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GRAFT TRANSMISSION, CULTIVAR REACTIONS, IMPLEMENTING CULTURAL AND CHEMICAL CONTROL OF MANGO MALFORMATION DISEASE IN EGYPT

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ABSTRACT

Grafting malformed scions on healthy rootstocks of Succhari, Ewaise and Zebda cultivars recorded 80%, 72.2% and 64.7% disease transmission, respectively. In the same time, grafting healthy scions of the three tested cultivars on healthy transplant as control showed no disease transmission and all grafting transplants forming healthy growth for three years to present. Grafting healthy scions of Succhari cultivar beside apical malformation disease recorded 25 % disease transmission. On the contrary, grafting healthy scions of Zebda (resistant cultivar) beside apical malformation or in the same place after removing malformation recorded no disease transmission and all grafted transplants formed healthy growth to present. The obtained results indicate that grafting resistant healthy material is necessary to avoid disease transmission. However, grafting malformed scions of susceptible cultivar on healthy rootstocks of susceptible or resistant cultivars proved that the disease could be transmitted through grafting materials. On the other hand, sixteen mango cultivars were evaluated for the level of the panicle malformation disease intensity. Diseases intensity varied significantly among the evaluated mango cultivars. Mango cultivars have been categorized as resistant or susceptible according to their performance against the malformation disease under field conditions .Out of tested cultivars, Tymour, Company and Seddick were found to be susceptible, however, Fagr kelan and Zebda showed resistance to malformation. Unfortunately, the obtained results indicated that non of the cultivars are completely resistant to malformation.

The information generated from this study is useful to quantify and examine the level of susceptibility of mango cultivars to malformation and to provide bases for designing combinations among various cultivars for strategies leading to increase planting of mango tolerant strains. Effect of pruning malformed panicles on disease incidence indicates that pruning malformed panicles with 25-30cm away of healthy stem had a clear effect on decreasing the percentage of malformation. The three fungicides Octave, Tachigaren and Topsin –M showed a significant effect on controlling mango malformation of vegetative mango transplant ,naturally infected after removing the malformation .The obtained results indicate that the disease can be controlled by use of resistant cultivars, removal of diseased parts and spraying trees with selective fungicides *i.e.* Octave or Topsin –M.The results of the present studies will be helpful to minimize the losses inflicted by mango malformation.

Keywords: Grafting, disease transmission, scions, resistant, tolerant, malformation, disease intensity.

INTRODUCTION

Mango malformation is a serious disease of *Mangifera indica* L. causing severe economic losses every year in mango-growing areas of the world. Currently, the disease has spread where mangoes are grown and causes the most severe damage in Egypt Ploetz *et al.*, 2002.Generally; malformed inflorescences produce no fruit, or abort at early stages and is

directly responsible for reduction in yield. *Fusarium mangiferae* has now been confirmed to cause mango malformation in different countries of the world and Koch's postulates have been completed successfully with this fungus in various countries (Abdel – Sattar , 1973, Ploetz and Gregory , 1993, Freeman, *et al*.,1999, Ploetz, *et al*., 2002 and Abdel –Sattar, *et al*., 2006) . The extent of infection varies from cultivar tocultivar. Likewise, a concerted effort in limiting spread of the pathogen among small farmers in Egypt has begun but further research is required to continue this progress. The mode of natural spread of the disease is still obscure. The disease moves slowly in infected orchards and till now the dissemination of the pathogen in nurseries and orchards is not well understood. Malformation may be moved to new cultivated areas in infected nursery plants. This is probably the primary mechanism for long distance spread of the disease. In Egypt, Kishtah, *et al*., 1983 reported that malformed symptoms could not be induced on healthy mango seedling by grafting. They also reported that the disease was not transmitted by seeds and seedlings grown from seeds collected from malformed trees which were healthy when planted in the greenhouse for 2 years .However, Kumar,*et al.,* (1993)stated that malformation is spread by grafting, which is a common means by which the disease is moved to new areas. Unfortunately, presently there is no detailed information in the country, for ranking of mango cultivars for tolerance to floral malformation. The present study had three objectives: (i) to evaluate the disease transmission via grafting materials under Egyptian conditions, (ii) to determine reactions of mango cultivars to infect with mango malformation and (iii) implement cultural and chemical control means of mango malformation.

MATERIALS AND METHODS

Study locations and plant source:

The present study was carried out from the beginning of 2010 to end of 2012 growing seasons. Grafting experiment was started on April, 2010 and followed up till 2012. Malformation disease survey experiment for symptoms detection was conducted on April, May and June of 2011and 2012 in four major producing areas in Egypt at governorates of Ismailia, Sharkia, Giza and Fayoum.

