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Morphological response of polyembryonic mango rootstocks (*Mangifera indica* L.) to different salt levels

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Abstract
A pot culture experiment was carried out to screen the ten polyembryonic mango rootstocks *viz*., Muvandan, Manipur, Peach, Prior, Mylepelian, Nekkare, Vattan, Chandrakaran, Sundarimanga and Kolambe against salinity by irrigating with saline water (Control, 50, 100 and 150 mM NaCl). Irrespective of different polyembryonic mango rootstocks, plant height showed decrement with increase in salt levels. At 150 mM NaCl, the least per cent reduction in plant height was recorded by Nekkare (26.79%) and the higher per cent reduction in was observed in Chandrakaran (64.36%) and Sundarimanga (63.91%) rootstocks. High dose of NaCl resulted in more pronounced reduction in the other parameters such as stem girth, number of leaves and leaf area per plant than low dose of NaCl treatment, indicating the detrimental effect of NaCl on plant biomass and physiological performance of the rootstocks. In view of the above mentioned parameters, it is concluded that Nekkare rootstocks perform better as compared with other rootstocks under different salinity treatments imposed.

Keywords: Polyembryonic mango rootstocks, salt levels, plant height, stem girth, number of leaves, leaf area

Introduction
Mango (*Mangifera indica* L.) is one of the most important fruit crops grown in India under both tropical and sub-tropical conditions. Mango is categorized as salt sensitive crop, which is not able to survive with soil EC more than 1 dsm^{-1} (Gupta and Sen, 2003) [4]. But in India, nearly 67.44 lakh hectares of land are identified as salt affected soils (Anon., 2018) [2]. The salt affected areas are predominantly found in states such as Gujarat, Uttar Pradesh, West Bengal, Rajasthan, Maharashtra, Odisha, Andhra Pradesh, Karnataka and Tamil Nadu which holds the largest belt of mango cultivation. Thus, to step up the mango production in the salt affected areas, it would be appropriate to develop salt-tolerant mango rootstocks instead of soil reclamation process (Dubey *et al*., 2006) [3]. The polyembryonic rootstocks are known to inherit genetic uniformity as of mother plant. Clonal multiplication of a desirable rootstock is not a possibility way as on date and in such a scenario, these polyembryonic mango rootstocks will help to achieve uniformity in growth rate and other aspects (abiotic and biotic stress conditions) by rootstocks. Although many workers have studied the effect of salinity on mango, very little efforts have been made to identify rootstocks tolerant salinity. In this backdrop, investigation on morphological response of ten polyembryonic mango rootstocks to different salt levels was done to find out tolerant rootstocks.

Materials and Methods
The pot culture experiment was conducted with four levels of NaCl, *i.e.*, 0 mM NaCl (control), 50 mM NaCl, 100 mM NaCl and 150 mM NaCl on ten different polyembryonic mango rootstocks *viz*., Muvandan, Manipur, Peach, Prior, Mylepelian, Nekkare, Vattan, Chandrakaran, Sundarimanga and Kolambe at Tamil Nadu Agricultural University, Coimbatore during 2018-2019. The experiment was conducted under completely randomized design with three replications. Plants were screened for salt stress under semiprotected condition upto three months. Fully matured polyembryonic mango stones were extracted from healthy mango fruits that were collected from various research institutes and utilized for raising the seedlings. Stones were washed and cleaned to remove the adhering pulp and dipped in water for flotation test. Floated stones were discarded and only sunken stones were used as seed material. The nucellar mango seedlings were transplanted from raised nursery beds and planted in polybags of size 40 cm X 24 cm X 24 cm. The bags were filled with 10 kg potting

mixture containing sand, soil and FYM in the ratio of 1:2:1. Bags were provided with punched drain holes at the bottom for drainage. The control plants were watered with pure water without any added NaCl (EC = 0.5 dSm^{-1} and pH- 6.9). The salinity treatments were imposed for about 90 days at periodic intervals based on the availability of moisture content in the soil.

