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Selection of Some Mango Seedling Trees Tolerant to Salinity Growing under Aswan Conditions

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ABSTRACT

This study was carried out during two successive seasons (2011 and 2012) at Aswan governorate. Irrigation source was ground water. This study aimed to select some mango seedling trees which were naturally tolerant to saline soils, irrigated by ground water for 20 years in an experiment conducted in Aswan governorate during seasons 2011 and 2012. Soil sample (loamy sand) was collected from successive depth (0-60cm) to study the effect of ground water on growing of selected seedling mango trees and Sukkary cultivar.Results revealed that electrical conductivity of ground water (3.2 ds/m) was significantly higher and consequently led to increase soil salinity. On the other hand, the second part aimed to using ISSR analysis to assess the genetic similarity among the selected mango seedlings and Sukkary cultivar (standard tolerant to salinity). Some fruit physical and chemical properties were studied in the selected seedling mango trees. Results indicated that tree No. 1 was the highest fruit contents of total sugars, TSS, soluble protein, vitamin C as well as fruit length and thickness. Seedling tree No. 3 was the highest yield, fruit weight, pulp weight, fruit reducing sugar, leaves total sugar, K+, Ca++, Mg++, Na+, Cl-, and Abscisic acid. Sukkary cultivar was the highest concentrations of leaves nitrogen and phosphorus.

Genomic DNA was subjected to PCR with the primers HB-09, HB-11, HB-12, HB-14 and HB-15. Forty three polymorphic loci were identified, approximately 100% polymorphism. The strongest relation was scored between seedling mango trees No. 2 and No. 3 reaching similarity of 100% while, Sukkary and tree No. 1 (similarity of 90%). The polymorphism revealed by ISSR markers differed towards three selected mango trees as well as Sukkary cultivar and primers used which means that genetic variability has been detected.

Key words: Mango Seedling trees, tolerant, saline soils

Introduction

Mango is the most important fruit crop all over the world, especially in tropical and subtropical regions. Mango is very sensitive to soil salinity at younger stage. Under conditions of arid and semi-arid regions like Egypt, limited supply of suitable water is considered a major problem restricted agriculture development in desert areas. In Egypt, where tree roots are frequently exposed to high water table, questionable irrigation, practices or saline water (Hassan and Abu El-Azayem, 1990).

Therefore the use of poor quality water is of particular importance. The salt affected soils have higher amount of chlorides and sulfates of the calcium, magnesium and sodium. Once deposited or released in the soil, these salts are brought to or near the surface by upward moving water, which evaporates, leaving the salt behind.

Unfortunately, high levels of these salts cannot be tolerated by most of the crop plants, a fact that severely limits the use of salt affected soils. When the soil solutions containing a relatively large amount of dissolved salts and brought into contact with a plant cell, the cell then collapses (Dubey *et al.,* 2007). The plant species, the kind of salt and the rate of solinization are major factors that determine the concentration at which cell succumbs (Dubey *et al.,* 2007), under the situation of salinity, plant growth is suppressed when the salt concentration exceeds threshold value growth rate and size of the plant progressively decrease with increases salinity, constituents of salts accumulate in toxic amount in leaves of mango, which in term inhibit growth causes leaf injury, nutrients imbalance and reduce uptake of major nutrients. Plant height and leaf area are drastically reduced due to salinity. Mango generally accumulates 2.5 to 3.0 times more than guava (Dubey *et al.,* 2007). This creates bearing problem and thus results reduction in fruit yield.

Salinity enhanced the production of proline (Nahed *et al.,* 2006 and Omaima *et al.,* 2011). As well as Abscisic acid increased proportionally with salinity level, the increments in leaf ABA reaches to (62. 91 and 67.16%) in 1st and 2nd year, respectively with concentration 5000 ppm compared with tap water (Haggag *et al.,* 1994). At different salinity levels, chlorophyll A, B and total chlorophyll contents were decreased sharply in all genotypes with increasing soil salinity (Dubey *et al.,* 2006). Some polyembryonic varieties are found to be

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tolerant to salinity, differences among roots tocks in response to salinity exist with fruit species and these differences are important when selecting plants adapted to this condition (Hassan and Catlin , 1984).

Therefore, the objective of this study is to select some mango seedling trees which were tolerant to saline soils as well as Sukkary seedling tree as a control (Sukkary root stock proved to be more appropriate root stock for use in salt regions, Omaima *et al.,* 2011). Molecular markers that are associated with important traits can be used as a selection tool.

