Effect of Postharvest Fruit-Decaying Fungi on Newly Introduced Peach Cultivars to Egypt
1. Disease Severity and Changes in Fruit Quality

El-samra,I.A. , A.M. Hussein ,S.M. Shama, and A.M.Y. Alawami
1&3 Agricultural Botany Dept., Fac. Agric., Saba Basha, Alex. Univ.
2 Pomology Dept., Fac. Agric., Alex. Univ.
3 Plant Protection Dept., Fac. Agric., Omar Al-mukhtar Univ., El-Beida, Libya.

ABSTRACT

Six peach cultivars, namely Flords Prince, Desert Red, T. Snow, T. Sweet, Swilling and Meit Ghamr were tested for their susceptibility to the main fruit rot fungi. Florda Prince, T. Snow and Swilling were proved to be the most susceptible cutlivar at room temperature (24 – 27 °C) to *Botrytis cinerea*, *Penicillium expansum* and *Rhizopus stolonifer*, respectively. At cold storage (0°C), T. Sweet cultivar was the most susceptible to *B. cinerea* or *P. expansum* compared with the other tested cultivars. On the other hand, the tested cultivars were not infected with *R. stolonifer* during cold storage. Percentages of weight loss of infected peach fruits of all the tested cultivars showed significant increase compared with those of healthy ones. The juice pH values were decreased in diseased fruits of all tested cultivars, while these values were increased in healthy fruits. Titratable acidity values were increased in inoculated fruits of all treatments, except those inoculated with *R. stolonifer* and kept at 0°C as compared to healthy ones. Soluble solids content values in both healthy and diseased fruits of Swilling cultivar were significantly higher than the other tested cultivars. Total soluble sugars and non-reducing sugar content were significantly lower in diseased fruits of all tested cultivars than in control. This trend was true whether fruits were stored at room or cold temperature. Decreasing rates in the content of sugars were more sound in fruits infected with *R. stolonifer* followed by *B. cinerea* and *P. expansum*. However, reducing sugar content significantly differed according to the tested cultivars and fungus applied.

INTRODUCTION

Peach "*Prunnus persica* L." Batsch is one of the most important fruit crops in Egypt.Some new cultivars were recently introduced to Egypt, based on their expected adaptation and success in such area. Among the newly introduced varitieties are Florda Prince, Desert Red, T. Snow, T. Sweet and Swilling.

Peach fruits are susceptible to many diseases during harvesting, marketing and storage which cause serious losses in the crop either in quiantity as well as quality of the fruits. These disease are caused by a large number of fungi as *Botrytis cinerea* , *Penicillium expansum* and *Rhizopus stolonifer* (Kaul and Sharma,1993; Pratella,1995; Delgado,1997 and Abbass,1999).

Many investigators both in Egypt and other countries revealed that the postharvest diseases affect changes in fruit quality, such as total acidity and pH (Hussin,1976; Abdel Malek,1987 and Mahmoud,1998) and soluble solids

content (Abdel-Rehim et al.,1973; Tarabeih et al.,1977; Abdel Malek,1987 and Ekundayo and Okigbo,1991).
The present investigation was conducted to study the susceptibility of newly introduced peach cultivars in Egypt to fruit-decaying fungi under different storage condition (at room temperature and at cold storage) and investigate the effect of postharvest decay on fruit quality.

MATERISLS AND METHODS

The fungi *Botrytis cinerea, Penicillium expansum* and *Rhizopus stolonifer* were found to be the major fungi isolated from peach fruits and their pathogenicity were confirmed. So, they were tested to estimate their effect on peach cultivars, Florda Prince, Desert Red, T. Snow, T. Sweet and Swilling. These newly imported cultivars have different harvest time. In addition to these newly introduced cultivars, Meit Ghamr cultivar commonly grown in Egypt was also tested for comparison (Fig. 1). The fruits were harvested at common commercial harvest stage. Fruits from each cultivar were picked in the early morning, packed in boxes and immediately transported to the laboratory. Fruits free from mechanical injury, scratching and wounding were selected, surface sterilized and inoculated (10^3 sporangiospores per milliliter of *R. stolonifer*, 10^4 conidia per milliliter of *P. expansum* or 10^5 conidia per milliliter of *B. cinerea*) according to procedures described by Hong et al., (1998). Inoculated fruits of each cultivar were then separated into two batches. In the first batch, fruits were incubated at room temperature (24 – 27 °C) for 5 days, while those of the second batch, were incubated in cold storage (0 ± 1°C, with 90-95% RH) for three weeks. After storage, the severity of infection was determined as mentioned before. Tests were carried out through the two successive seasons (2000 & 2001) using three replicates per treatment and eight fruits per replicate. Samples were taken for determination of fruit physical and chemical properties at harvest and at the end of storage period. Fruit weight loss were estimated by initially weighing 8 fruits and then weighing the same fruits at the end of storage and their weight loss was calculated as percentage. Refractometric soluble solids content, pH and titratble acidity using 0.1N NaOH were determinated (A.O.A.C.,1986). Total soluble sugar, non-reducing sugar and reducing sugar were determined according to Thomas and Dutcher,(1924).

RESULTS AND DISCUSSION

1. Disease severity

Results presented in Table 1 and illustrated in Fig. 2 indicated that the tested peach cultivars significantly differed in their susceptibility to infection with *B. cinerea, P. expansum* and *R. stolonifer* when inoculated fruits were stored at room temperature. Moreover, among

