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ORIGINAL PAPER

# Influence of some agrochemical products on Loquat inflorescence blight, leaf spot and fruit rot diseases.

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## ABSTRACT

Inflorescence blight, leaf spot and fruit rot are the most important diseases that significantly decrease the production of loquat trees in Egypt. The typical symptoms were observed on loquat trees cv. Emanuel (15-years- old) grown in the Experimental Farm at El-Qanater El-Khairia Horticultural Research Station (EHRS), Agricultural Research Centre (ARC), Qaloubiya governorate during 2021/2022 and 2022/2023. Disease incidence and disease severity were higher during 2022/2023 than 2021/2022 under natural field infection. *Alternaria alternata* (Fr.)Keissler and *Monilinia fructicola* G.Wint. fungi were isolated from diseased inflorescences, diseased spotted leaves and fruits furthermore, *Fusarium solani* Mart. fungus was isolated from spotted leaves. *M. fructicola* showed the highest frequency among fungi isolated from diseased inflorescences and leaves but *A. alternata* was the highest isolated fungus from rotted fruits. Pathogenicity test showed that *A. alternata* and *M. fructicola* were able to induce inflorescence blight, leaf spot and fruit rot diseases on loquat. On the other hand, little spots were appeared on leaves inoculated by *F. solani*. *In vitro*, the efficacy of four agrochemical products (Score 25%, Scar Nat 70%, Pyrmadol 40% and Decent 32.5%) was measured on the linear growth of the isolated fungi. Generally, growth of the isolated fungi was totally inhibited with Score (25% EC), Scar Nat (70% WP), Pyrmadol (40% SC) and Decent (32.5% EC) at the rate of 1ml or 1g/L. Score and Decent were more effective than Scar Nat and Pyrmadol. *In vivo*, under filed conditions, treatment with Score (100 ml/100 L water) significantly decreased inflorescence blight, leaf spot and fruit rot diseases during the two experimental seasons followed by Decent (100 ml/100 L water) and the lowest efficacy was obtained with Pyrmadol (100 ml/100 L water).
**Keywords:** Loquat, *Eriobotrya japonica*. *Alternaria alternata*, *Monilinia fructicola*.

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## INTRODUCTION

Loquat (*Eriobotrya japonica* Lindl) is a tropical and subtropical tree within the genus Erobotrya belonging to family Rosaceae, grown commercially for its eatable's fruits. Loquat is the English name but Beshmelah is the Arabic name. Loquat fruit is yellow to orange, contains 3-4 seeds, 5-6 cm long and sweet test as well as pear-shaped. Thirty countries *i.e.*, Italy, Turkey, Syria, Egypt and others have planted loquat trees while the trees are native and commercial in China as well as Japan (Alwash, 2017). In Egypt, loquat was introduced at 1805-1849 but the fruit is not widely known. Cultivars grown in Egypt include El-Sukkary, Emanuel and Premiere (Elsabagh, 2011). Loquat trees are liable to infection by several pests, fungal pathogens and other pathogens have been reported to cause diseases on loquat. Moreover, brown rot disease caused by *Monilinia fructicola* is the most important disease on Loquat and cause many damages on loquat fruit and other parts on trees therefore, worrying disease in the future, the causal pathogen fond and which has been extensively reported on peach, plum, apricot, cherry, apple and pear (Michailides *et al*., 2007 and Luo, 2017). The first report from China, *Monilia* spp. were isolated and identified also using molecular analysis from diseased loquat fruits showing fruit rot symptoms. In addition, *M. yunnanensis*, *M. fructicola* and *M. mumecola* cause brown rot disease on loquat fruits. From the three fungi, *M. fructicola* appeared to be the most virulent one in the pathogenicity on loquat and peach fruits. (Yin *et al*., 2021). In Japan, *Fusarium* sp. caused fruit rot disease of loquat (Takushi and Kamekawa 2011). Furthermore, the first report in Pakistan reported that *F. solani* was isolated from loquat fruit showing rot disease (Abbas *et al*. 2017). Also, the fungal species in the genus *Alternaria* are common necrotrophs with different lifestyles, ranging from saprotrophes to endophytes to pathogens. *Alternaria alternata* causes several diseases on Loquat trees such leaf spot, fruit rot and other diseases in Greece (Tziros, 2013). Furthermore, *A. alternata* has been reported as the causal pathogen of leaf spot and fruit rot diseases on loquat in Palestine (Batta, 2005). This study focused on loquat inflorescence blight, leaf spot and fruit rot diseases, isolation and identification of the pathogenic fungi. In Egypt, to date many information are missed for about the control of loquat diseases. The present study measured the reduction of inflorescence blight, fruit rot and leaf spot diseases of loquat on Emanuel cultivar (15 years- old), during 2021/2022 and 2022/2023 by using, four agrochemical products, Score 25% EC, Scar Nat 70% WP, Pyrmadol 40% SC and Decent 32.5% EC.