So, ISSR – PCR – analysis was conducted to identify the selected mango seedling trees and assess the genetic similarity among the three selected mango seedlings and sukkary cultivar.

Materials and Methods

The present investigation was conducted during two successive seasons 2011 and 2012 on mango seedling trees grow in an orchard located at Ban Ban, Aswan governorate. Twenty years old seedling mango trees as well as tree of Sukkary cultivar (tolerant salinity) were irrigated by ground water (2048 ppm) concentration of soluble salts in an experiment conducted in Aswan governorate during 2011 and 2012. The texture of the investigated soil was loamy sand with water table depth not less than two maters. Three seedling mango trees as well as sukkary seedling tree were selected as uniform in vigour. All experimental trees received the same management applied for the orchard. Four compsite soil samples (0.0 – 60 cm depth) from the investigated orchard were collected and analyzed for some physical and chemical properties according to the standard methods described by wilde *et al.* (1979), as well as characteristics of irrigation water used in the experiment. The obtained results are shown in tables 1 and 2.

Table 1: Physical and chemical analysis of the investigated orchard soil depth (0-60cm).

Particle size distribution %				Micronutrition (ppm)			
Sand	Silt	Clay	Texture	Mn	Zn	Cu	Fe
79.58	8.51	11.68	Loamy Sand	10.80	2.0	0.21	5
Soluble cations (mg/l)				PH (1: 25)	E.C (1: 2.5)	$CaCO_3$ %	OM %
K^+	Na^+	Mg^{++}	Ca^{++}				
0.0	1.97	106.0	20.80	8.2	9.35	4.20	1.33
Soluble Aninos (mg/L)				Macronutrition (ppm)			
So_4	CL	HCo_3	Co_3	N	P	K	
55.37	91.0	1.60	0.0	50.0	16	752	

Table 2: Chemical composition of ground water sample:

Soluble Aninos (mg/L)				Soluble cations (mg/l)				PH	E.C ds/m	Adjusted S.A.R	Conc. of total soluble salts
So4	CL	HCo3	Co3	K^+	Na^+	Mg^{++}	Ca^{++}				
7.61	300	3.80	0.0	0.5	15.84	6.60	12.04	8.2	3.20	17.47	2048

EC = Electrical conductivity. PH = Acidity algorithm, dslm = descisiemen/meter in 5.1 units. (equivalent to m mho/cm = 1millim mols/centimeter).
Mg/L = Milligram per liter = parts per million (ppm). Ca^{++} =Calcium Mg^{++} =Magnesium Na^+ =Sodium K^+ =Potassium $Co3^{--}$ =Carbonate $HCO3^-$ =Bicarbonate Cl^- =Chloride $SO4^{--}$ =Sulphate.

In both 2011 and 2012 seasons , the chosen seedling mango trees were evaluated , i. e. the physical and chemical characters of fruits , each of chosen seedling mango trees was represented by sample of 10 fruits as taken from each tree (3 panicles for each replicate). The following points were investigated:
1. Yield: at harvest time, yield of each tree was calculated as number and weight of fruits (g).

Fruit properties:

Physical characteristics: the physical characteristics included fruit weight (g), pulp weight (g), fruit length (cm), fruit diameter (cm) and fruit thickness (cm) by using vernier colliper.

Chemical characteristics:

Total soluble solids (TSS) percentage was determined by using a digital refractometer (Abbe – Leica).Total acidity (g/100ml) as (g/100g f. wt.) citric acid was determined by titrating the diluted pulp with 0.1 N NaOH using phenolphythalin as an indicator as gram of citric acid per 100 grams fruit pulp , was determined according to A. O. A. C (1990). The percentage of total, reducing and non-reducing sugars, in fresh juice were analyzed according to the method of Lane and Eynon out lined in A.O.A.C (1990). Vitamine "c" content was

determined in fresh juice as milligrams of ascorbic acid per 100g juice using 2,6 dichlorophenol indophenols according to A.O.A.C (1990). Protein percentage: to determine soluble protein, tissue powder samples (20 mg for each) were boiled in 10 ml distilled water for two hours. After cooling the water extract was centrifuged and the supernatant was completed to a define volume by distilled water, then the soluble proteins were determined according to Lowry *et al.* (1951).

Leaf minerals determination:

According to Chapman (1960) leaf samples were collected in early October by picking the third leaf of the base from the shoot. Leaves were wet digested and analyzed for N, P, K, Ca and Mg according to the method obtained by Chapman and Pratt (1961). Sodium was determined by flame photometer. Chloride was extracted from the ashed samples with hot water and titrated with standard silver nitrate (A. O. A. C, 1965).
Proline determination: was measured using sulphoric acid (3% V/V), ninhydrin (1.25g), and absorbance noted at 520 nm, methods described by Bates *et al.* (1973).

