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Full Length Research Paper

Enumeration and estimation of insect attack fruits of some cultivars of Punica granatum.

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In this study, five cultivars of *Punica granatum* identified (two of which are endemic, while the other three are new) were grown in certain farms at Al-Taif, Saudi Arabia. Enumeration to the insects attack its' fruits illustrated that, there are three insects, namely, *Virchola livia*, *Ectomyelois ceratonia* and *Pseudococcus maitimus* (or/and *Pseudococcus citri*) infested both cracked and healthy pomegranate fruits. The population density of immature stage of *V. livia* was noticed in healthy fruit more than cracked fruit, while *E. ceratonia* was shown the converse. Besides, there is high infection by the three insects at 2008 more than 2009. Measurement susceptibility of the five cultivars showed that, Al- Taif cultivar was the most resistant one to V*. livia* infestation, being 3.5 and 1.8% of immature stage/20 healthy or cracked fruits. While the most resistance one to immature stages of *E. ceratonia was* Wonderful-mangulatory cultivar recording infestation of 0.0 and 2.4% of immature stage/20 healthy or cracked fruits during 2008 and 2009.

Key word: Pomegranate cultivars, *Virchola livia*, *Ectomyelois ceratonia*, mealy bugs, susceptibility.

INTRODUCTION

Pomegranate is one of the most important trees around the world. It was cultivated in ancient Egypt and early in Greece and Italy. Recently, the products of pomegranate tree (including, peels, juice, leaves, seeds, flower, etc.) have medicinal and industrial importance (Negi et al., 2003; Kulkarni et al., 2004; Malik et al., 2005; Neurath et al., 2005; Sumner et al., 2005). Pomegranate is considered as an excellent tree for growing in arid zones for its resistance to drought conditions. It is now widely cultivated in Mediterranean, tropical and sub-tropical area (Evreinoff, 1949; Zukovskij, 1950; Wilson, 1974; Melgarejo and Martinez, 1992).

Botanically, the pomegranate (*Punica granatum* L.) is included in the family of Punicaceae. It is a small tree, much branched, nearly spiny, leaves opposite, oblong lanceolate, showy flowers are found on the branch tips or in clusters, calyx red, fleshy with pointed sepals, petals red, enclosing numerous stamens. The fruit is technically a berry. It has a leathery skin, reddish or yellowish green wall and white spongy tissue into compartments packed with transparent sacs filled with juicy, red, pink or whitish pulp. In each sac, there is one white or red, angular, soft or hard seed (Morton, 1987).

All parts of the tree have been utilized as a source of tannin for curing leather. The juice is used for pharmaceutical purposes. It is also used in treating dyspepsia and leprosy (Encyclopedia, 2010). This tree is very sensitive to injury by different insect species, acting as boring insects which caused serious damage to its products (Ismail et al., 1989; Knodel and Agnello, 1990; Shelton et al., 2006). For its economic importance, there are many researches carried out in different part of the world to genetically improve the pomegranate tree; so, there are hundreds of cultivars and types existing across many countries. Varieties are often classified as sweet, sweet-sour and sour, early, mid season and late, juicy and table fruit, soft-seeded and hard-seeded or major and minor. The names originates frequently either from the place of cultivation or from the color of the fruit.

The objective of this study was to enumerate the insect

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attack of some pomegranate tree fruits cultivars as indicator to its susceptibility.

MATERIALS AND METHODS

The experiment was carried out in special farms (which cultivated with different pomegranate tree cultivars) in Al- shafa, Al- Rodaf and middle Al- Taif city in Kingdom of Saudi Arabia during two successive fruiting seasons 2008/2009. Pomegranate varieties were identified according to colour, taste and size of fruits (Wilson, 1974; Facciola, 1990). The selected experiment trees were not treated by any insecticide and were fertilized by common known soil fertilizer.