Mango susceptible cultivars (Ewaise and Succhari) and the resistant cultivar (Zebda) for vegetative and floral malformation disease in Egypt were used in the grafting experiment green house during April, 2010 for disease transmission demonstration. A total of 150 malformation free mango transplants of two years old from disease free nursery at Ismailia were used in this experiment. A total of 100 infected mango transplants were collected from different commercial nurseries at Sharkia Governorate were kept at isolated greenhouse to be used as source of infected scions.

1-Grafting experiment for malformation symptom transmission :

Soft wood grafting method was followed according to Kulwal and Tayde (1989) and Gandhoke (1993) because this technique is easy to use and is effective in dry, hot weather. Veneer grafting method was also

followed according to Ram and Bist (1982).Malformation disease transmission experiment was designed to include the following treatments:

1) Scions from malformed branches grafted on susceptible healthy transplants
2) Scions from malformed branches grafted on resistant rootstocks healthy transplants
3) Scions from malformed-free branches grafted on susceptible healthy transplants
4) Scions from malformed-free branches grafted on resistant rootstocks healthy transplants
5) Scions from malformed-free branches grafted beside apical malformed branch or in the same place after removing malformation.
6) Scions from malformed-free branches grafted on healthy transplants of each susceptible cvs. (Ewaise and Succhari) and resistant cv. (Zebda) to serve as control treatments. Each treatment was replicated 15 times on transplants with grafted scions. The grafted transplants were maintained in screening greenhouse and received normal practices of irrigation and nutrition followed in commercial mango transplants nurseries. During the period from April 2010 to April, 2012 the grafted transplants were screened for malformation symptoms. Data collected at the end of experiment as average percentages of transplants with transmitted malformation symptoms and transplants with non-transmitted malformation symptoms were recorded.

2- Survey and cultivar reactions to malformation in mango orchards:

A survey of mango malformation in four governorates: Ismailia, Sharkia , Giza and Fayoum was carried out during April, May and June 2011 and continued during April, May and June 2012for assessment and ranking of malformed panicles in mango trees. The bearing trees (12-15 years old) of 16 diverse cultivars of both indigenous and exotic cvs namely, Company, Tymour, Mabrouka, Seddiek, Alphonso, Kiett, Tommy Atkins , Dabsha, Succhari, Bullock,s Heart, Hindi Sinnara, Ewaise, Hindi-Meloky, Golic, Fagr – Kelan and Zebda were surveyed. Orchards soil was sandy loam, lightly compact, with 0.5% organic matter approximately and pH around 8.00. The trees spaced at 6 m between rows and plants were 5 to 8 m high depending upon the genotype. A sampler woody frame of size (2m×1m) was used on the four sides (North, West, South and East) on the middle height of the canopy of a tree. The total number of healthy and malformed panicles in the frame was counted and averaged. For each of the cultivars, four replicates were maintained. The characteristics of malformed panicles growth are explained according to Ishfaq, *et al*., (2008) as follow:

a- Compact = the panicle is much stunted; the peduncle is thick and short with secondary branches crowded closely on it.
b- Heavy Compact = Panicles are very compact due to crowding of flowers; the head sometimes looks like cauliflower.
c- Medium Compact = Panicles are slightly less compact.
d- Loose compact = the panicles are larger in size but open in shape.

e- Light compactness = Panicles are difficult to distinguish from normal ones at a later stage during development; they can be recognized by their compactness.

The percentages of malformed panicles in different mango cultivars were determined in each location during the two years 2011 and 2012 and the mean average was recorded.

3- Implementing cultural control of mango during 2011 and 2012:

A survey of mango malformation in three locations (Al-Ferdan, Al-Manayef and El-Kantarh districts) during 2011 and repeated in the same orchards during 2012 in Ismailia Governorate was carried out. Pruning malformed panicles in each orchard was carried out by eliminating the diseased parts with 25-30cm away of healthy stem to study the effect of pruning malformed panicles on disease occurrence.

Another set in each orchard (10 trees) was left without pruning as a control. These experiments started on med of March of 2011 and repeated med March 2012 in the same places and the final results were recorded during September 2011 and 2012 after fruit harvest and the mean of the two years was recorded. A Sampler woody frame of size (2m×1m) was used as mentioned above. The percentages of malformed panicles in 4 replicates of different mango cultivars were counted and averaged for each location during 2011 and 2012. Data for the two years were pooled and analyzed using a completely randomized design.

4- Chemical control:

(a) **- On malformed seedlings (2011):**

Octave 50WP at 2g / Liter, Tachigaren 40WS at one ml/Liter and Topsin-M70 WP at one g/liter were sprayed on naturally infected transplants after removing the apical and lateral malformation with 15-20 cm of the healthy stem tissues. Fifty transplants for each treatment were sprayed every 15 days started first of October 2011for ten times at Faculty of Agriculture Farm, Suez Canal Univ., Ismailia Governorate. Control treatment was performed using fifty transplants sprayed with sterilized water every 15 days.

