seed of pod was recorded in treatment T₁ (41.33) which was followed by treatment T₇ (41.43) and treatment T₈ (43.3) respectively. However T₁ was at par with T₇ and T₈. Rest of the treatments were intermediate. Anwanobong and Brisibe (2015) [3] reported that okra hybrids local variety recorded maximum number of seed per pod (43.50) while minimum in LD88 (33.40).

Seed yield per pod (g) at harvest the data showed in Table 5 in respect of seed yield per pod revealed that maximum number of seed yield of pod was recorded in treatment T₂(3.28) which was followed by treatment T₄ (2.94) and treatment T₆(2.90) respectively. However T₂ was at par with T₄. The minimum number of seed yield of pod was recorded in treatment T₇ (2.62) which was followed by treatment T₁ (2.62) and treatment T₈ (2.73) respectively. However T₇ was at par with T₁ and T₈. Rest of the treatments were intermediate.

Table 5: Number of seed per pod and seed yield per pod of different hybrids of okra

Tr. No.	Treatment	No. of seed /pod	Seed yield/pod (g)
T ₁	Parbhani kranti	41.33	2.62
T ₂	Pusa- A4x Parbhani Bhendi	47.80	3.28
T ₃	Parbhanni Bhendix Phule Utkarsha	44.20	2.78
T ₄	Pusa- A4 xBO-2	46.80	2.94
T ₅	BO-2X Kashi pragati	43.46	2.74
T ₆	Pusa- A4x Phule Utkarsha	45.04	2.90
T ₇	BO-2X Phule Utkarsha	41.43	2.61
T ₈	Hybrid No.-10	43.30	2.73
	SE	1.36	0.12
	CD 5%	4.15	0.37

Yield attributes

Yield per plant (kg) at harvest the data showed in Table 6 in respect of yield per plant revealed that maximum yield per plant was recorded in treatment T₂ (0.11) which was followed by treatment T₄ (0.099) and treatment T₃(0.090) respectively. However T₂ was at par with T₄ and T₃. The minimum number of yield per plant was recorded in treatment T₁ (0.054) which was followed by treatment T₈ (0.066) and treatment T₇ (0.084) respectively. Rest of the treatments were intermediate. Farook *et al.* (2002) [7] reported that okra Pusa Green was

recorded maximum yield (17.85 t/ha). It was followed by (16.67 and 16.07 t ha yield) obtained from Clemson and Penta Green.

Yield per plot (kg) at harvest the data showed in Table 6 in respect of yield per plot revealed that maximum yield per plot was recorded in treatment T₂ (3.74) which was followed by treatment T₄ (3.38) and treatment T₃(3.08) respectively. The minimum yield per plot was recorded in treatment T₁ (1.84) which was followed by treatment T₈ (2.27) and treatment T₇ (2.85) respectively. Rest of the treatments were intermediate.

Table 6: Yield per plant, yield per plot and yield per hectare of different hybrids of okra

Tr. No.	Treatment	Yield/plant (kg)	Yield /plot(kg)	Yield/ha
T ₁	Parbhani kranti	0.054	1.84	102.22
T ₂	Pusa- A4x Parbhani Bhendi	0.11	3.74	207.58
T ₃	Parbhanni Bhendix Phule Utkarsha	0.090	3.08	170.92
T ₄	Pusa- A4 xBO-2	0.099	3.38	184.06
T ₅	BO-2X Kashi pragati	0.084	2.88	159.99
T ₆	Pusa- A4x Phule Utkarsha	0.090	3.06	169.99
T ₇	BO-2X Phule Utkarsha	0.084	2.85	158.51
T ₈	Hybrid No.-10	0.066	2.27	125.92
	SE	0.02	0.07	4.94
	CD 5%	0.006	0.23	15.0

Yield per ha (q/ha) at harvest the data showed in Table 6 in respect of yield per hectare revealed that maximum yield per hectare was recorded in treatment T₂ (207.58) which was followed by treatment T₄ (184.06) and treatment T₃ (170.92) respectively. However T₄ was at par with T₃. The minimum yield per hectare was recorded in treatment T₁ (102.22) which was followed by treatment T₈ (125.92) and treatment T₇

(158.51) respectively. Rest of the treatments were intermediate.