To estimate the population density of the most common insects attacking pomegranate fruits, healthy and cracked fruits were collected randomly (totally 25 fruits/one trees); then they were put in plastic sacks and investigated under laboratory conditions. The investigated fruits were performed once after two weeks during fruiting season of pomegranate tree (from 1st May to 31st August). The sample was collected randomly from five trees per each farm. To evaluate the susceptibility of different five pomegranate cultivars, samples were collected from one farm (Al- Rodaf), put each cultivar in separated plastic sacs and then previous steps in collection and investigation were followed.

Percentage of infestation = no of infested fruits/ total number of collected fruits X100

RESULTS AND DISCUSSION

Identification and description

The examination of the fruits (size-exocarp, color-seeds, color-juice taste) revealed that there are five different cultivars which are described in Table 1 and Figures 1 to 5. Vernacular names were adopted after Morton (1987). Al-Taify cultivar was considered the most known cultivar at the farms in the study area followed by mangaloty, while the other three cultivars are new ones.

Estimation of the population density of some insect attack on healthy and cracked pomegranate fruits at different regions in Al-Taif city

Results in Tables 2 and 3 revealed that both healthy and cracked fruits were attacked by *V. livia, E. ceratonia* and *P. maitimus* (or/and *P. citri*) but at different levels during fruiting seasons (2008 to 2009).

However, no significant difference ($P > 0.05$) was recorded in the mean numbers of immature stages of *V. livia* at healthy fruits and cracked ones, which ranged between 13.8 to 20.4 immature stages/20 healthy fruit and 4.05 to 15 immature stages/5 cracked fruit/tree at different investigated areas during fruiting seasons (2008 to 2009), respectively. The total mean of infection by *V. livia* was recorded with slight significant ($P < 0.05$) variation of 35.1 and 33.2 immature stages/25 healthy/tree at middle El-Taif, when compared with 21.83, 19.5 and 18.6 Immature stages/25 healthy/tree at Al- Rodaf and Al-Shafa during 2008 to 2009, respectively.

The highest level of infection by *V. livia* was recorded at different investigation areas in Al-Taif from 4th to 18th July (during July, after full growth of fruits approximately), during 2008 to 2009, respectively.

On the other side, there was no significant ($P > 0.05$) variation between infection by *E. ceratonia* on healthy and cracked fruits during 2008 to 2009, while the total mean of infection, at the middle of Taif, was recorded to be moderately significant ($P < 0.01$) at 28.3 immature stages/25 fruits, during 2008 only. Infected fruits by *E. ceratonia* were started early (before fruit growth) and its peak of infection reached its maximum on the 19th of June during 2008 to 2009.

In the case of mealy bugs, the mean of infection was recorded at a moderate significant variation ($P < 0.01$) in health fruits which ranked from 171 to 53 immature stages/20 healthy fruits /tree, when compared with the mean of infection on cracked ones which ranged from 3.7 to 8.5 at the investigation area, during 2008 to 2009. The mealy bug attack started early at the fruiting season (20th May), while the maximum peak was reached on the 19th of June during 2008 to 2009.

Susceptibility of five pomegranate cultivars to infection by *V. livia* and *E. ceratonia*

It was found that Hegazy-Bathan cultivar is the highest susceptible cultivar to infection by immature stages of *V. livia*, with a recorded infection of 57.6 and 67.8% of immature stage/20 healthy or cracked fruits/tree, when compared with other investigated cultivars during two successive seasons (2008 and 2009), respectively (Figure 6), while the most resistant one to infection by immature stages of *V. livia* was Al- Taif cultivar, having an infection of 3.5 and 1.8% of immature stage/20 healthy or cracked fruits during 2008 and 2009, repectively.

On the other side, both Magrabi Abu-Halgom and Sweet-Banaty cultivars were moderately susceptible to infection by *E. ceratonia* when compared with other investigated cultivars, while its infection range was between 31.7 and 43% of immature stage/20 healthy or cracked fruits during 2008 and 2009, respectively (Figure 7). However, the most resistant one to infection by immature stages of *E. ceratonia* was noticed at Wonderful-mangulatory cultivar when compared with others, having a recorded infection of 0.0 and 2.4% of immature stage/20 healthy or cracked fruits during 2008 and 2009, respectively.