(b)- On established trees

Pre-treatment data on randomly selected trees (8 replications for each treatment) were recorded by counting total number of vegetative and floral malformation on each tree before spraying with each of the three tested fungicides under study to record the increase over the previous count. Spraying with the previous fungicides (Octave, Tachigaren and Topsin-M) on the disease occurrence of malformed panicles in infected orchard was carried out during 2012. Mango trees were sprayed with low pressure sprayer at 15-days intervals started mid of September 2012 after harvesting of mango fruits, at Faculty of Agriculture Farm, Suez Canal Univ., Ismailia Governorate, in a complete randomized block design with 8 replications for each treatment. In control treatment, trees were sprayed only with sterilized water at 15 days intervals. The percentages of malformed panicles were counted and averaged for each treatment as mentioned above.

Statistical analysis:

The obtained data were statistically analyzed by analysis of variance (ANOVA) using the fisher LSD method. Means were separated by fisher's

protected least significant differences (LSD) at P 0.05 level (Gomez and Gomez, 1984).

RESULTS AND DISCUSSIONS

1- Transfection via grafting:

Data presented in Table (1) indicate that grafting malformed scions on healthy rootstocks of Succhari showed 12 malformed nursery transplants which represent 80% of disease transmission while 3 nursery plants showed healthy growth till three years. The corresponding figure for grafting malformed scions on healthy Ewaise rootstocks reached 72.2% of disease transmission. However, grafting healthy scion of Succhari (susceptible cultivar) on malformed rootstocks showed malformed growth on two transplants which represent 11% of disease transmission while 16 nursery plants showed healthy growth till three years. In the same time, grafting healthy scions of the same cultivar beside apical malformation disease recorded 25 % disease transmission. On the other hand, grafting malformed scions on healthy Zebda rootstocks (tolerant cultivar) recorded malformed growth on 11 transplants which represent 64.7% of disease transmission while 6 nursery plants showed healthy growth till now. On the contrary, grafting healthy scions of Zebda (resistant cultivar) beside apical malformation or in the same place after removing malformation recorded no disease transmission and all grafting transplants forming healthy growth to present. In the same time, grafting healthy scions of the three tested cultivars on healthy seedling as control showed no disease transmission and all grafting transplants forming healthy growth to present.

Table (1):Transmission via grafting, two years after grafting (April 2010 to April 2012) to present.

Type of grafting	Total No. of grafted seedling	No. of malformed seedling	No. of healthy seedling	% of transmission via grafting
1-Infected scions on highly susceptible healthy Succhari rootstocks	15	12	3	80
2-Infected scions on highly susceptible healthy Ewaise rootstocks	18	13	5	72.2
3–Infected scions on tolerant Zebda rootstocks	17	11	6	64.7
4– Healthy Succhari scions on malformed nursery seedling	18	2	16	11
5– Grafting healthy Zebda scions beside apicale malformation	17	0.0	17	0.0
6– Grafting healthy Succhari scions beside apical malformation	16	4	12	25
7–Grafting healthy Zebda scions on malformed transplants after removing malformation	15	0.0	15	0.0
8–Grafting healthy scions on healthy rootstock of the three cultivars as control.	18	0.0	18	0.0

The obtained results indicate that the spread of malformation transmitted by grafting infected bud wood, which is a common means by which the disease can moved to new areas. Epidemiological studies on the malformation of mango are limited; it is very difficult to understand the spread and transmission of malformation disease. In Egypt, non-grafted seedlings used for production are commonly cultivated directly beneath mature trees bearing malformed tissues Ploetz *et al*., (2002).Malformation may be moved to new cultivated areas in infected nursery plants. This is probably the primary mechanism for long distance spread of the disease. These results are in agreement with those reported by Kumar *et al* ., (1993) who stated that malformation was spread by grafting, which is a common means by which the disease can move to new areas (that is only the available reference to present). On the contrary, these results are not in agreement with those reported by Kishtah *et al*., (1983) in Egypt as they reported that malformed symptoms could not be induced on healthy mango seedling by grafting. They also reported that the disease was not transmitted by seeds and seedlings grown from seeds collected from malformed trees which were healthy when planted in the greenhouse for 2 years. Therefore, it could be recommended from this investigation that mango malformation disease could be transmitted through grafting materials. Also, grafting resistant healthy material are necessary to avoid disease transmission. However, grafting malformed scions of susceptible cultivar on healthy rootstocks of susceptible or resistant cultivars proved that the disease could transmitted through grafting materials. So, new plantations should be established with pathogen-free nursery stock. Scion materials should never be taken from an affected orchard. Affected plants that are observed in the nursery should be removed and destroyed. Nurseries should also not be established in orchards, especially which may be affected by malformation.