The morphological characters were recorded after the end of salinity treatments. The plant height was measured from the ground level up to point of emergence of youngest leaf on the stem and expressed in cm. The stem girth was measured at 15 cm above the ground level and expressed in cm. The number of photosynthetically active leaves was counted at 90th day after initiation of treatment and recorded as number. Leaf Area Meter (LICOR, 3000) is used for estimating leaf area and expressed in cm^2. The data were analysed using the STAR package (Statistical Tools for Agricultural Research developed by IRRI, Philliphines) to calculate the significant differences among the treatments. The data shown are the average of three replications and were statistically significant at the p = 0.05 level.

Results and discussion

Plant height was significantly affected by increase in the salinity levels. During the experimental period, control plants grew continuously, while the height of salt treated plants decreased significantly at 50, 100 and 150 mM NaCl after 90 days (Table 1). Comparing the performance of ten polyembryonic mango rootstocks, Nekkare was found to show the higher plant height whereas Chandrakaran and Sundarimanga rootstocks showed the least plant height at all the three different salt levels. The reduction in plant height may be toxic effect of the salt, alteration in the nutritional level within the plants and also reduction in the uptake of major nutrients (Munns and Tester, 2008) [6]. There was significant differences in stem girth among the mango rootstocks at all salt concentrations (Table 2). At higher salt level (150 mM NaCl), the minimum reduction in stem girth of about 12.96% was recorded in Mylepelian rootstocks as compared with control. The higher percent of stem girth reduction per cent was recorded in Sundarimanga rootstocks (41.74%) which was on par with Chandrakaran rootstocks (40.69%) as compared with its respective control. The occurrence of damage in the middle lamella under salinity stress might have lead to reduction in stem girth. The findings of this study are in line with the research conducted by Dubey *et al*. (2006) [3] and Roy *et al*. (2014) [9] in mango. Salt stress possessed significant variation with respect to number of leaves per plant in all the mango rootstocks (Fig. 1). The higher number of leaves per plant was recorded in Nekkare rootstocks (16.15, 14.43, 10.23) at all the three salt levels (50, 100 and 150 mM NaCl) respectively. The lowest number of leaves per plant was recorded in the Sundarimanga and Chandrakaran rootstocks at all the salt levels. The higher percent reduction, as compared with control was recorded in the Sundarimanga (69.46 %) and Chandrakaran (67.77 %) rootstocks at 150 mM NaCl treatment. Sensitive cultivars accumulate ions quickly than tolerant cultivars and this ion accumulation leads to death of leaf and finally the death of whole plant. In sensitive cultivars, leaf defoliation was more pronounced due to salinization than in tolerant ones. The study by Nimbolker *et al*. (2018) [7] reported that leaf number decreased after imposition of salinity stress in polyembryonic mango genotypes. Among rootstocks, the higher leaf area per plant was observed in Nekkare (68.27 cm^2) which was statistically on par with Muvandan (67.58 cm^2) and Manipur (66.42 cm^2) and the lowest leaf area per plant was recorded in Sundarimanga (33.19 cm^2) (Fig. 2). The lower leaf area that was recorded with higher salt concentrations might be due to the reduced development and differentiation of tissues, shrinkage of cell contents, unbalanced nutrition, damage of membrane and disturbed 'avoidance mechanism' (Akram *et al*., 2007) [1]. Similar observations were made by Pandey e*t al*. (2014) [8] in mango and Khayyat e*t al*. (2014) [5] in pomegranate respectively. Finally, it is concluded that, among the ten studied rootstocks, Nekkare performed better regarding the morphological parameters that were influenced by salt stress conditions.