In conclusion, this study showed that the population density of the immature stage of *V. livia* was healthier than that of the cracked fruit, while *E. ceratonia* was shown conversely. In addition, three insects were highly infested at 2008 than at 2009. These observations may be attributed to climatic factors, types of trees or crops which were cultivated around or in between pomegranate

Table 1. Identification of tested pomegranate cultivars.

English and vernacular name of tested cultivar	Description
Al-Taify	Fruit size is big; fruit peel (exocarp) colour is orange-yellow; seeds are dark red; taste of its juice is little acidic (Figure 1).
Banaty - sweet	Fruit size is medium; fruit peel (exocarp) colour is green reddish around its neck; seeds colour are white and sometimes faint purple; taste of its juice is sweet without acidity (Figure 2).
Mangaloty-wonderful	Fruit size is big; fruit peel (exocarp) colour is greenish red; seeds colour is light rose; taste of its juice is acidic (Figure 3).
Magrapy – Abu-halgom	Fruit size is ranged from middle to big; fruit peel (exocarp) colour is ranged from light to dark red; fruits seeds colour are dark red; taste of its juice is little acidity; plant has spins (Figure 4).
Hegazy – Bathan	Fruit size is ranged from small to medium; fruit peel colour is light orange; seeds are pink; taste of its juice is sweet (Figure 5).

Table 2. Population density of insects attacking fruits of pomegranates trees fruits at different regions in Al Taif city during fruiting seasons 2008.

Investigated date area	*Virchola livia*						*Ectomyelois ceratonia*						Mealy bug					
	Mean number of immature stage/20 healthy fruits/tree or/and 5 cracked fruits/tree																	
	Al – Shafa		Middle Al Taif		Al-Rodf		Al – Shafa		Middle Al Taif		Al-Rodf		Al – Shafa		Middle Al Taif		Al-Rodf	
	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked
20/5/2008	0.0	0.0	2	0.0	6	0.0	0.0	0.0	0.0	0.0	0.2	5	18.2	0.0	8.6	0.0	79.1	0.0
4/6/2008	0.0	0.0	10	0.0	0.0	5	0.0	0.0	5	6	2	4	106	0.0	12.2	42.2	140.8	3.5
19/6/2008	11.5	0.0	14	10	15	5	20	5	20	15	3	15	181.5	0.0	20.2	65.2	233	18.2
4/7/2008	24	10.0	26	20	20	3.2	0.0	5	20	20	15	20	111	26	382	0.0	84.5	2.5
19/7/2008	18.5	15	26	29	20	10	15.5	3	17.5	10	18.5	7	178.5	0.0	292	0.0	219.5	7.5
3/8/2008	17	5	31	22	36	3	11.5	1	19.5	25	18	4.8	72.2	0.0	337	16	151.5	2.2
18/8/2008	26	10	32	24	26	2	20	2.8	20	20	17.5	8	114	0.0	146	0.0	75.2	1.5
Means	13.8	5.7	20.1	15	17.8	4.03	9.6	2.4	14.6	13.7	10.6	9.1	111.6	3.7	171.1	17.6	140.5	5.1
Total means	19.5[a]		35.1[b]		21.83[a]		12[a.]		28.3[c.]		19.7[a.]		115.3[a`]		188.7[a`]		145.6[a`]	
Statistical analysis	$L.S.D._{.0.05}$= 11.4; $L.S.D_{0.01}$= 15.4						$L.S.D._{.0.05}$= 8.8; $L.S.D_{0.01}$=11.83						$L.S.D._{.0.05}$= 82.96;$L.S.D_{0.01}$= 110.9					

Means with the same letters for each insect have no significant difference (P > 0.05).