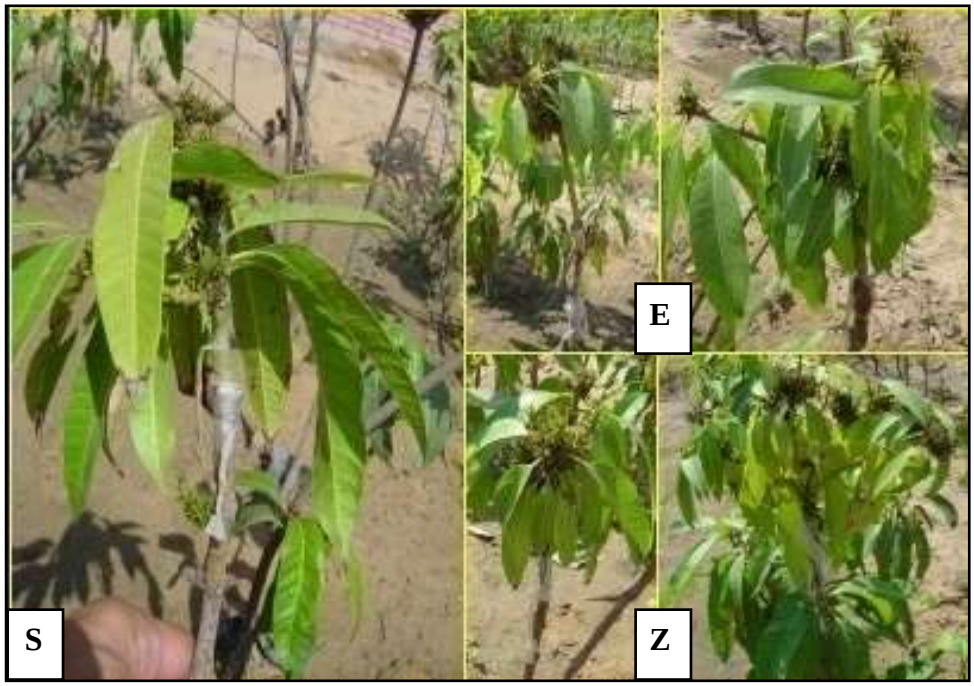

Fig.(1):Soft wood grafted malformed scions on healthy rootstocks of Succhari, Ewaise and Zebda cultivars showing vegetative malformation , two years after grafting to present.

Fig. (2):Soft wood grafting healthy scions on malformed seedlings, two years after grafting to present.

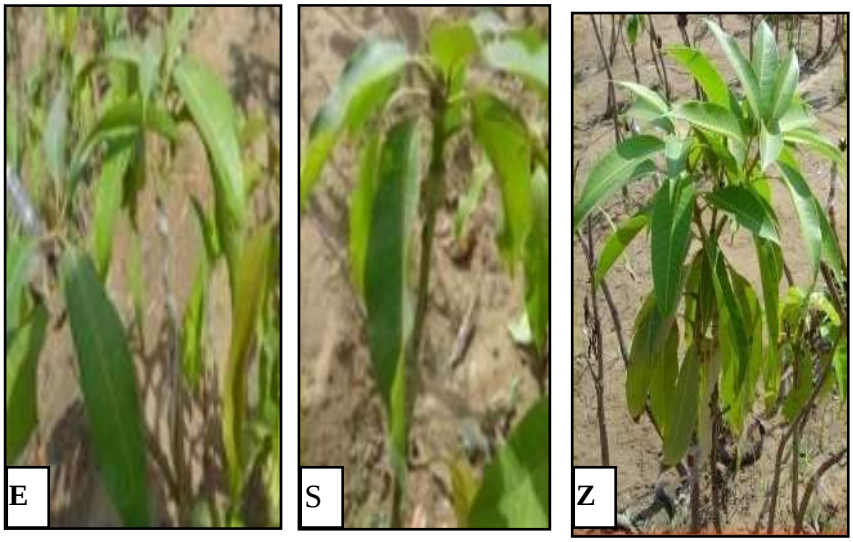

Fig. (3):Soft wood grafting healthy scions of Ewaise(E) ,succhari(S) and Zebda(Z) on healthy succhari seedlings (control).

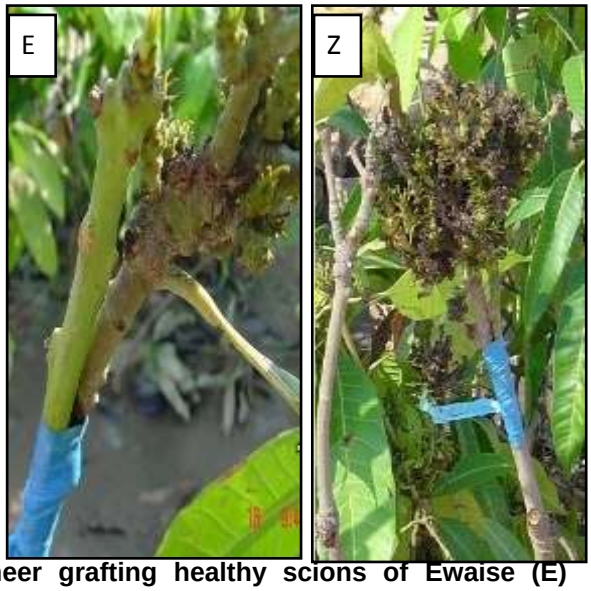

Fig.(4):Veneer grafting healthy scions of Ewaise (E) and Zebda(Z) beside malformed seedling .