Measurement of ABA content :According to Wepp and Wareing (1972), B- inhibitor complex contains abscisic acid (ABA) was determined by the lettuce seed germination bio-assy. Fifty lettuce seeds variety (Romaine) were added to 6cm wide, shallow petri dishes containing the segment of the chromatograms (Zones at RF 0.6 – 0.8) of different samples to be tested. This was moistened with 2.0ml of distilled water. The seeds were germinated under continuous light at about 25ºC. Germination percent was recorded after 48hr .The endogenous inhibitors as affected by different treatments were expressed as germination percent of lettuce seeds. Determination of chlorophyls a and b: the amounts of chlorophylls a and b were determined spectrophotometerically described (Metzner *et al.* 1965). Total soluble sugars determination: total soluble sugars were extracted with 80% V/V ethanol from dry and ground leaves for determination according to the method described by Dubois *et al*. (1951).

ISSR- PCR analysis: ISSR- PCR reactions were conducted according to Williams *et al.* (1990) and Yang and Quiros (1993) using five primers. Amplification was conducted in 25 µl reaction volume containing the following reagents 2.5 µl of d DNT. PS (2.5 µ mol), 2.5 ml Hg Cl_2 (2.5 µ mol) and 2.5 µl of 10x buffer, 3.0 ml of primer (10 pmol), 3.0 of template DNA (25 µg/ml), 1 ml of RNA polymerase (1mg / ml) and 12.5 µl of steriled H_2O. The PCRs were programmed for one cycle at 94 C for 4 min followed by 45 cycles each of 1 min at 94 °C, 1 min at 51 °C, and 2 min at 72 °C, the reaction was finally stored at 72°C for 10 min. The PCR products were separated on a 1.5% agarose gel and fragments sizes were estimated with the 100 bp ladder DNA marker (ferments) with sequence of 1000, 900, 800, 700, 600, 500, 400, 300, 200 and 100 bp.

Statistical analysis:

A randomized complete block design was adopted for the present investigation; data were statistically analyzed by the standard methods according to Snedecor and Chochran (1980). The new L.S.D test was used for comparison between means. The DNA bands generated by each primer were counted and their molecular sizes were compared with those of the DNA markers. The bands scored from DNA profiles generated by each primer were pooled together. Then the presence or absence of each DNA band was treated as a binary character in a data matrix (coded 1 and 0, respectively) to calculate genetic similarity and to construct dendrogram tree among the studied three selected mango seedling trees, beside Sukkary cultivar (tolerante to salinity). Calculation was achieved using Dice similarity coefficient (Dice, 1945) as implemented in the computer program SPP-10.

Results and Discussions

Soil analysis:

According to the results obtained in table (1) the surface layet and subsurface texture and structure were classified as loamy sand. This is an indication that the suspended matter and the sediment materials of the ground water has affected the textural components. Data in table (1) showed the effect of ground water application on the PH of the studied soil sample was found to be very high (8.2) soils tending to be high in sodium chloride. Table (1) represents the electric conductivity (Ec) value of the investigation soil. Ones, as shown from (Ec) value which was 9.35ds/m , using ground water for irrigation increases the (Ec) Value in the soil . The data also , revealed that Na^{+} is the dominant cation followed by Mg^{++} and Ca^{++} . The use of ground water for irrigation can increase the soluble salts concentration in the soil especially chlorides salts concentration in the soil especially chlorides AlKilan *et al.* (1997)

Water analysis:

As shown in table (2) the ground water had as slightly high (PH) level, and so it would be interesting to apply a corrector acid to avoid manganese and calcium precipitation (Pitts,1996).Salinity problems appear when the electric conductivity(EC) of the irrigation ground water is higher than 1.5 ds/m, and the ground water fail to fulfill all the necessary requirements for their use. The highest observed level of electrical conductivity in our trials was primarily due to the high concentration of chlorides in ground water. Results, also, showed that chloride was dominated in the ground water. Results also showed that chloride was dominated in the ground water followed by sulfate. Data showed that the descending order of cations presence in ground water was Na^{++} > Ca^{++} > Mg^{++} > K+.