Table 3. Population density insects attacking fruits of pomegranates trees fruits at different regions in Al Taif city during fruiting seasons 2009.

Investigated date area	*Virchola livia*				*Ectomyelois ceratonia*				Mealy bug			
	Mean number of immature stage/20 healthy fruits/tree or/and 5 cracked fruits/tree											
	Al – Shafa		Middle Al Taif		Al – Shafa		Middle Al Taif		Al – Shafa		Middle Al Taif	
	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked	Healthy	Cracked
20/5/2009	1.5	0.0	0.0	0.2	0.0	0.0	0.2	1	29.1	0.0	8.6	0.0
4/6/2009	10	0.5	0.0	4.2	8	16	2.5	1	43.5	3.2	12.2	14.2
19/6/2009	10	12	15	1.5	10	3.5	0.5	13	27	51	120	16.5
3/7/2009	12.5	13	10	18	10	12	10	5	84.5	2.2	112	0.0
18/7/2009	8	11.5	38	28	18	19	18	28	119.5	1.4	61.2	0.0
1/8/2009	13.5	11.2	42	10	15	24	18	28	101.2	0.0	23.5	1.2
16/8/2009	10	16	38	28	19	22.5	14.5	16.5	75.2	1.5	34.5	0.0
Means	9.4	9.2	20.4	12.8	11.9	13.9	9.1	13.2	68.6	8.5	53.1	4.6
Total means	18.6[a]		33.2[b]		25.8 [a.]		22.3[a.]		77.1 [a`]		57.7 [a`]	
Statistical analysis	$L.S.D_{0.05}$ = 12.7; $L.S.D_{0.01}$ = 17.34				$L.S.D_{0.05}$= 9.91; $L.S.D_{0.01}$= 13.42				$L.S.D_{0.05}$= 34.47; $L.S.D_{0.01}$= 46.71			

Means with the same letters have no significant difference (P > 0.05).

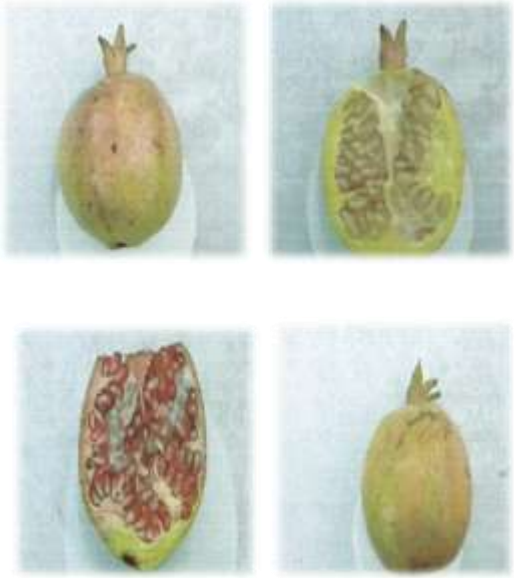

Figure 1. External and internal shape of Al- Taify pomegranate varieties.

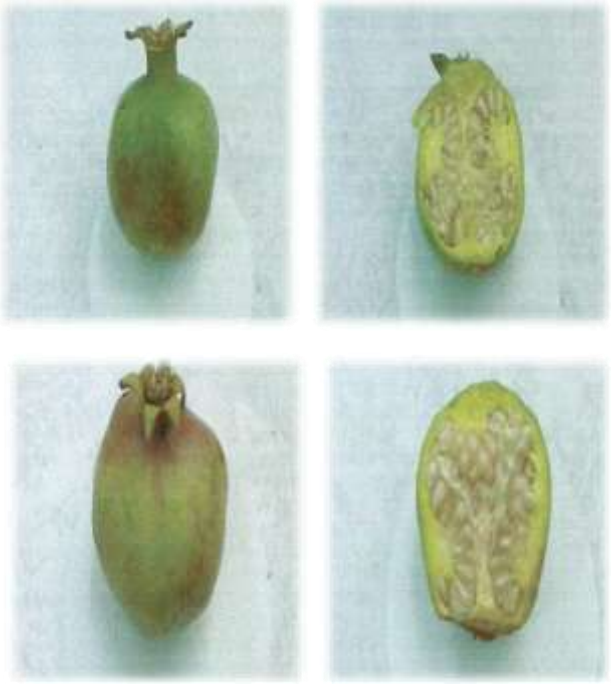

Figure 2. External and internal shape of Banaty pomegranate varieties.