2 - Relative susceptibility of Egyptian mango cultivars to malformation disease intensity (two years 2011 &2012):

Sixteen mango cultivars were evaluated for the level of the panicle malformation disease intensity. The intensity varied significantly among the evaluated mango cultivars of tested cultivar ,four were susceptible, four were moderately susceptible, four were susceptible tolerant , one was moderately tolerant , one was tolerant, one was resistant, while one was highly resistant to malformation.

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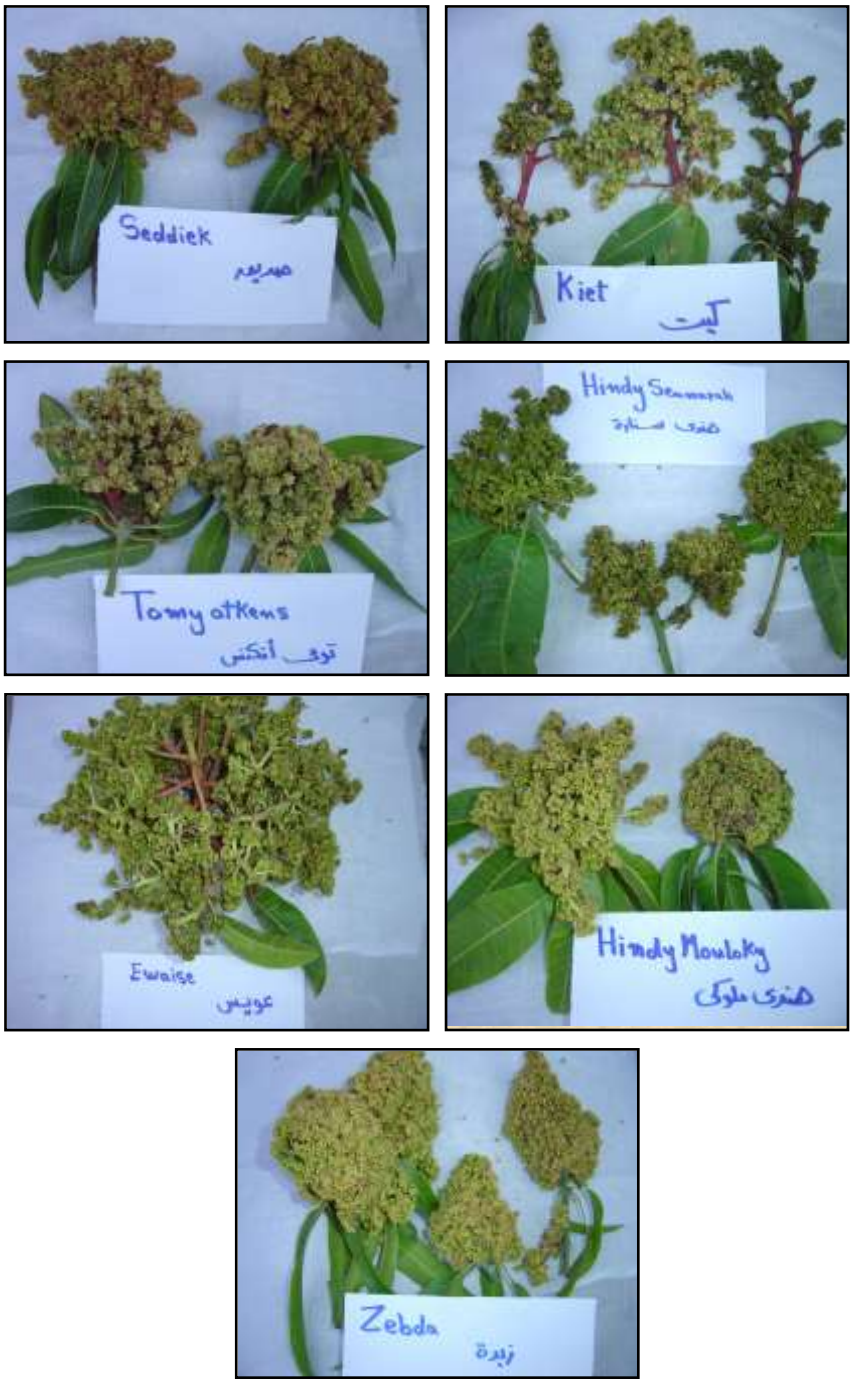

Fig.(5):Different types of malformations on some susceptible, moderately and resistant mango cultivars.