Effect of increasing salinity on yield / tree:

From the data in table (3) which illustrated yield / tree of the selected seedling mango trees as well as Sukkary cultivar, it was found that tree No.3 had the highest value 394.26 and 356.84 kg /tree in both seasons among the selected mango seedling trees and Sukkary cultivar. These results are in harmony with Naglaa (2010) and Abo-Rekab *et al.,* (2014) who evaluated some seedling mango trees and their yield /tree.

Effect of increasing salinity on fruit physical characteristics:-

Data in table (3) and fig (1) illustrated physical characteristics of the three selected seedling mango trees as well as Sukkary cultivar (control). Highly significant differences were noted among mango fruits in fruit weight. Fruit weight of tree No. 3 recorded the highest values reached 579.8 and 637.2 g in the first and the second seasons, respectively compared with the others selected fruits and the control.

Regarding pulp weight, data in table (3) showed highly significant differences and fruits of tree No.3 had the highest values (519.5 and 580.2g in the first and the second seasons, respectively).

Significant differences in fruit diameter were also noted among selected mango fruits and Sukkary cultivar as shown in table (3). Maximum fruit diameter was recorded in fruits of tree No. 3 (10.61 and 10.97 cm in both seasons, respectively).

Significant differences in fruit thickness were noticed among mango fruits in table (3).

Maximum fruit thickness (9.97 and 10.27 cm) in the first and the second seasons, respectively) were recorded in fruits of tree control. Data in table (3) showed significant differences among mango selected fruits in fruit length, whereas, fruits of tree No. 1 obtained the highest fruit length in both seasons of study (18.87 and 18.97 cm, respectively).

Table 3: Yield per tree and fruit physical characters of the selected mango trees as well as Sukkary cultivar during 2011 and 2012 seasons.

Treatments	Yield / tree Kg/tree		Fruit weight (g)		Pulp weight (g)		Fruit length (cm)		Fruit diameter (cm)		Fruit Thickness	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 1	Season 2	Season 2	Season 1	Season 2	Season 1	Season 2
Control	106.59	99.40	193.80	198.80	158.50	163.30	8.83	9.53	9.82	10.13	9.97	10.27
T1	189.41	180.88	291.40	323.00	241.60	272.80	18.87	18.97	6.72	7.00	4.97	5.43
T2	293.27	264.17	465.50	489.20	411.00	432.60	15.78	16.13	10.37	10.87	8.40	8.70
T3	394.26	356.84	619.50	680.20	579.80	637.20	17.03	17.90	10.61	10.97	8.90	9.23
L.S.D.(0.05)			56.30	50.70	55.10	47.90	0.66	0.44	0.12	0.27	0.27	0.21

Effect of increasing salinity, which due to use ground water (2048 ppm) on fruit chemical characteristics:

Data in table (4) illustrated chemical characteristics of the selected seedling mango and Sukkary cultivar. Significant differences were noticed among mango selected fruits and Sukkary cultivar in TSS percentage, the highest TSS percentage was detected in fruits of tree No.1 in both seasons of study (23 and 25.4%, respectively). The lowest total acidity percentage was recorded in fruits of tree No.1 comparing with the other selected seedling mango fruits and Sukkary cultivar.

It is clear from table (4) that total sugars percentage of tree No.1 fruits was the highest values (14.43 and 15.67% in the first and the second seasons, respectively) as well as non-reducing sugar percentage in the tree No.1 fruits which obtained the highest values (10.15 and 10.70 % in both seasons, respectively), while the tree No.3 fruits recorded the highest values in reducing sugar percentage in both seasons of study (4.68 and 5.36%, respectively). The same trend was detected in vitamin C content. The highest values in both seasons of study were recorded in fruits of tree No.1 (51 and 54 mg, respectively). Data in table (4) showed that the highest percentage of soluble protein was recorded in fruits of tree No.1 (1.27 and 1.33 % in both seasons, respectively) comparing with the other selected seedling mango and Sukkary cultivar.

All the previous results goes in the line with the previous findings of Zaied *et al.* (2007), Jilani *et al.* (2010) and Naglaa (2010) and Abo-Rekab *et al.* (2014) who evaluated some seedling mango fruits characteristics.