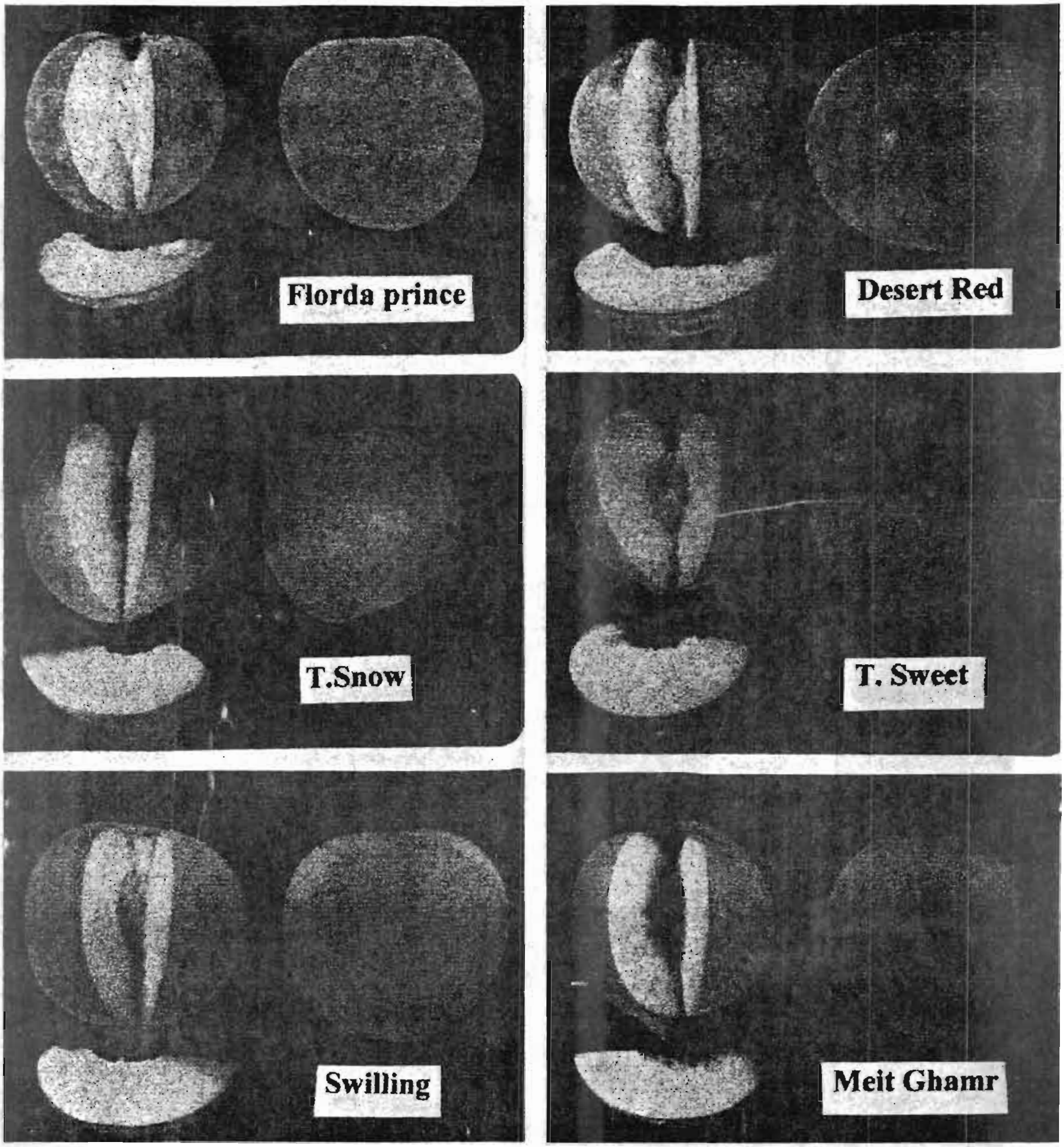
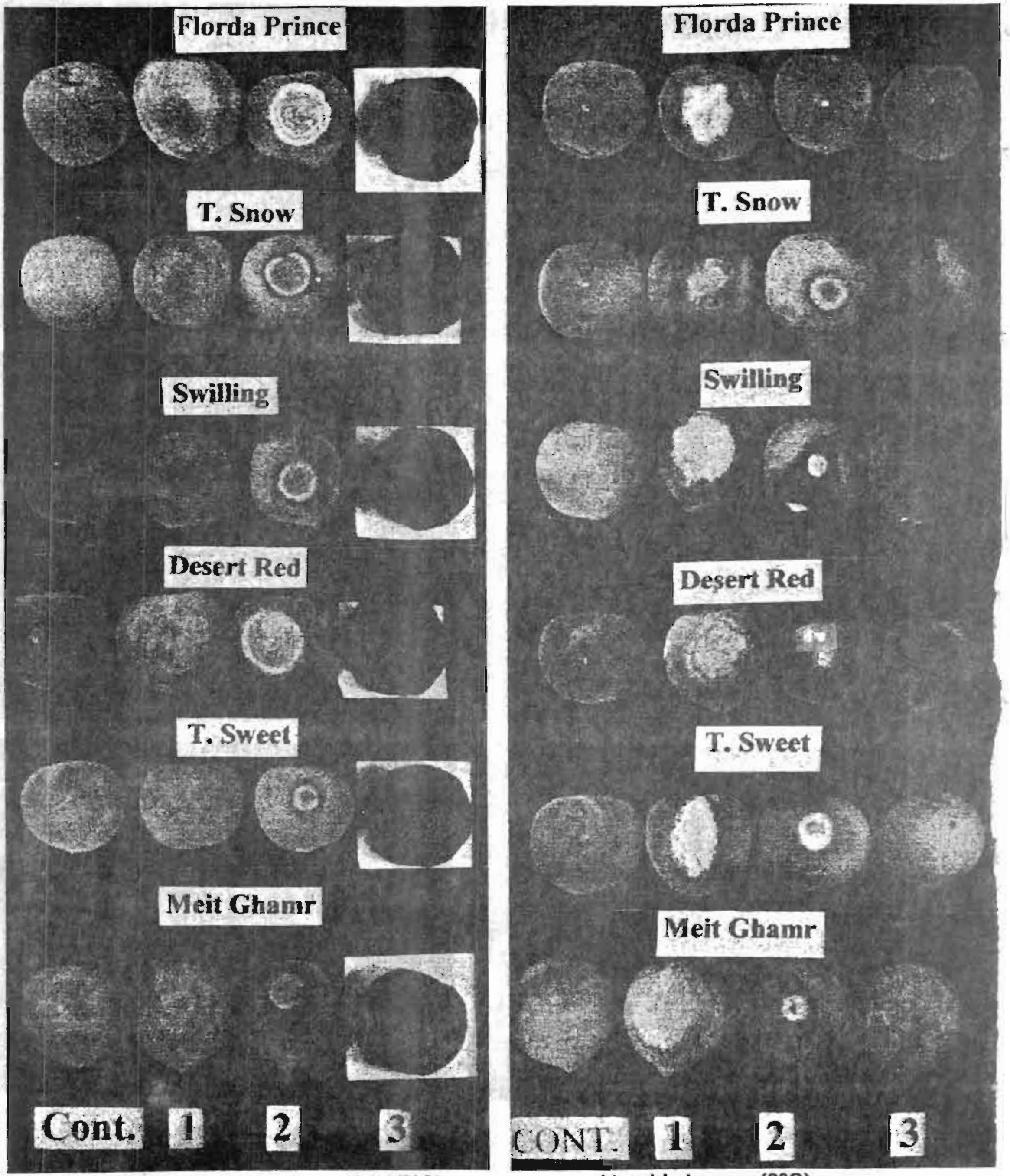


Fig. 1. Peach cultivars used in this study.



At room temperature (24-27°C) At cold storage (0°C)

Fig. 3. Effect of inoculation with the main fruit-decaying fungi on certain peach cultivars. (Cont.) non-inoculated fruits, (1) inoculated fruits with *B. cinerea*, (2) inoculated fruits with *P. expansum* and (3) inoculated fruits with *R. stolonifer*.