Unfortunately, the obtained results indicated that none of the tested cultivars was completely resistant to malformation. Presently there is no detailed information in Egypt, for ranking of mango cultivars for tolerance to floral malformation disease. Data presented in Table 2 indicate that all the cultivars clearly differed in intensities of malformation and have been ranked. It was noted that there was highest malformation frequency in Tymour (65.21%), which produced medium compact type of inflorescence. The cultivar Company thus proved to be the most susceptible cultivar for mango malformation (58.12%) among all cultivars. The incidence of malformation was also high in Saddiek (54.54%) another local selection, which also produced compact type of inflorescence with reddish color, followed by Mabrouka(52.86 %).The growers of the highly susceptible cultivars should be very careful and regular in carrying out the control measures. Dabsha,Alphonso,Keitt, and Tommy Atken were found to be moderately susceptible cultivars, which showed medium level of malformation i.e.,33.78,33.44, 33.27and 31.69%, respectively. Succhari, Bullock,s Heart , Hindi-Sinnara , and Ewaise were found moderately tolerant . The average intensity of malformed inflorescences in the case of above cultivars falls between23.76 to29.59 %. The malformation susceptibility was lowest in Hindi-Meloky (10.1%) andGolic (7.13%).However, the other cultivars Figri kelan (4.71 %) and Zebda (2.35%) fall into the category of resistant cultivars for the attack of mango malformation.The obtained results differs from those reported by Haggag, Wafaa *et al*.,(2010). They reported that the maximum infection of traditional cultivars in Egypt was observed in Hindi Sennara, Alfonso, Timour and Zebda .However, the exotic Tomy , Keit and Kent cultivars appeared to be moderate susceptible. Abdel- Sattar, *et al*., (2006) reported that the disease was found in all inspected mango orchards in Lower Egypt, while the survey of mango malformation in Middle Egypt revealed the presence of vegetative malformation only in Assuit Governorate .However, inflorescent malformation in all inspected orchards in Middle Egypt was absent. They also reported that all inspected orchards in Upper Egypt (Quena , Luxor and Aswan Governorates) proved that Upper Egypt are free from both vegetative and inflorescent malformation .

This variation in the disease intensity among cultivars in Delta might be attributable to the interaction of the host genotype to the pathogen. The malformation incidence is influenced by several factors like tree growth habit (time of flushing), physiology, rate of transpiration and cellular structure. Kumar *et al.* (1993) reported that early-emerging flower buds were severely infected; whereas later buds escaped from the disease; this difference was empirically attributed to the relatively high temperature during panicle development. The shape and structure of the panicles differed markedly among the varieties depending upon the cellular structure and physiology under environmental factors Chakrabarti *et al.,* (1990). Similarly malformed inflorescences of different cultivars were variable in respect of their shapes, sizes, growth and compactness. Our goal in this research was to quantify and examine the level of susceptibility of mango cultivars to malformation.

The information generated from this study is useful to quantify and examine the level of susceptibility of mango cultivars to malformation and to provide bases for designing combinations among various cultivars for strategies leading to increase planting of mango strains tolerant to this disease. It is important to indicate that the disease screening under natural conditions often yielded conflicting results. Therefore, disease resistant capacity needs to be confirmed by artificial inoculation of the host plants. The development of improved inoculation techniques seems to make the task easier.

3-Cultural control

Pruning malformed panicles was carried out by eliminating the diseased parts with 25-30cm away of healthy stem to study the effect of pruning malformed panicles on disease occurrence, compared with those left without pruning as controls. Experiments were begun in 2011 and continued till 2012. Disease incidence results were recorded during September 2012 after fruit harvest.

Table (3): Effect of pruning malformed panicles on disease incidence in 3 heavily infected orchards in three locations in Ismailia Governorate during 2012.

Treatment	El-Ferdan		El-Manayef		El-Kantarah		Mean	
	Malformed /inspected	%	Malformed /inspected	%	Malformed /inspected	%	Malformed /inspected	%
Pruning panicle	9/55	16.4%	10/55	18.2 %	8/55	14.5%	9/55.	16.4%
Without pruning (Control)	34/54	62.9%	30/55	54.5%	32/55	58.2%	32/54	58.5%

Results indicate that pruning malformed panicles with 25-30cm away of healthy stem had a clear effect on decreasing the percentage of malformation. This trend was observed at the 3 locations as the percentage of malformation reached16.4, 18.2and 14.5% for El-Ferdan, El-Manayef and El-Kantaraah, respectively, while the corresponding values in the non-pruned, control treatment reached 62.9, 54.5 and 58.2%, respectively. In the same time, the lowest percentage of malformed panicle was recorded on pruned malformed panicles in treated orchards at El-Kantarh district, however, the highest percentage of mango malformation was observed in orchards without pruning (Control) at El-Ferdan district. The results of the present studies will be helpful to minimize the losses inflicted by mango malformation. These results are in agreement with those of Zafar *et al.,* (2011), who reported that clipping at 45 cm distance followed by spray of benomyl showed the best results giving 70.37 % decrease over previous years count. However, Noriega-Cantu *et al.,* (1999) stated that integrated management consisting of pruning, acaricide, and fungicide sprays, resulted

in slower rates of epidemic development , lower levels of initial and final disease, and lesser areas under the disease progress curves.