Number of picking at harvest the data showed in Table 7 in respect of number of pickings revealed that maximum number of picking (8) were recorded in treatment T₂ which was followed by treatment T₄ (7) and treatment T₅ (7) respectively. The minimum number of pickings (5) were

recorded in treatment T₁ (5) which was followed by treatment T₃ (6) and treatment T₇ (6) respectively. However T₃ was at par with T₈ and T₇. Rest of the treatments were intermediate.

Table 7: Number of picking of different hybrids of okra

Tr. No.	Treatment	Number of picking
T ₁	Parbhani kranti	5
T ₂	Pusa- A4x Parbhani Bhendi	8
T ₃	Parbhanni Bhendix Phule Utkarsha	6
T ₄	Pusa- A4 xBO-2	7
T ₅	BO-2X Kashi pragati	7
T ₆	Pusa- A4x Phule Utkarsha	7
T ₇	BO-2X Phule Utkarsha	6
T ₈	Hybrid No.-10	7

Pest and disease incidence

Fruit borer (per cent) at harvest the data showed in Table 8 in respect of fruit borer revealed that. The minimum fruit borer of pod was recorded in treatment T₂ (16.33) which was followed by treatment T₄ (16.66%) and treatment T₃ (21%) respectively. However T₂ was at par with T₄ and maximum in treatment T₁ (26%) which was followed by treatment T₈ (22.66%) and treatment T₇ (21.37%) respectively. However T₁ was at par with T₇. Rest of the treatments were intermediate. Phad *et al.* (2009) [12] who reported per cent incidence fruit borer ranged from 18.23 -24.60.

Table 8: Per cent incidence of fruit borer and yellow vein mosaic virus of different hybrids of okra

Tr. No.	Treatment	Fruit borer (%)	YVMV (%)
T ₁	Parbhani kranti	26.0	5.44
T ₂	Pusa- A4x Parbhani Bhendi	16.33	6.45
T ₃	Parbhanni Bhendix Phule Utkarsha	21.0	9.73
T ₄	Pusa- A4 xBO-2	16.66	6.51
T ₅	BO-2X Kashi pragati	20.10	9.73
T ₆	Pusa- A4x Phule Utkarsha	20.0	6.47
T ₇	BO-2X Phule Utkarsha	21.37	13.01
T ₈	Hybrid No.-10	22.66	6.46
	SE	0.57	0.47
	CD 5%	1.74	1.43

Yellow vein mosaic virus the present investigations, the okra plants were seen to be affected with (YVMV) towards the end of the cropping season. The minimum incidence of yellow vein mosaic virus recorded in treatment T₁ (5.44) which was followed by treatment T₂ (6.45%) and T₈ (6.46%) respectively. However was at par with T₂ and T₈. The maximum incidence of yellow vein mosaic virus recorded in treatment T₇ (13.01%) which was followed by treatment T₅ (9.73%) and treatment T₃ (9.73%) respectively. However T₅ was at par with T₃. Neroshia *et al.* (2015) reported that YVM virus ranged from 10.71 to 17.86 percent.

Conclusion

From the critical evaluation of result obtained from the F₁ progenies of okra in the present investigation following conclusion may be drawn. The treatment T₂ (Pusa-A4 x Parbhani Bhendi) had shown significantly superior results in terms of growth attributes like Plant height (cm), stem girth(cm), number of branches per plant, number of nodes per plant, inter nodal length (cm), leaf area (cm²), days to first flowering, days to 50% flowering, length of pod (cm), diameter of pod (cm), number of pods per plant, average weight of pod (g), number of seeds per pod, seed yield per

pod (g), fruit yield per plant (g), fruit yield per plot, fruit yield per hectare (q/ha), number of picking, keeping quality (shelf life), fruit borer incidence (%) and YVMV incidence (%). The correlation of okra hybrids was positive and significant between yield per plant (dependable variable) with length of fruit, average weight of pod, stem girth, number of fruits per plant, number of branches, leaf area and diameter of pod.

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