## MATERIALS AND METHODS

### Disease incidence and disease severity (%) under natural infection:

This experiment was achieved on loquat trees cv. Emanuel (15-years- old) grown in an experimental farm at El-Qanater El-Khairia, Horticultural Research Station (EHRS), Agricultural Research Centre (ARC), Qaloubiya governorate during 2021/2022 and 2022/2023. Loquat tress was designed as three replicates and each replicate consisted of ten trees. Disease incidence (%) as well as disease severity (%) of (inflorescence blight, fruit rots and leaf spot) were estimated. Disease incidence (%) was calculated using the following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected inflorescences,fruits and leaves}}{\text{Total number of inspected inflorescences,fruits and leaves}} \times 100$$

The disease severity (%) was determined using the following formula:

$$\text{DS (\%)} = \frac{\Sigma\, n \times v}{5N} \times 100$$

Where:

n= Number of each of infected inflorescences, fruits and leaves of each grade.

N= Total number of the inspected inflorescences, fruits and leaves (each alone).

5 = Maximum disease severity grade.

v = Numerical value of each grade as follows: -

- 0 = healthy inflorescences, fruits and leaves.
- 1 = above 1 - 25% of each, inflorescence blight, fruit rots or leaf spot.
- 2 = above 25- 50% of each, inflorescence blight, fruit rots or leaf spot.
- 3 = above 50- 75% of each, inflorescence blight, fruit rots or leaf spot.
- 4 = more than 75% of each, inflorescence blight, fruit rots or leaf spot.
- 5 = complete inflorescence blight, fruit rots or leaf spot.

### Fungi associated with infected samples:

Isolations were made routinely from symptomatic material of diseased loquat (inflorescence blight, fruit rot and leaf spot). Small pieces of tissues were taken from diseased parts and surface-sterilized in 70% ethanol for 10 sec, 1% NaOCl for 0.5 min, washed two times in sterilized water and dried between two pieces of sterilized filter paper, then planted onto sterilized water agar (WA) medium in Petri plates. Hyphae growing out from the tissue pieces were sub-cultured into sterilized plates containing a new fresh PDA, incubated at 22°C for 3 days. To obtain pure cultures, hyphal-tips were taken to new Potato dextrose agar PDA medium.

All isolates were preliminary identified according to their cultural characteristics and microscopic examination, at Plant Pathology Research Institute, Agric. Res. Center, using the descriptions of, Booth (1971), Barnett & Hunter (1986) and Simmons (1995). Fungal isolates were grown onto PDA in test tubes maintained at 4°C for further studies. Frequency of the fungal isolates was calculated according to Hassan *et al*., (2021).

**Pathogenicity test:**

Pathogenicity test was carried out during 2021/2022 and 2022/2023 on healthy inflorescences, fruits and leaves of cv. Emanuel, Loquat branch (40 - 50 cm) containing one inflorescence and/or some new leaves were thoroughly washed by water, surface sterilized with 1% sodium hypochlorite solution for one min, followed with washing by sterilized water. Branches with prepared inflorescence and/or leaves were individually inserted into one-liter sterilized glass bottles, each containing nutrient solution (2% $K_2SO_4$, 1% Urea, 0.5% $ZnSO_4$ and 0.3% Borax) according to Khamis *et al*. (2007). Concerning fruits, mature loquat fruits were washed by water, surface sterilized with 1% sodium hypochlorite solution for one min, followed by washing with sterilized water. Each inflorescence, leaves and fruits were wounded by small scratch and inoculated individually by spore suspension of *Alternaria alternata*, *Monilinia fructicola* and *Fusarium solani*, each alone ($10^6$spores/ml) collected from 7:8 days old cultures using atomizer (Lachhab *et al*., 2015). Nine inflorescences/fungus were used as three replicates and 6 branches each containing 6:9 leaves/ fungus as three replicates. Three replicates for each fungus and 5 fruits were used for each replicate. Loquat fruits were incubated for 10 days at room temperature. Artificially inoculated inflorescences and leaves were kept for 21 days at greenhouse conditions (22:25°C) and assessed for disease symptoms using the disease severity (%) scale as mentioned before. Additionally, the same numbers of unwounded inflorescences, leaves and fruits were inoculated by spraying spore suspension ($10^6$ spores/ml) of *Alternaria alternata, Monilinia fructicola* and *Fusarium solani*, each alone. Loquat fruits were incubated for 10 days at room temperature. Artificially unwounded inoculated inflorescences and leaves were kept for 21 days at greenhouse conditions at the same temperature (22:25°C). The causal fungi of inflorescence blight, leaf spot and fruit rot were re-isolated again for identity confirmation.