Table 1. Degrees of infection (DI%) with the major fruit-decaying fungi on the newly introduced peach cultivars under different storage conditions

Cultivars	Degree of infection %* (DI%)					
	at room temperature**			at 0°C		
	B. cineria	*P. expansum*	*R. stolonifer*	*B. cineria*	*P. expansum*	*R. stolonifer*
Florda Prince	70.83 a	58.75 a	91.11 a	52.50 c	31.25 c	0
Desert Red	69.17 b	60.00 b	77.22 b	60.00 b	35.00 cb	0
T. Snow	65.00 c	60.83 c	90.83 a	54.17 cb	37.92 cb	0
T. Sweet	65.42 c	60.00 b	92.50 c	68.75 a	49.58 a	0
Swilling	59.17 d	56.67 d	94.58 d	55.83 cb	38.75 cb	0
Meit Ghamr	48.33 e	54.58 e	85.42 e	50.83 c	40.42 b	0

$$\text{*Degree of infection (\%)} = \frac{\text{Sum of individual ratings}}{\text{No. of fruits assessed}} \times \frac{100}{5}$$

** Room temperature = 24-27°C
Different letters in a column denote significant differences according to Duncan's multiple range test at 0.05 level of probability.

all the tested cultivars Florda Prince, T. Snow and Swilling were proved to be the most susceptible to *B. cinerea*, *P. expansum* and *R. stolonifer*, respectively. The other tested cultivars showed different degrees of tolerance against the examined fungi. Variations among cultivars in their susceptibility to decay agents were also recorded by Margosan et al., (1997) and Hong et al., (1998), they found clear differences among peach cultivars in their susceptibility to infection with *M. fructicola*. On the other hand, Biggs and Northover (1988) did not find any differences between peach cultivars Redhaven and Loring in their degrees of infection with the same fungus.

Storage at 0°C proved that T. Sweet cultivar was found to be highly susceptible to fungal invasion by *B. cinerea* and *P. expansum* as compared to other cultivars. Moreover, all cultivars were not infected with *R. stolonifer* during cold storage period (21 days at 0°C). These findings were in agreement with those of Abdel Malek (1987); Tadrous (1991), Jalil et al. (1997); Chen, et al. (1998) and Abbass (1999). Sommer (1985) who reported that some postharvest pathogens having minimum temperatures for growth of about 5°C or higher and have developmental stages very sensitive to low temperature. *R. stolonifer* and *A niger* are examples According to the present study on the development of peach fruit decay, the cold storage condition exhibited the lowest degrees of infection compared with those realized at room conditions. This trend was true with all tested fungi.

2. Weight loss.

The experimental results illustrated in Fig. 3 revealed that the rates of weight losses were higher in diseased fruits than in healthy ones. At room temperature, fruits inoculation with *R. stolonifer* caused a pronounced increase in weight loss percentages. Similar result was obtained with *B. cinerea* but if inoculated fruits were stored at cold conditions. Boreck et al. (1985) mentioned that storage losses in fruits depended on the time of picking and storage temperature. Moreover, the effect of these factors varied among cultivars. Generally, fruit weight loss depended upon water loss and utilization of carbohydrates and organic substrates by pathogenic fungi for their physiological activities as respiration. Besides, fruit weight loss of all cultivars increased as the infection progressed and as the storage period advanced. The present results were similar to those obtained by Mohsen, (1994); Kamal et al. (1996) and Mohamed (1999).

3. Juice pH.

The obtained data presented in Fig. 4 showed that diseased fruits of all the tested cultivars gave the lowest mean values of pH compared with healthy ones. Meanwhile, juice pH values decreased as storage period progressed compared with the initial pH values for all cultivars. The above reported results agreed with that reported by Kader et al. (1982) on peach cultivars, who found that the juice pH increased as acidity decreased. Results showed also a considerable increase of fruit juice pH with the increase of storage temperature. This confirmed the findings of Miller and McDonald (1998).

4. Titratable acidity (TA%).

The results of this investigation (Fig. 5) showed that titratable acidity (TA%) in fruits infected with any of the tested fungi was higher than that in the healthy ones. Moreover, TA% in healthy fruits at the end of the storage period significantly decreased compared with that determined at harvest. This was true for all cultivars except Meit Ghamr peach cultivar. Similar results were recorded on the % of titratable acidity in various crops such as peach (Kumar and Chitkara, 1983; Abdel-Malek, 1987; and Gonzalez et al. 1992 and Mohamed, 1999), Mango (Hussin, 1976), grapes (Radwan, 1985) and Tomato (Fallik, et al. 1993). This increase in TA% in diseased fruits might be due to enzyme activity in hydrolyzing the fruit components producing remarkable amount of acids.

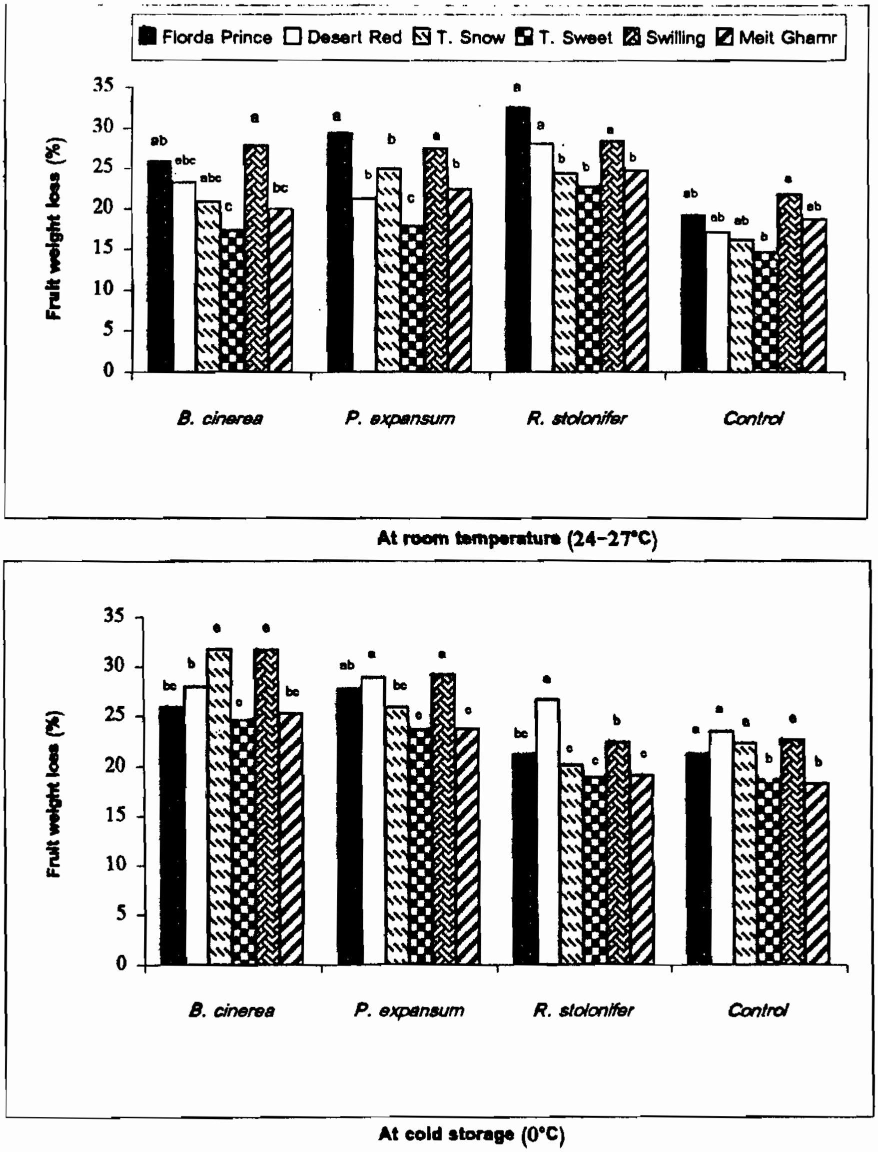
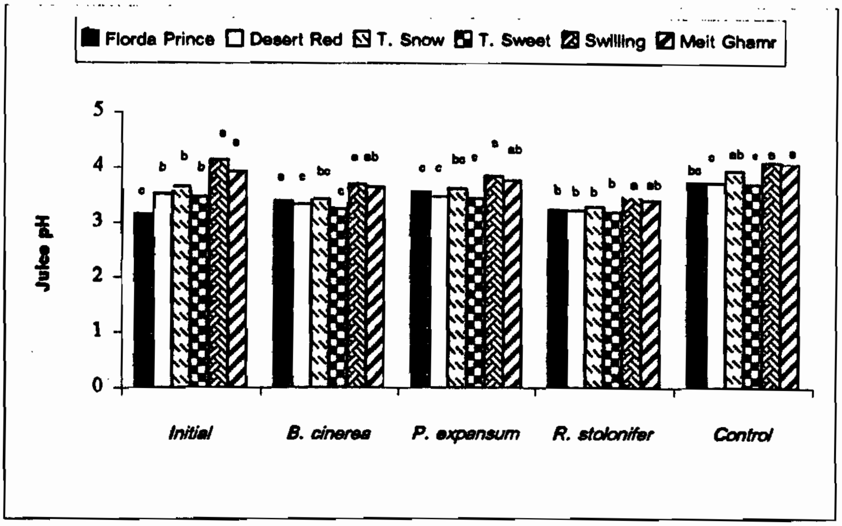