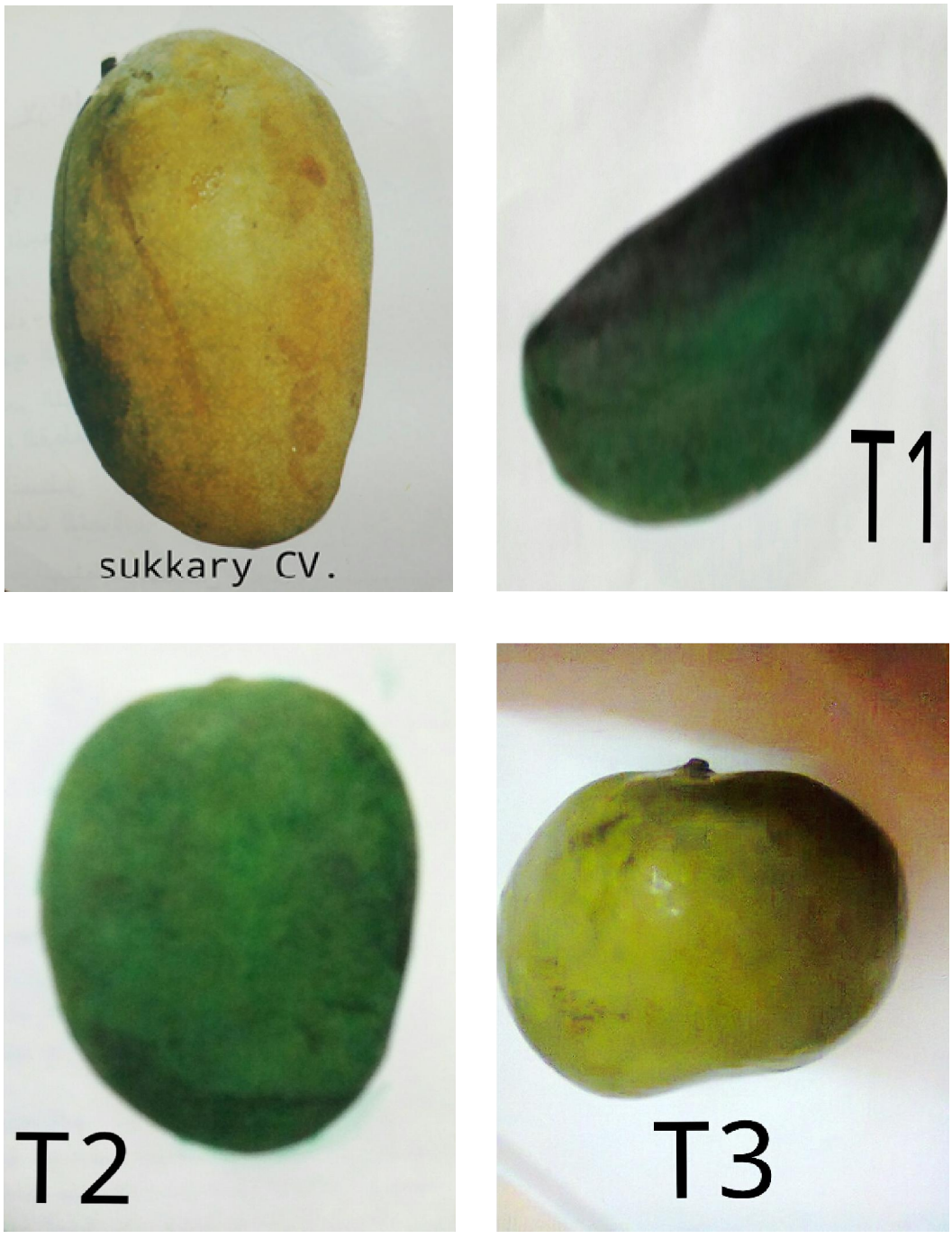

Fig.1: The fruits of the selected seedlings mango and Sukkary CV.

Effect of increasing salinity, which due to use ground water(2048ppm) on leaf chemical composition:-

Results in table (5) showed that chlorophyll a and b contents in leaves significantly decreased with increasing salts concentrations. The highest contents of such plant pigments were detected in leaves of tree No. 2 followed in descending order by those of Sukkary cultivar, tree No. 1 and tree No. 3 . Results also showed that total sugar content in leaves of seedling mango trees significantly tended to decrease with increasing salts. Table (5) illustrated that total sugar content in leaves of mango seedling trees and Sukkary cultivar significantly tended to decrease with increasing salts concentrations. The highest content of total sugars was found in leaves of tree No. 3 followed by that in tree No. 2. Results in table (5) also showed that the amino acid proline content in leaves of mango seedlings and Sukkary cultivar significantly increased, in general, with increasing salt concentrations. The highest was found in leaves of tree No. 2 followed by that detected in leaves of tree No. 3, while Sukkary cultivar leaves tended to exhibit the lowest proline content. The obtained results in table (5) revealed that nitrogen content in leaves of seedling mango trees and Sukkary cultivar on dry weight basis, appeared to be significantly decreased with increasing salt concentrations. Sukkary cultivar was the highest in nitrogen content comparing with those of seedling mango trees. Results of table (5) showed significantly decreases in phosphorus contentfor leaves with increasing salt concentrations.