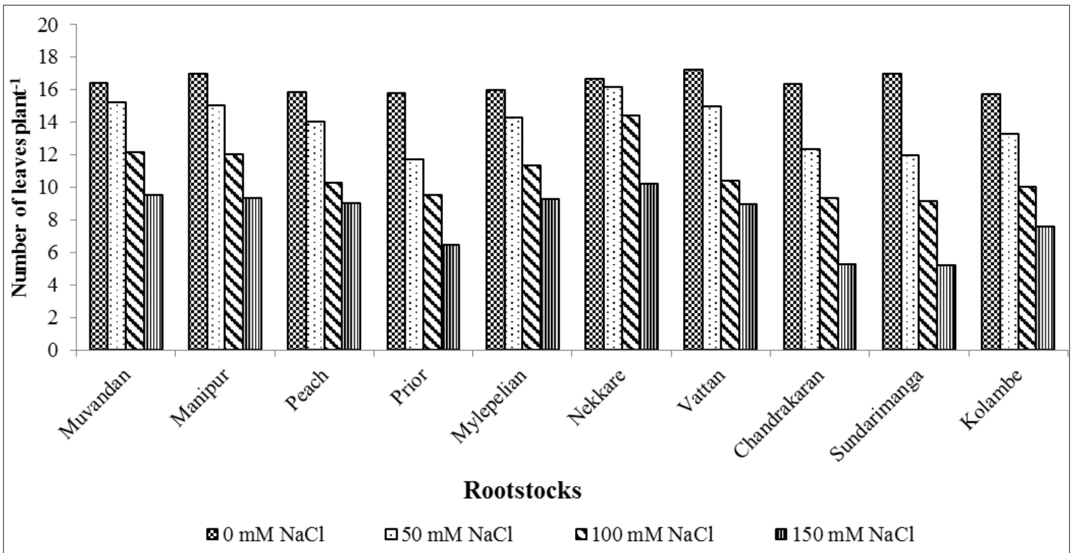

Fig 1: Effect of salt stress on number of leaves $plant^{-1}$ of polyembryonic mango rootstocks

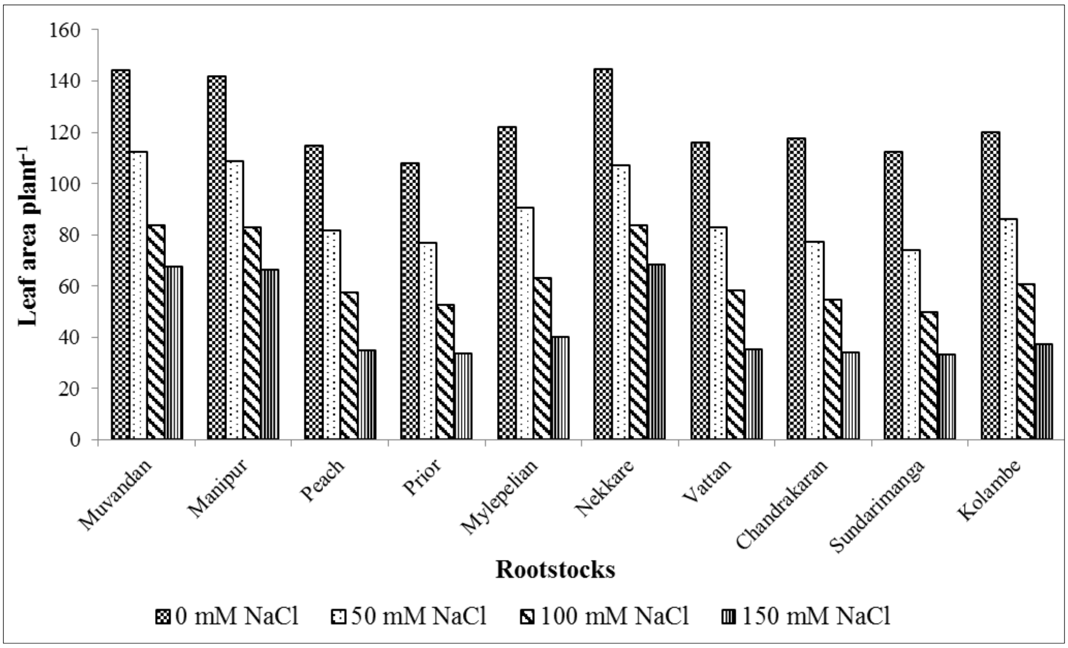

Fig 2: Effect of salt stress on leaf area plant^{-1}of polyembryonic mango rootstocks

Table 1: Effect of salt stress on plant height (cm) of polyembryonic mango rootstocks