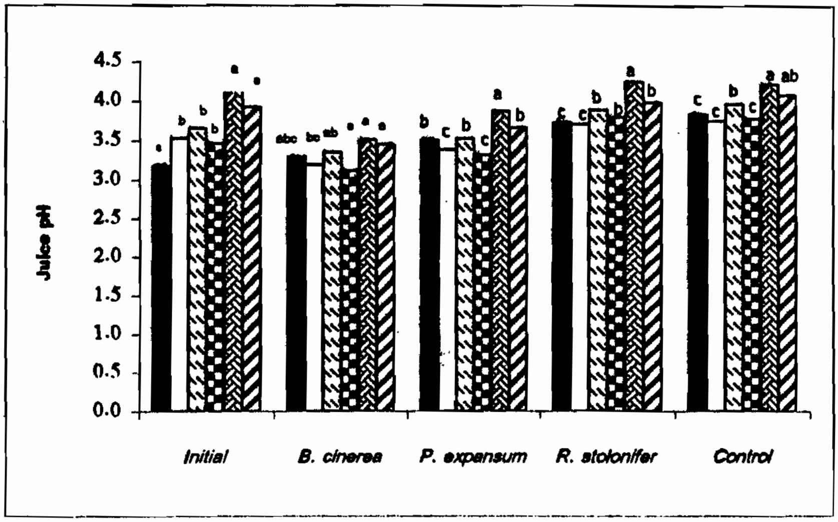
Fig. (3). Fruit weight loss percentages of peach fruits of different cultivars inoculated with the main fruit-decaying fungi and kept under different storage conditions.

Control = noninoculated fruits

Bars within the same pathogen or control with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability



At room temperature (24-27°C)



At cold storage (0°C)

Fig. 4). The juice pH of peach fruits of different cultivars inoculated with the main fruit-decaying fungi and kept under different storage conditions.

Control = non-inoculated fruits.

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability

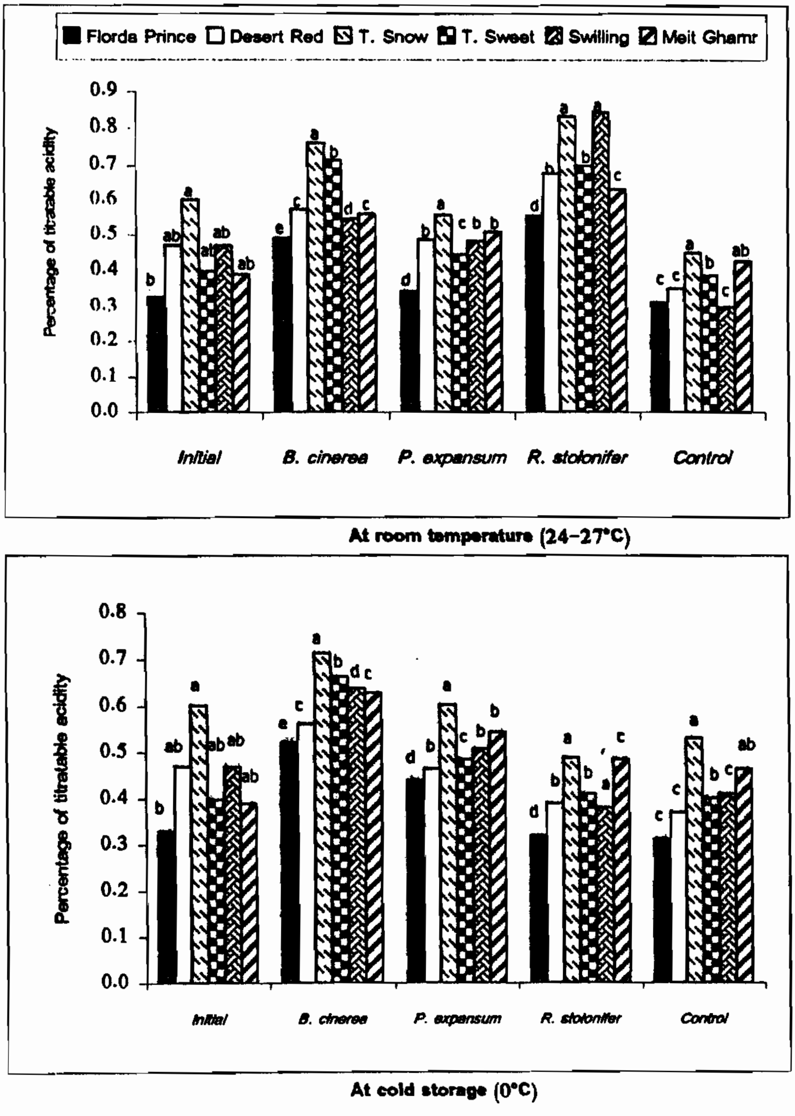


Fig. (5). Percentage of fruits titratable acidity (as malic acid) in peach fruits of different cultivars inoculated with the main fruit-decaying fungi and kept under different storage conditions.