**Bioassays of agrochemical products.**

To decrease the percentage of inflorescence blight, fruit rots and leaf spot, four commercial agrochemical products (Table 1) were evaluated *In vitro* on the linear growth of the isolated fungi, and *In vivo* for their effect on loquat trees cv. Emanuel (15-years- old).

**Table (1):** Tested agrochemical products.

| Product | Active ingredients | Status | Conc./ L |
|---|---|---|---|
| Score 25% | Difenoconazole | EC | 0.5 and 1ml |
| Scar Nat 70% | Thiophanate-methyl | WP | 0.5 and 1g |
| Pyrmadol 40% | Pyrimethanil | SC | 0.5 and 1ml |
| Decent 32.5% | Azoxystrobin 20% + Difenoconazole 12.5% | EC | 0.5 and 1ml |

***In vitro* experiment:**

Four agrochemical products, score 25% EC, Scar Nat 70% WP, Pyrmadol 40% SC and Decent 32.5 % EC were evaluated *in vitro* for their efficacy on linear growth of *M. fructicola* and *A. alternata* (the famous causals of inflorescence blight, fruit rots and leaf spot). Treatments were added each alone to 250 mm flasks containing autoclaved PDA media before solidifying, then poured in 9cm Ø plates. After solidification, the plates were inoculated at the center with disks 5 mm Ø of 7days old cultures of the tested fungus, then incubated at 22:24°C. Untreated plates inoculated with the tested fungi served as control. Six plates were used for each treatment as replicates. When any of the control plates were full growth, the average colony diameter was calculated according to Hassan *et al*., (2021).

**Field experiment.**

This experiment was conducted in a 15-years old cv. Emanuel loquat orchard located in EHRS, ARC, during 2021/2022 and 2022/2023 to evaluate the efficacy of the previously mentioned agrochemical products for controlling inflorescence blight, fruit rot and leaf spot diseases under field conditions using the concentration that gave the best inhibition of the tested pathogens growth *in vitro*, 1ml or 1g/liter water. Nine trees were used as three replicates for each treatment. Additionally, nine trees sprayed with water only were used as control. Treatments were sprayed three times at 15 days intervals, the first application of the tested agrochemical products was sprayed at fruit set (Dec. 10$^{th}$ and 15$^{th}$ for 2021 and 2022, respectively). And also, agrochemical products were sprayed twice, 25 and 15 days before harvest. Loquat trees were fertilized, irrigated and sprayed to prevent insect injury for a healthy growth in the orchard. Disease severity levels (%) of inflorescence blight, fruit rot and leaf spot were calculated at fruit mature stage (March 20$^{th}$ and 25$^{th}$ for 2022 and 2023, respectively). The efficacy of the tested products was calculated using the formula:

$$\%\ \text{Efficacy} = \frac{\text{Control(c)} - \text{Trreatment(t)}}{\text{Control}(c)} \times 100$$

Where:

c= Disease severity of each of inflorescence blight, fruit rot or leaf spot % in the control.

t= Disease severity of each of inflorescence blight, fruit rot or leaf spot % in treated trees.

**Statistical analysis:**

All the obtained data during both years were subjected to analysis of variance method according to Snedecor and Cochran (1990). Duncan's Multiple Range test (Duncan, 1955) was used to compare differences among means.

## RESULTS

**Disease incidence and disease severity (%) under natural infection:**

Data in Table (2) and Figs. (1, 2 and 3) show that values of disease incidence (DI %) and disease severity (DS %) of loquat inflorescence blight, leaf spot and fruit rot under natural infection were higher during 2022/2023 than 2021/2022. Fruit rot showed the highest averages of disease severity in first and second season. Leaf spot showed the lowest disease incidence and severity in the first and second seasons. Inflorescence blight showed the highest averages of disease incidence in the first and the second season.