On the other hand leaves of Sukkary cultivar exhibited the highest phosphorus content comparing with those of seedling mango trees. All results previous goes in the line with the previous findings of Abd El-Karim, 1994, Nahed *et al.,* 2006 and Omaima *et al.,* 2011.

Table 4: Effect of increasing salinity on fruit chemical characters of the selected mango trees as well as Sukkary cultivar during 2011 and 2012 seasons.

Treatments	T.S.S. % f.wt.		Total Acidity g/100g f.wt.		Total Soluble Sugers % f.wt.		Rducing Suger % f.wt.	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 1	Season 1	Season 2
Control	21.03	22.77	0.31	0.35	12.07	12.55	3.00	2.95
T1	23.00	25.40	0.19	0.25	14.43	15.67	4.29	4.87
T2	22.47	24.20	0.29	0.30	12.77	13.20	4.62	5.21
T3	21.57	23.50	0.36	0.42	12.33	12.73	4.68	5.36
L.S.D 0.05)	1.19	1.33	0.01	0.02	0.67	0.52	0.71	0.53
Treatment	Non-Rducing Suger % f.wt.		Vitamin C mg/100mg f.wt		Proteine % d.wt.			
	Season 1	Season 2	Season 2	Season 2	Season 1	Season 2		
Control	9.07	9.60	25.33	27.00	0.93	1.00		
T1	10.15	10.79	51.00	54.00	1.27	1.33		
T2	8.15	7.99	28.67	30.00	1.13	1.25		
T3	7.66	7.38	30.67	32.33	1.23	1.27		
L.S.D 0.05)	0.61	0.74	1.47	1.91	0.08	0.09		

Table 5: Effect of increasing salinity on the concentrations of leaf chlorophylls a and b, total soluble sugars, proline, leaf nitrogen and phosphorus of the selected seedling mango trees and Sukkary cultivar during 2011 and 2012 seasons.

Treatments	Chlorophyll a mg/g F.wt.		Chlorophyll b mg/g F.wt.		Total soluble sugars g/100g d.wt.		Proline %		Nitrogen %		Phosphorus %	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	1.213	1.248	1.111	1.136	1.21	1.33	0.444	0.497	1.950	2.066	0.293	0.316
T1	1.066	1.103	0.851	0.919	3.94	4.19	0.683	0.781	1.700	1.749	0.193	0.215
T2	1.085	1.134	0.969	0.995	3.99	4.30	0.807	0.905	1.594	1.628	0.219	0.241
T3	0.901	0.918	0.744	0.785	6.54	7.03	0.853	0.925	1.410	1.448	0.245	0.255
L.S.D (0.05)	0.012	0.014	0.008	0.005	0.23	0.16	0.045	0.022	0.025	0.061	0.010	0.008

The obtained results in table (6) indicated that K content in the leaves of mango seedlings as well as sukkary cultivar significantly decreased with increasing salts concentration in irrigation water. Seedling tree No. 3 appeared to have the highest K level followed by of seedling tree No. 1, while Sukkary cultivar had the lowest level. Results in table (6) showed that Ca^{+2} level in the leaves of mango seedling as well as Sukkary cultivar significantly increased proportionally to the highly salt concentrations. In this regard, tree No. 3 have the highest calcium and magnesium levels, while Sukkary cultivar had the lowest calcium & magnesium levels .

Results in table (6) indicated that increasing salts concentration in the irrigation water significantly increased both Na^+ and Cl^- contents in leaves of seedling mango as well as sukkary cultivar. Seedling of tree No. 3 appeared to have the highest levels of both Na^+ and Cl^- followed by tree No. 2 in decreasing order, while sukkary cultivar was of the lowest levels of Na^+ and Cl^-.