Control = non-inoculated fruits.

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability.

5. Soluble solid content (SSC).

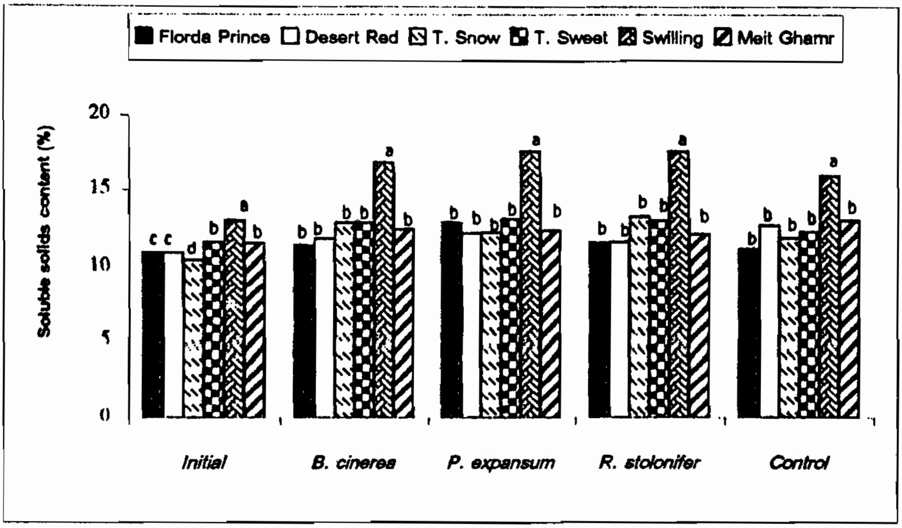
The percentage of soluble solids content (SSC) in healthy and diseased fruits for Swilling cultivar was significantly higher than that of the other five tested cultivars (Fig. 6) . However, the present results showed that differences in SSC between healthy and diseased fruits were insignificant. This trend was true weather fruits were stored at room temperature or at cold conditions. Pronounced increase in soluble solids content was obtained in stored peach fruits of all tested cultivars compared with the initial values of SSC estimated at harvest time. These results are in agreement with those reported by Kumar and Chitkara (1983) and Mohamed (1999). This increase may not reflect the increase in sugars but it indicates the solubility of such materials and part of which is expected to affect the flesh texture (Mohamed, 1999). In addition, that the increase of soluble solids content in stored fruits may be due to the associated increase in fruit water losses with the subsequent increase in juice concentration at the end of the storage period.

6. Sugars.

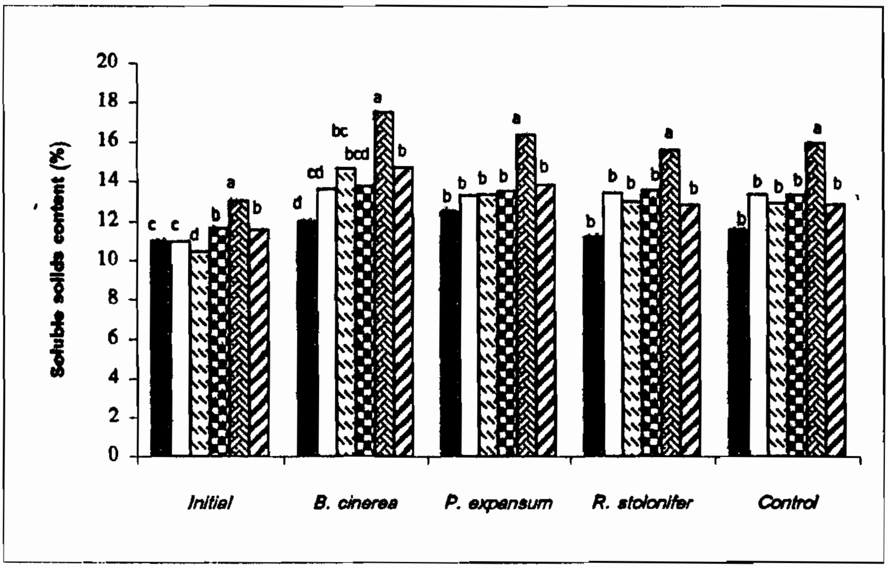
The results of the present investigation illustrated in Figs. 7 and 8 showed a pronounced decrease in total soluble sugar (TSS) and non-reducing sugars in diseased fruits of all cultivars compared with uninoculated control fruits at the end of storage period (at room temperature or 0°C). The decrease in the content of these sugars was more apparent in fruits infected with *R. stolonifer* followed by those with *P. expansum* and *B. cinerea*, respectively. The present results were in line with those of Abdel-Malek (1987); Baraka et al. (1987); Gaber et al. (1990) and Ekundayo and Okigbo (1991) they reported a high decrease of sugar contents in infected fruits. The activity of fungal infection on carbohydrates uptake from the affected tissues could be the reason of such reduction.

On the other hand, the reducing sugar content in diseased fruits stored at room temperature or at 0°C varied according to the cultivar applied and type of fruit-decaying fungi used in inoculation (Fig.9). These findings partially in agreement with those reported by Abdel-Rehim et al. (1973);Tarabeih et al. (1977) and Abdel-Malek (1987). From data of the present investigation, the Swelling cultivar was one of the most susceptible cultivars to infection with the tested fungi. Moreover, it gave the highest mean values of soluble solids content and total soluble sugars content as compared with the other tested cultivars.

According to the present results (Fig. 7), slight increase in total soluble sugars was obtained due to storage of healthy fruits of all tested cultivars at room temperature as compared with the initial mean values stimated at harvest time, whereas slight decrease was observed at cold storage. Non-reducing sugars decreased while reducing sugar increased in all cultivars at the end of storage period (at room temperature or 0°C) as compared with those values measured at harvest time (Figs. 8 and 9) Such results were in agreement with those reported by Kader et al (1982), Kumar and Chitkara (1983) and



At room temperature (24-27°C)



At cold storage (0°C)

Fig. (6). Soluble solids content in peach fruits of different cultivars inoculated with the main fruit-decaying fungi and kept under different storage conditions.

Control = non-inoculated fruits.

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability.