4-Chemical Control

A- On malformed seedlings (2011):

Octave at 2g / Liter, Tachigaren at one ml/Liter and Topsin-M at one g/liter were sprayed on naturally infected seedlings after removing the apical and lateral malformation with 15-20 cm of the healthy stem tissues. Fifty transplants for each treatment were sprayed every 15 days started First of October 2011for ten times at Faculty of Agriculture Farm, Suez Canal Univ., Ismailia Governorate.

Results shown in Table (4) indicate that Octave showed a significant effect on controlling mango malformation as it recorded 6% infection followed by Topsin-M which showed 12% infection as compared with the control treatment .However, Tachigaren, exhibiting moderate effect on controlling the disease at the concentrations tested reached 14% which still lower than that in the control which showed 30% malformed seedlings, one year after treatment. Similar results were reported by Noriega-Cantu *et al.,* (1999) and Zafar *et al.,* (2011).

Table (4): The effect of three fungicides on the control of malformation of vegetative mango transplants naturally infected after removing the malformation.

Fungicides	Concentrations	No. of tested seedlings	No. of infected seedlings	Percentage of infection
Octave 50WP (Prochloraz 46,1%)	2g/L	50	3	6
Tachigaren 40WS (70% Hymexazole)	1ml/L	50	7	14
Topsin-M70 (70 Thiophanate methyl)	1ml/L	50	6	12
Control	-----	50	15	30
LS.D at 5%			3.39	2.97

B – On established trees:

Results in Table (5) indicate that the fungicides differed in their effect. The fungicide Octave had a significant effect on controlling mango malformation if compared with the control treatment. While Tachigaren and Topsin –M showed non -significant effect on controlling inflorescent mango malformation at the concentration tested.

Table(5):Effect of spraying three fungicides on inflorescent malformation of mango at Faculty of Agriculturale Farm, Suez Canal University, season 2010/2011.

Fungicides	Concentration	Replicates and percentage of infection								Mean Percentage of malformation %
		1	2	3	4	5	6	7	8	
Octave 50WP	2.0g/L	38.5	30.9	39.6	37.0	39.0	41.6	42.2	41.2	38.8
Tachigaren 40WS	1.0ml/L	40.8	37.2	40.2	42.4	41.6	39.9	38.9	42.4	40.4
Topsin –M70	1.0g/L	41.6	40.2	41.2	39.8	39.8	42	40.8	41.6	40.8
Control	-	53.2	42.6	45.0	44.2	44.2	42.3	48.1	39.9	44.8
LSD at 5 %										4.49

The obtained results, in general, indicate that the disease could be controlled by use of resistant cultivars, removal of diseased part and spraying the trees with selective fungicide *i.e.* Octave or Topsin –M70.

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انتقال مرض تكتل وتشوه المانجومن خلال التطعيم ومدي قابلية اشجار اصناف المانجو للاصابة بهذا المرض وطرق المكافحة الزراعية والكيماوية

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قسم النبات الزراعي - كلية الزراعة - جامعة قناة السويس