Results in table (6) also showed that abscisic acid(endogenous inhibitor) significantly increased proportionally with increasing salt concentrations in the irrigation water, the increments in leaf abscisic reached 55 and 57% in the first and the second seasons, respectively (as germination percent of lettuce seeds) with tree No. 3 which have the highest level of abscisic acid, while Sukkary cultivar had the lowest level of abscisic acid in the first and the second seasons 20.97 and 24.37%,respectively(as germination percent of lettuce seeds). These results are in harmony with Daie *et al.* (1979) and Haggag *et al.* (1994) who mentioned that high abscisic

acid contents measured under stress may be due to rapid synthesis in the leaves or to transport from roots. All previous results goes in the line with the previous findings of Abd El-Karim, 1991, Nahed *et al.,* 2006 and Omaima *et al.,* 2011

Table 6:Effect of increasing salinity on leaf minerals (K+, Ca++, Mg++, Cl-,and Na+) and absicic acid concentrations of the selected seedling mango trees and Sukkary cultivar during 2011 and 2012 seasons**.**

Treatments	K %		Ca %		Mg %		Cl %		Na %		A.B.A. % (germination percentage of lettuce seeds)	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	0.607	0.640	0.526	0.546	0.891	0.937	0.192	0.218	0.214	0.318	20.97	24.37
T1	1.257	1.289	1.843	1.933	1.130	1.327	1.964	1.984	1.238	1.506	31.97	32.20
T2	1.171	1.187	1.957	1.986	1.253	1.437	2.448	2.570	1.718	1.789	49.77	55.07
T3	1.314	1.337	2.026	2.147	1.550	1.650	3.204	2.359	1.775	1.818	55.00	57.00
L.S.D .05	0.015	0.009	0.055	0.043	0.052	0.080	0.013	0.011	0.054	0.061	2.61	2.48

ISSR – DNA analysis:

DNA analysis by using five ISSR primers (HB-09,HB HB12, HB_{14} and HB15) for the similarities among the three selected seedlings mango tolerant to salinity, i.e. (T1, T2 and T3) and the standard tolerant salinity Sukkary cultivar as shown in figure (2).The results revealed that ISSR of mango DNA using the five selected primers generated a total of 43 polymorphic loci with approximately 100% polymorphism (tables 7 and 8). The dendrogram tree and the similarity indices among the three selected mango tolerant salinity and sukkary cultivar (standard salinity tolerant) utilizing ISSR markers presented in table (9) and fig (3), using dice computer package, the strongest relation was scored between seedling mango tree No.2 and tree No.3 (similarity of 100%), while the relation between sukkary and tree No.1 was recorded 90% on the other hand the relation similarity between sukkary cv and tree No.2 was recorded 83%. On the other hand the dendrogram resulting from the unweighted pair-group arithmetic (UPGMA) cluster analysis indicated that the three selected mango seedling tolerant salinity and Sukkary cultivar (standard tolerant salinity) could be divided into two clusters from the same node. The first cluster divided into two subclusters, the first sub cluster contains tree No.1 and the second subculster contains sukkary cultivar while, the second cluster contains tree No.2 as shown in fig (3). Similar levels of polymorphism were found in the previous findings of Faleiro *et al.* (2009), and Souza *et al.,* (2011). The number and percentage of polymorphism in ISSR fragments depend on the number and variability of the cultivars and accessions analyzed also, are in harmony with Abo Rekab (2013).

Table 7: Primers sequences, names, polymorphic, monomorphic bands and polymorphism percent detect of ISSR analysis in three selected mango and Sukkary cv.

Primer name	Amplified bands (10ci)	Monomorphic bands	Polymorphic bands	Polymorphic %
HB-09	7	2	5	71.43
HB-11	11	5	6	54.55
HB-12	10	4	6	60.00
HB-14	10	4	6	60.00
HB-15	5	3	2	40.00
Total	43	18	25	

Table 8: ISSR analysis (total bands, polymorphic bands, monomorphic bands, unique bands and monomorphic percent.

Analysis	Total bands	Polymorphic bands	Monomorphic bands	Unique bands	Monomorphic %
ISSR	43	25	18	17	58.14

Table 9: Genetics similariy matrices among the three selected mango seedlings tolerant to salinity as well as sukkary cv. accessions as computer according to Dice coefficient from ISSR.