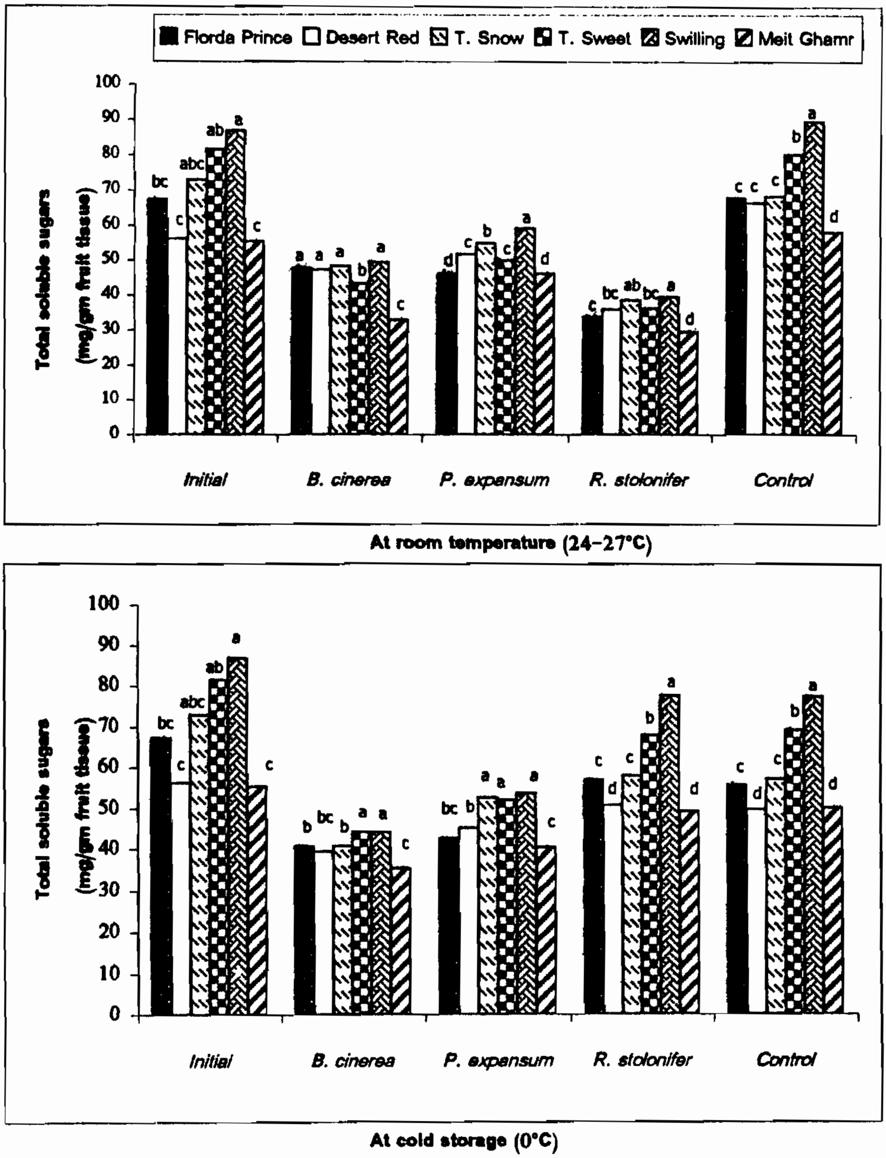
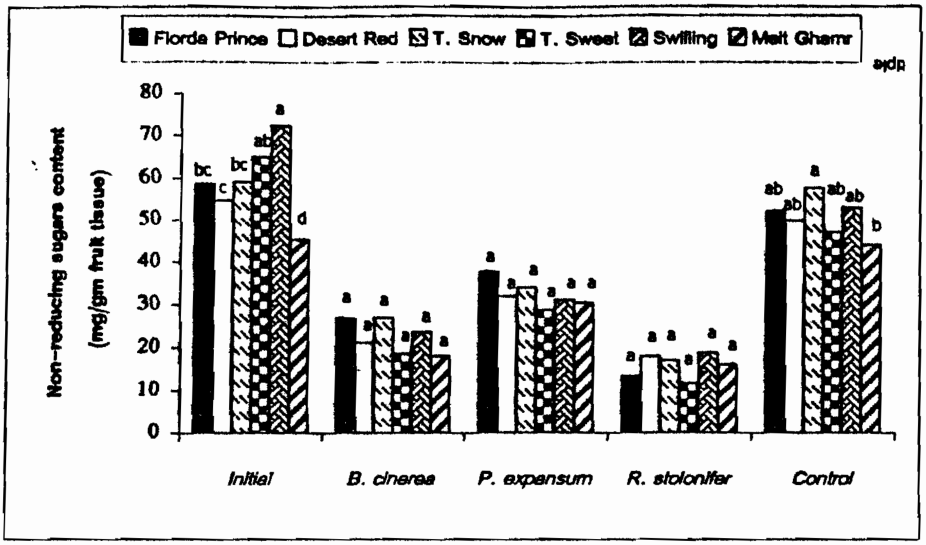


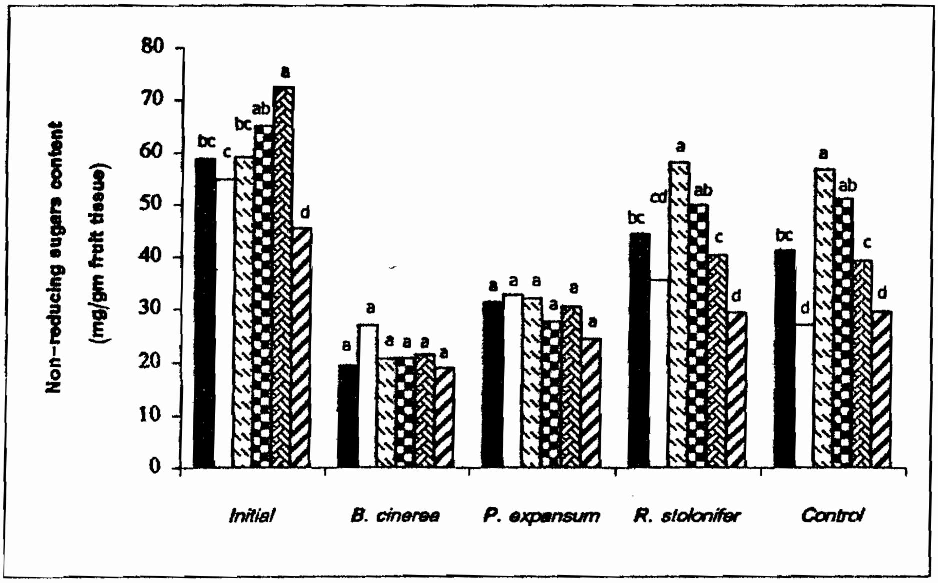
Fig. (7). Total soluble sugars (mg/gm fruit tissue) in peach fruits of different cultivars inoculated with the main fuit-decaying fungi and kept under different storage conditions.

Control = non-inoculated fruits

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability



At room temperature (24-27°C)



At cold storage (0°C)

Fig. (8). Non-reducing sugars (mg/gm fruit tissue) in peach fruits of different cultivars inoculated with the main fruit decaying-fungi and kept under different storgae conditions.

Control = non-inoculated fruits.

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability.