Figure 3. External and internal shape of Mangaloty-wonderful pomegranate varieties.

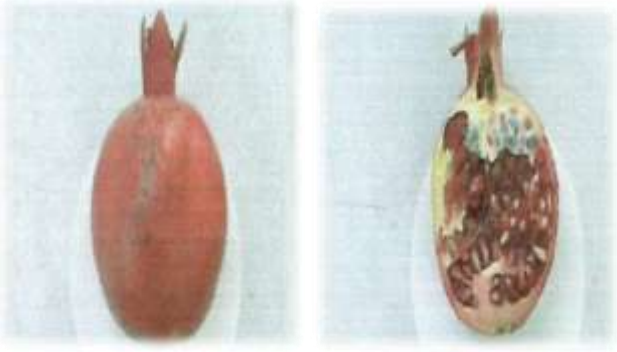

Figure 4. External and internal shape of Magrapy -Abu-halgom pomegranate varieties.

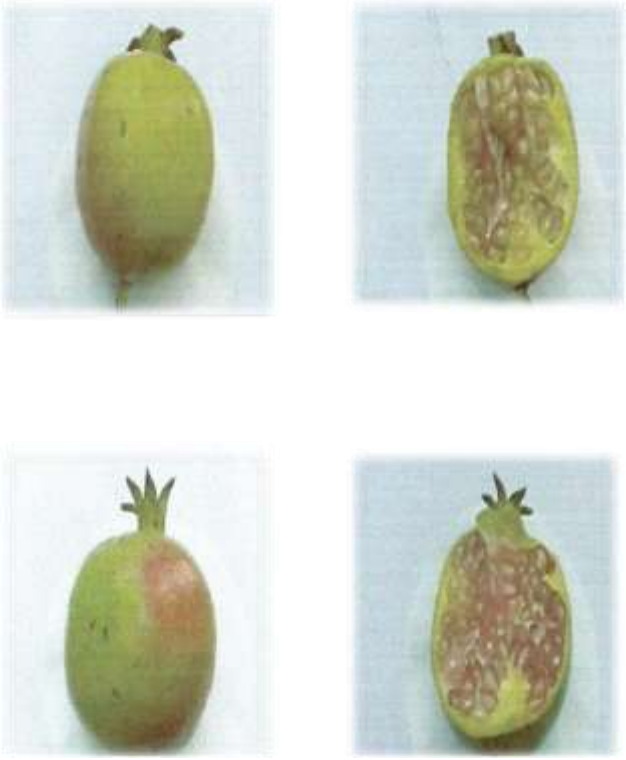

Figure 5. External and internal shape of Hegazy - Bathan pomegranate varieties.