	Sukkary Cv.	1	2
1	0.90		
2	0.83	0.76	
3	0.03	0.00	1.00

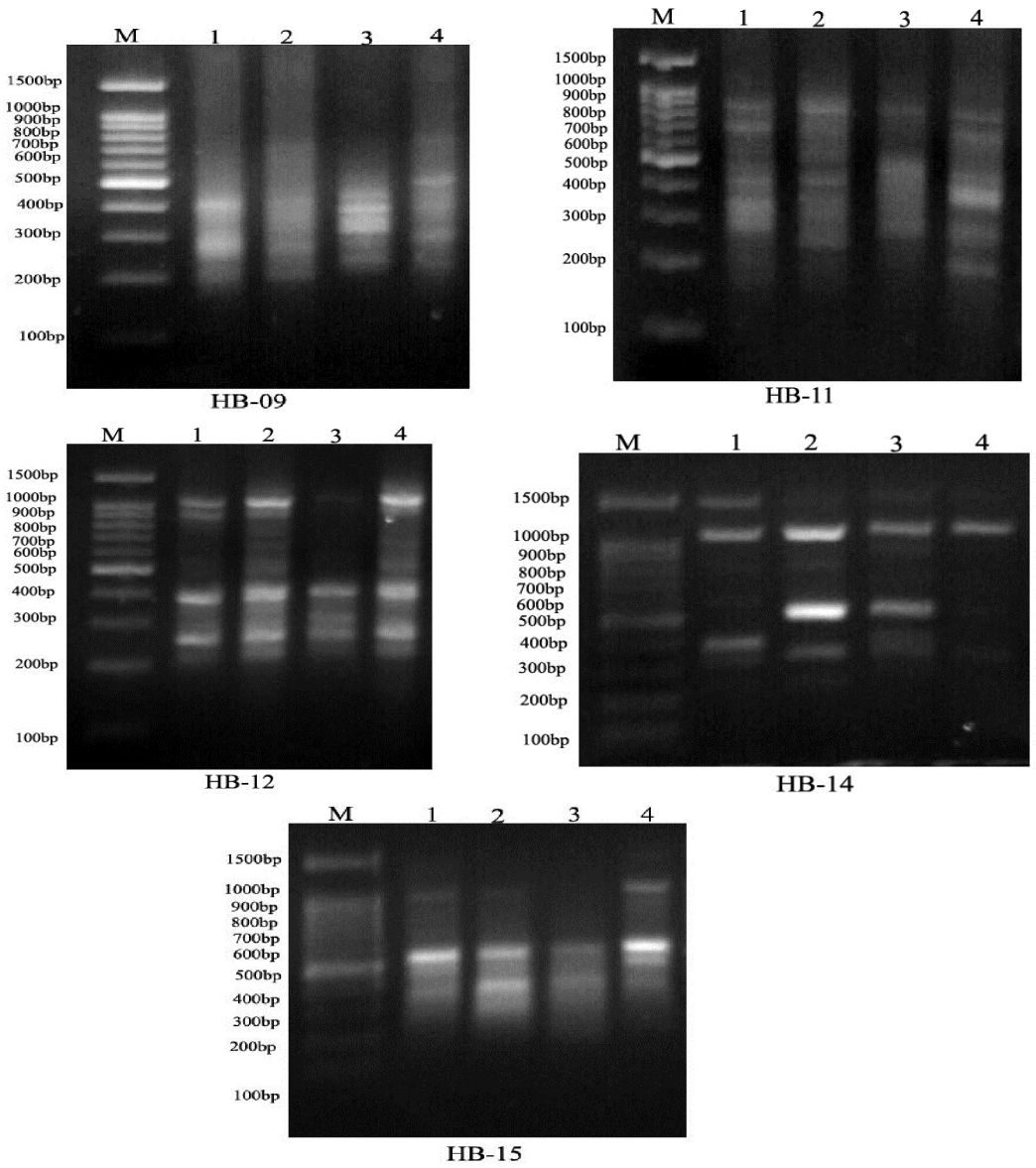

Fig. 2: ISSR products generated with primers HB-9, HB-11, HB-12, HB-14 and HB-15 of the selected seedling as well as Sukkary cultivar

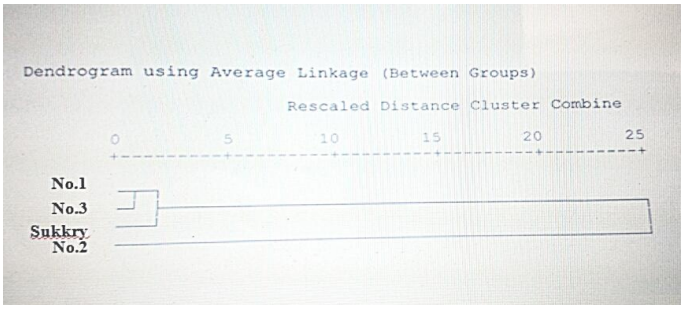

Fig. 3: Dendrogram for the three selected mango seedlings tolerant salinity as well as Sukkary cv. standard (salinity tolerant) accession constructed from the ISSR data using unweighed pair – group arithmetic (UPGMA) and similarity matrices computed according to Dice coefficient.

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