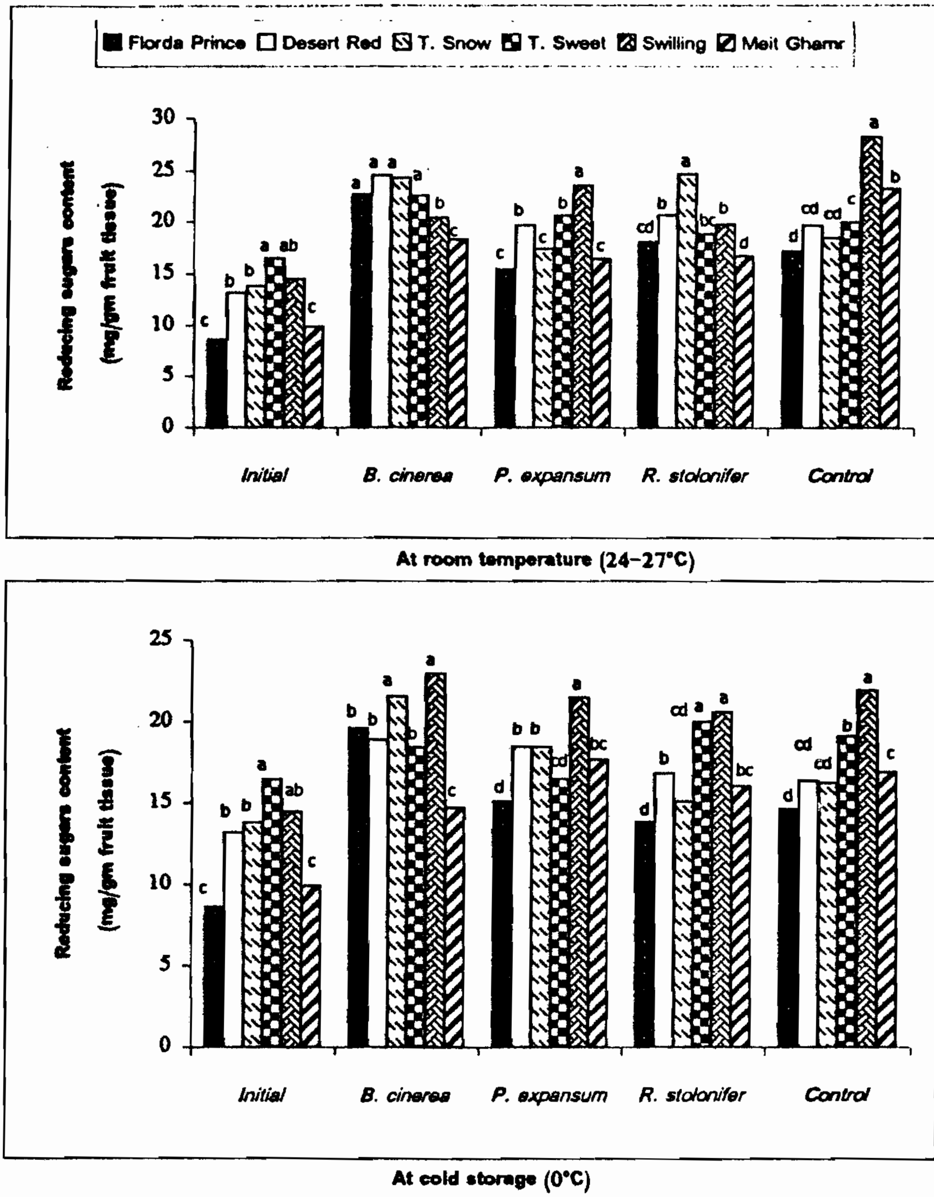


Fig. (9). Reducing sugars (mg/gm fruit tissue) in peach fruits of different cultivars inoculated with the main fruit-decaying fungi and kept under different storgae conditions.

Control = non-inoculated fruits.

Bars within the same pathogen, control or initial with the same letter do not differ significantly according to Duncans multiple range test at 0.05 level of probability.

Mohamed (1999). According to the obtained results, at later stage of storage increase in total soluble sugars with subsequent decrease in flesh firmness of healthy fruits are considered encouraging factors for the incidence of infection with different fruit-decaying fungi.

REFERENCES

Abbass, G.E. 1999. Studies on postharvest diseases of peaches. M. Sc. Thesis. Dept. of Agric. Botany, Fac. of Agric., Suez Canal Univ. 104 pp.

Abdel-Malek, A.M. 1987. Studies on fruit rot diseases of certain stone fruits (Peach, Apricot and Plum) in A.R.E. Ph.D. Thesis, Fac. of Agric., Cairo Univ. 283 pp.

Abdel-Rehim, M.A., E.I.Wasfi, and M. S. Hassouna, 1973. Some changes in tomato fruits due to infection by *Alternaria alternata* and *Geotrichum candidum*. Egypt J. Phytopathol. 5: 55-64.

A.O.A.C. 1986. Association of official analytical chemists. Official Methods of Analysis. Association of Official Analytical. Chemists, Washington, 4, D.C. U.S.A.

Baraka, M.A., M.A. Abdel-Sattar, and A.H.El-Assal. 1987. Biochemical changes in date palm fruits infected with *Thielaviopsis paradoxa*. Egypt J. Phytopathol. 19 (1-2): 61-69.

Biggs, A.R. and J.Northover .1988. Early and late-season susceptibility of peach fruits to *Monilinia fructicola*. Plant Disease 72: 1070-1074.

Boreck, H., H. Zdyb, and B. Wottas .1985. Preliminary experiments in plum storage. Prece Doswiadcalner Zakresu Sadownictwa 25: 197-206. (Hort. Abst. Vol. 57: 5318).

Chen, L.C, T.Z. Chen, and Y. W. Chung . 1998. Effect of temperature, water potential and light illumination on the spore and sclerotia germination, mycelial growth, sporulation and sclerotia formation of *Botrytis elliptica* and *B. cinerea*. Plant Pathology Bulletin 7 (4): 167-176.

Delgado, M. 1997. Peaches and nectarine. Mastering the disease of conservation. Arboriculture Fruitiere 505: 19-21.

Ekundayo, C.A. and R.N. Okigbo . 1991. The effect of pathogenic fungi on the nutritional value of the black plum (*Vitex doniana*). Nigerian Journal of Botany 4: 61-68.

Fallik, E., J. Klein, S. Grinberg, E. Lomaniec, S. Lurie, and A. Lalazar. 1993. Effect of postharvest heat treatment of tomatoes on fruit ripening and decay caused by *Botrytis cinerea*. Plant Disease 77: 985-988.

Gaber, M.R., O.I. Saleh; N.A. Hussien, and Z.A. Shehata . 1990 . *Botryo diplodia* fruit rot of pear fruits, some physiological and pathological studies. Annals Agriculture Science, Ain Shams Univ. 35 (1): 427-444.

Gonzalez, A.R., A. Mauromoustakos, G. Prokakis, and Aseloge. 1992. Influence of year, cultivar and fruit maturity on quality of peach puree. J. Food Qual. Trumbal, Conn. Food and Nutrition Press 15 (2): 97-109.