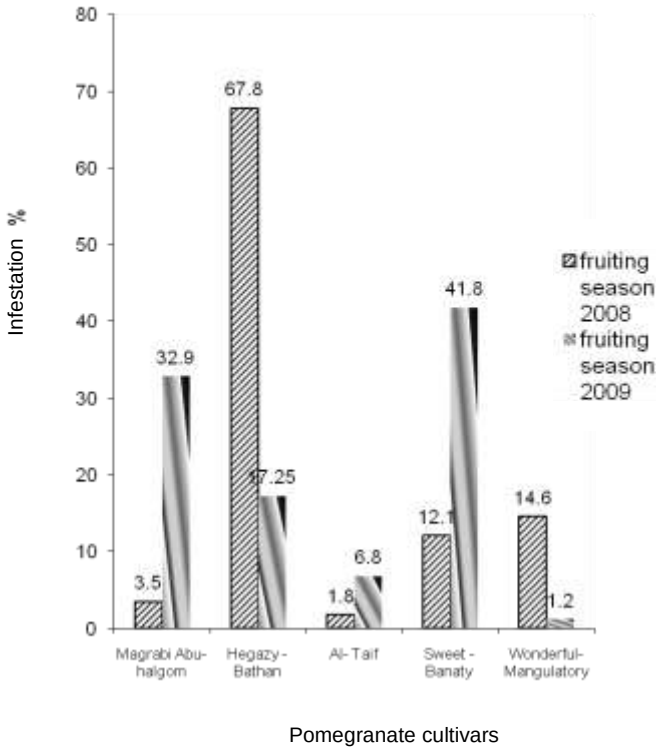

Figure 6. Susceptibility of different pomegranate varieties to infestation by V. livia during two fruiting seasons (2008 to 2009).

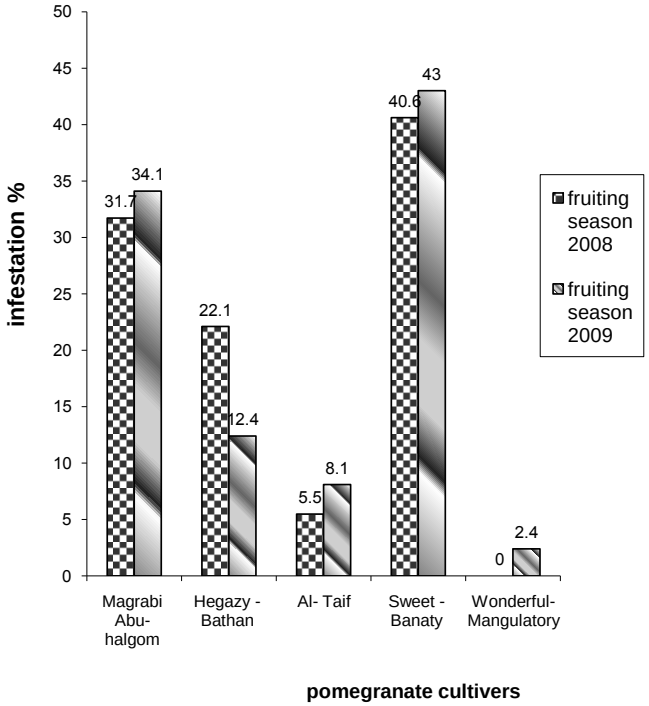

Figure 7. Susceptibility of different pomegranate varieties to infestation by *E. ceratonia* during two fruiting seasons (2008 to 2009).

trees.

Additionally, there are variations in the susceptibility of five pomegranate trees to infection by *E. ceratonia* and *V. livia* which may be attributed to a variation in the physical characteristic of each one (as color, tissue hardness, etc.) or the chemical constituents which affected insects selection.

Generally, the ultimate goal of the entire process of host plant selection, comprising host finding, recognition and acceptance of the food plant utilization, is maximized in the fitness or fecundity of insects (Mitchell, 1981). Host acceptance depended on the palatability of the food, which is a function of the ratio of positive to negative sensory factors. Once the food plant is accepted by the insect, the plant is considered suitable. However, several chemical constituents of plant cultivars serve as olfactory and gustatory stimuli to insect attack, like sugar or amino acids. Such stimuli are specific and are crucial in evoking the behavioral response of insect preference or antixenosis to plant (Panda and Khush, 1995).

Recommendations

Based on the previous data, the following recommenddations could be considered: (1) Removing cracked fruits from the tree or those that fell on the ground; (2) cover the fruits before complete maturation (during the middle of June) or follow any protection program; (3) cultivation of the most resistance varieties.

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