	Plant height (cm)						
Salt levels Rootstocks	**Control**	**50 mM NaCl**	**Per cent decrease***	**100 mM NaCl**	**Per cent decrease***	**150 mM NaCl**	**Per cent decrease***
Muvandan	51.25	47.17	7.96	38.41	25.05	31.25	39.02
Manipur	51.52	47.25	8.29	37.25	27.70	30.73	40.35
Peach	50.45	45.01	10.78	34.22	32.17	27.21	46.07
Prior	50.22	42.95	14.48	31.05	38.17	20.05	60.08
Mylepelian	50.15	45.05	10.17	36.87	26.48	28.25	43.67
Nekkare	52.25	48.94	6.33	43.25	17.22	38.25	26.79
Vattan	50.54	42.75	15.41	33.21	34.29	25.37	49.80
Chandrakaran	51.43	41.21	19.87	27.92	45.71	18.33	64.36
Sundarimanga	51.95	42.06	19.04	28.45	45.24	18.75	63.91
Kolambe	50.38	44.25	12.17	32.68	35.13	22.57	55.20
Mean	51.01	44.66	12.45	34.33	32.72	26.08	48.93
S.Ed	-	0.994	0.552	0.752	1.601	0.562	1.961
C.D(p=0.05)	NS	2.074	1.108	1.569	3.204	1.172	3.880

* - per cent decrease compared with control
NS – Non-significant

Table 2: Effect of salt stress on stem girth (mm) of polyembryonic mango rootstocks

	Stem girth (mm)						
Salt levels Rootstocks	**Control**	**50 mM NaCl**	**Per cent decrease***	**100 mM NaCl**	**Per cent decrease***	**150 mM NaCl**	**Per cent decrease***
Muvandan	14.24	14.01	1.62	13.24	7.02	11.13	21.84
Manipur	14.42	13.91	3.54	13.32	7.63	11.15	22.68
Peach	13.96	13.23	5.23	12.16	12.89	9.25	33.74
Prior	14.75	13.31	9.76	12.48	15.39	10.23	30.64
Mylepelian	13.73	13.14	4.30	12.23	10.92	11.95	12.96
Nekkare	14.51	14.22	2.00	13.59	6.34	11.02	24.05
Vattan	13.57	12.97	4.42	11.23	17.24	9.15	32.57
Chandrakaran	14.01	13.18	5.92	11.91	14.99	8.31	40.69
Sundarimanga	14.23	13.26	6.82	12.02	15.53	8.29	41.74
Kolambe	13.95	13.10	6.09	12.32	11.68	10.05	27.96
Mean	14.14	13.43	4.97	12.45	11.96	10.05	28.89
S.Ed	-	0.29	0.27	0.27	0.23	0.19	0.81
C.D(p=0.05)	NS	0.62	0.56	0.56	0.51	0.38	1.64

* - per cent decrease compared with control
NS – Non-significant

References

1. Akram M, Malik MA, Ashraf MY, Saleem MF, Hussain M. Competitive seedling growth and K^+/Na^+ ratio in different maize (*Zea mays* L.) hybrids under salinity stress. Pakistan J. Bot. 2007; 39:2553-63.
2. Anonymous, 2018. http://www.cssri.org/index.php. option+com _content&view+article&id=122.
3. Dubey AK, M Srivastav, R Singh, RN Pandey, PS Deshmukh. Response of mango (*Mangifera indica* L.)

genotypes to graded levels of salt stress. Indian J. Agric Sci. 2006; 76:670-672.
4. Gupta NK, NL Sen. Studies on initial establishment of mango seedling in saline environment. South Indian Hort. 2003; 51:106-109.
5. Khayyat M, A Tehranifar, GH Davarynejad, MH Sayyari-Zahan. Vegetative growth, compatible solute accumulation, ion partitioning and chlorophyll fluorescence of 'Malas-e-Saveh' and 'Shishe-Kab' pomegranates in response to salinity stress. Photosynthetica. 2014; 52(2):301-312.
6. Munns R, M Tester. Mechanisms of salinity tolerance. Annu. Rev. Plant Biol. 2008; 59:651-681.
7. Nimbolkar PK, RM Kurian, KK Upreti, RH Laxman, LR Varalakshmi. Seed germination and seedling growth responses of polyembryonic mango (*Mangifera indica* L.) genotypes to salinity stress. Intl. J. Chem. Stud. 2018; 6(2):3641-3648.
8. Pandey P, AK Singh, AK Dubey, OP Aswathi. Effect of salinity stress on growth and nutrient uptake in polyembryonic mango rootstocks. Indian J. Hort. 2014; 71(1):28-34.
9. Roy RK, M Robbani, M Ali, SK Bhowal, ANM Erfan. Variations in salinity tolerance of selected mango rootstocks. Bangladesh Agron. J. 2014; 17(1):89-94.