Hong, C.X., T.J. Michailides, and B.A. Holtz . 1998. Effects of wounding, inoculum density and biological control agents on postharvest brown rot of stone fruits. Plant Disease 82: 1210-1216.

Hussein, N.A. (1976). Studies on mango fruit rot. M.Sc. Thesis, Fac. of Agric., Ain Shams Univ. Egypt. 147 pp.

Jalil, R.C., S.A. Norero, and H.G. Apablaza. 1997. Effects of temperature on mycelial growth of *Botrytis cinerea* and its antagonist *Trichoderma harzianum*. Cienciae Investigation Agraria 24: 125-132.

Kader, A.A., M.H. Christi, and Alexander Chordas. 1982. Postharvest quality of fresh and canned digestion peaches as influenced by genotypes and maturity at harvest. J. Amer. Soc. Hort. Sci. 107 (6): 947-951.

Kamal, H.M., M.T. Kebeel, and S.M. Etreby. 1996. Physiological studies on fruits of some old and new peach varieties. Bull. Fac. of Agric. Cairo Univ. 47: 611-628.

Kaul, J.L. and R.L. Sharma . 1993. Postharvest fungal disease of stone fruits in Himachal pradesh. Plant Disease Research 8 (1): 65-66.

Kumar, A. and Chitkara . 1983 . Physico-chemical changes in the developing fruits of Safeda peach (*Prunus persica* Batsch). Haryana Journal of Horticultural Science. 12: 48- 51 (C.F. Hort. Abst. 55 (3): 180).

Mahmoud, M.A.E.1998. Studies on the effect of some physical and chemical treatment on the growth and development of citrus fruit rot agents during storage and marketing. Ph.D. Thesis, Fac. Of Agric. (Saba Basha), Alex. Univ. 169 pp.

Margosan, D.A., J.L. Smilanick, G.F. Simons, and D.J. Henson . 1997. Combination of hot water and ethanol to control postharvest decay of peaches and nectarines. Plant Disease. 81: 1405-1409.

Miller, W.R. and R.E. McDonald . 1999 . Short-term heat conditioning of grapefruit to alleviate irradiation injury. Hortscience 33 (7): 1224-1227.

Mohamed, K.S. 1999. Postharvest studies on newly introduced peach varieties in the North West Region of Egypt. M.Sc. Thesis, Fac. Agric. (Saba-Bacha). Alex. Univ. Egypt 148 pp.

Mohsen, T.A. 1994. Effect of some preharvest treatments on fruit quality and storage of some peach cultivars. M.Sc. Thesis, Fac. of Agric. Cairo Univ. 114 pp.

Pratella, G.C. 1995 . Notes on the bio-pathology and techniques of storage-transport of fruits. Peach (Second part). Rivista di Frutticoltura e di Ortofloricoltura 57 (1): 78-81.

Radwan, F.M. 1985. Studies of grapevine fruits rot in A.R.E. M.Sc. Thesis, Fac. of Agric , Cairo Univ Egypt

Sommer, N.F. 1985. Principles of disease suppression by handling practices. In: Postharvest technology of horticultural crops by Kader, A.A., Kasimire, R.F., Mitchell, F.G., Reid, M.S., Sommer, N.F. and Thompson, J.F. The reagents of the University of California. 75-82 pp.

Tadrous, A.Z. (1991). Pathological studies on strawberry fruit rot in A.R.E. M.Sc. Thesis, Fac. of Agric., Suez canal Univ.

Tarabeih, A.M., H.M. Sheir, G.I. Fegla, and A.R. El-Mahdy . 1977. Reducing sugars content of citrus fruits infected with *Alternaria citri*, *Oospora citriauranttii* and *Penicillium digitatum*. Egypt. J. Phytopathol. 9: 87-89.

Thomas, W. and R.A. Dutcher . 1924. Picric acid method for carbohydrate. J. Amer. Chem. Soc. 46: 1662-1669.

الملخص العربى

تأثير فطريات عفن الثمار بعد الحصاد على أصناف الخوخ المدخلة حديثا الى مصر.

١- شدة المرض والتغيرات فى جودة الثمار.

ابراهيم عبدالسلام السمرة، عواد محمد حسين، سعد محمود شمة، عزالدين محمد يونس العوامى

١&٣ قسم النبات الزراعى- كلية الزراعة- سابا باشا – جامعة الاسكندرية.

٢ قسم الفاكهة – كلية الزراعة – جامعة الاسكندرية .

٤ قسم وقاية النبات – كلية الزراعة – جامعة عمر المختار- البيضاء – ليبيا .

اختبرت قابلية ٦ أصناف من الخوخ هي فلوردا برنس ، ديزرت ريد ، تي سنو ، تي سويت ، سويلينج وميــت غمر وذلك للإصابة بفطريات أعفان ثمار الخوخ . وأوضحت النتائج أن الصنف فلوردا برنس كان أكثر الأصناف المختبرة إصابة بالفطر بوترايتس سيناريا ، وأن الصنف تي سنو أكثرها إصابة بالفطر بنسليوم اكسبنســيوم أمـــا الصنف سويلينج فكان أكثرها إصابة بالفطر رايزوبس ستولونيفير وذلك علي درجة حرارة الغرفة (٢٤-٢٧°م) . وعند الاختبار تحت ظروف التخزين البارد (0°م) كان الصنف تي سويت أكثرها إصابة بكل من الفطر بوترايتس سيناريا والفطر بنسليوم اكسبنسيوم مقارنةً بالأصناف الأخرى . من ناحية أخرى فإن جميع الأصناف تحت الدراسة لم تحدث لها إصابة بالفطر رايزوبس ستولونيفير طوال فترة التخزين المبرد . أدت إصـــابة ثمار الخوخ بفطريات الأعفان إلى زيادة الفاقد في الوزن مقارنة بالثمار السليمة وذلك في جميع الأصـــناف المختـــبرة . انخفـــض الرقم الهيدروجيني في الثمار المصابة لكل الأصناف بينما ارتفع في الثمار الســليمة وارتفعــت نسبة الحموضة الكلية في الثمار المصابة مقارنةً بالثمار السليمة. ولقد كانت نسبة المواد

الصلبة الذائبة في ثمار الصنف سويلينج المصابة والسليمة أعلى معنوياً عن الأصناف الأخرى. ووجد أنه في كل الأصناف المختبرة كان محتوي الثمار المصابة من السكريات الكلية والسكريات غير المختزلة أقل معنوياً مـــن الثمار السليمة وذلك على درجة حرارة الغرفة أو تحت ظروف التخزين المبرد ولقد كان هذا الانخفاض أكـــثر وضـــوحاً عند الإصابة بالفطر رايزوبس ستولونيفير ثم الفطر بوترايتس سيناريا وأخيراً الفطر بنسليوم اكسبنسيوم. أما عن محتوى الثمار المصابة من السكريات المختزلة فلقد ثبت أنه لا يخضع لنظام محدد بالزيادة والنقصان وذلك تبعاً لنوع الفطر الممرض والصنف المختبر .