تطعيم اقلام مصابة بالتكتل او ماخوذة من اشجار مصابة على اصول سليمة من اصناف المانجو سكرى وعويس وزبدة سجل انتقال الاصابة من الطعم الى الاصل بنسبة 80 % ,72,2% ,64,7% على الاصناف الثلاثة على التوالى – فى نفس الوقت تطعيم اقلام سليمة من الاصناف الثلاثة على اصول سليمة لنفس الاصناف الثلاثة كمقارنة اظهر خروج نموات سليمة غير متكتلة لمدة 3 سنوات وحتى الان – تركيب طعوم سليمة للصنف سكرى بجوار تكتل قمى سجل انتقال للمرض بنسبة 25 % . على العكس تطعيم اقلام من الصنف زبدة المقاوم بجوار تكتل قمى او مكان التكتل بعد ازالتة سجلت عدم انتقال للمرض وان كل الشتلات المطعومة اظهرت نموات سليمة حتى الان . النتائج المتحصل عليها بالبحث تشير الى ان تطعيم اقلام سليمة و مقاومة للتكتل تعتبر امر ضرورى لتجنب انتقال المرض . بينما تطعيم اقلام مصابة لاصناف قابلة للاصابة على اصول مقاومة او قابلة للاصابة اثبتت ان المرض يمكن ان ينتقل عن طريق مواد التطعيم . على الجانب الاخر , تم تقييم 16 صنف مانجو لتحديد وتقييم مستوى الاصابة بمرض تكتل الشماريخ وشدتة . شدة الاصابة تختلف بين اصناف المانجو المختبرة فقد وجد من بين الاصناف المختبرة اربعة اصناف : تيمور ,كبانية ,صديق ,مبروكة كانت قابلة للاصابة بينما كانت الاربعة اصناف: دبشة ,الفونس ,كيبت ,تومى اتكن متوسطة القابلية للاصابة . فى حين كانت الاصناف الاربعة : سكرى ,قلب الثور ,هندى سنارة ,عويس قليلة التحمل للاصابة بينما كان الصنف هندى ملوكى متوسط التحمل للتكتل . اظهر الصنف جولك تحملة للاصابة بالتكتل – كذلك اوضحت النتائج ان الصنف فجرى كلان كان مقاوما للتكتل بينما كان الصنف زبدة اكثر مقاومة للتكتل - ولسوء الحظ لم تشير النتائج المتحصل عليها وجود صنف مقاوم بالكامل للإصابة بالتكتل . المعلومات التى تولدت من هذة الدراسة توصى بالتوسع في زراعة اصناف المانجو الاكثرمقاومة لمرض التكتل . كما اوضحت النتائج ان قص وازالة التكتلات الخضرية والزهرية مع 25 -30 سم من الانسجة السليمة طوال العام كان لة تاثير واضح فى خفض النسبة المئوية للاصابة بالمرض . كذلك اظهر الرش بالمبيد الجهازى "اوكتاف" فروق معنوية فى مكافحة المرض بينما اظهر الرش بالمبيد " تشاجرين " او المبيد "توبسين-ان" فروق غير معنوية عند الرش على شتلات او اشجار المانجو. النتائج المتحصل عليها من هذة الدراسة توضح انة يمكن مقاومة مرض التكتل فى المانجو والحد من انتشارة بزراعة اصناف مانجومقاومة للمرض مثل الزبدة والفجريكلان – مع ازالة الاجزاء المصابة بالمرض طوال العام ورش الاشجار باحد المطهرات الفعالة مثل "الاوكتاف" وهذة المعاملات تساعد فى تقليل الخسائر المتسببة عن مرض التكتل والتشوة في المانجو

قام بتحكيم البحث

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Table (2):Intensity of mango malformation in different cultivars of mango grown in four governorates during two excessive seasons 2011 and 2012 in Egypt

Name of Cultivar	First Year % 2011				Second Year % 2012				Average %	Type of inflorescence	Ranking
	Isma	Shar	Giz	Fay	Isma	Shar	Giz	Fay	2 years		
Tymour	59.0	68.5	65.1	56.5	71.7	63.8	77.6	59.5	65.21	Compact	Susceptible
Company	53.4	61.0	57.8	60.3	59.5	58.7	59.8	54.5	58.12	Compact	Susceptible
Seddiek	50.9	55.4	52.8	58.6	57.3	49.6	60.3	51.4	54.54	Heavy compact , red in color	Susceptible
Mabrouka	52.6	53.8	51.6	55.7	51.9	54.6	52.4	50.3	52.86	Semi Compact	Susceptible
Dabsha	36.6	33.2	32.3	32.7	31.8	34.3	33.7	35.6	33.78	Medium Compact	Moderately S.
Alphonso	30.5	29.4	41.5	37.8	33.4	29.5	31.7	33.7	33.44	Medium Compact	Moderately S.
Keitt	34.4	32.9	28.7	31.8	30.2	33.9	38.7	35.6	33.27	Heavy compact	Moderately S.
Tommy Atkins	33.1	30.8	28.5	30.5	29.3	32.4	35.4	33.5	31.69	Heavy compact, red in colour	Moderately S.
Succhari	32.9	29.8	27.8	28.6	26.4	29.5	31.9	29,8	29.59	Medium Compact	S. Tolerant
Bullock,s Heart	31.5	28.4	26.5	27.2	24.1	28.2	28,4	27.2	27.69	Medium Compact	S. Tolerant
Hindi-Sinnara	23.7	28.8	30.7	24.6	23.5	27,6	26.7	25.6	26.40	Semi Compact	
Ewaise	21.3	24,2	26.5	22.3	22.1	25.4	24.8	23.5	23.76	Medium Compact	S. Tolerant
Hindi-Meloky	9.2	8.3	11.6	7.4	10.2	12.6	9. 7	11.8	10.1	Semi Compact	M. Tolerant
Golic	5.5	6.7	6.4	7.1	6.4	9,2	7.4	8.3	7.13	Slightly loose	Tolerant
Fagr kelan	4.6	3.5	7.8	6.2	5.6	4.5	3.4	2.1	4.71	Light compact	Resistant
Zebda	2.1	1.6	3.5	2.4	1.7	3.4	1.7	2.4	2.35	Semi loose	Highly Resistant

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