**Table (2):** Disease incidence and disease severity of loquat inflorescence blight, leaf spot and fruit rot under natural infection during 2021/2022 and 2022/2023 seasons.

| Diseases | 2021/2022 | | 2022/2023 | |
|---|---|---|---|---|
| | DI% | DS% | DI% | DS% |
| Inflorescence blight | 36.66a | 16b | 40a | 18b |
| Leaf spot | 16.66c | 10c | 20c | 12c |
| Fruit rot | 30b | 20a | 33.33b | 23a |

*No significant differences between the treatments with the same letter/s in the same column at P≤0.05
DI%=Disease incidence & DS%= disease severity

**Fungi associated with infected trees:**

Pure cultures of the isolated fungi were identified as *Alternaria alternata* (Fr.) Keissler, *Monilinia fructicola* G.Wint. and *Fusarium solani* Mart. based on the cultural characteristics and microscopic observations. Data in Table (3) show that the three isolated fungi were associated with loquat inflorescence blight, leaf spot and fruit rot symptoms. *A. alternata*, *M. fructicola* were isolated from infected inflorescences, leaves and fruits furthermore, *F. solani* was isolated only from infected leaves. *M. fructicola* was the highest isolated fungus from plant organs infected by inflorescence blight and leaf spot but *A. alternata* showed the highest frequency among the isolated fungi from rotted fruits during the two years of the investigation.

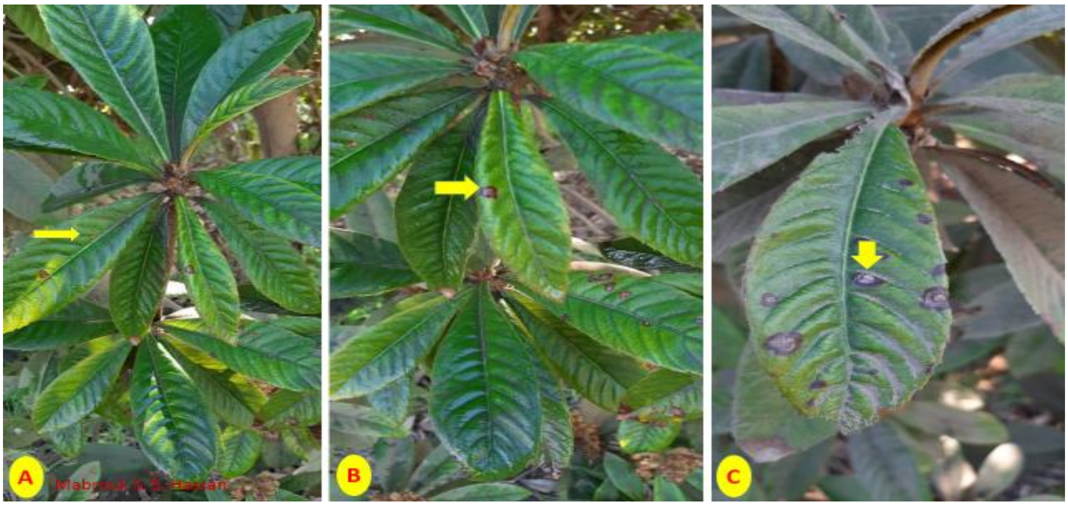

**Fig. (1):** Loquat leaves showing natural leaf spot symptoms (A), (B) and (C).

**Fig. (2):** Healthy loquat inflorescence (A), inflorescence showing typical inflorescence blight symptoms (B) and (C).

**Fig. (3):** Loquat fruit rot symptoms under field conditions. Naturally infected fruit (A), natural typical fruit rot symptoms (B), rotted fruits (C), completely rotted and mummified fruits (D).

**Pathogenicity test:**

Data concerning the pathogenicity test show that *A. alternata* and *M. fructicola* were able to induce inflorescence blight, leaf spot and fruit rot diseases on loquat with different degrees (Figs. 4, 5, 6 and 7). On the other hand, little spots were appeared on leaves inoculated by *F. solani*. Additionally, data in Table (4) show that the highest disease severity of each of inflorescence blight, leaf spot and fruit rot on loquat cv. Emanuel during 2021/2022 and 2022/2023 was obtained from the infection by *M. fructicola* followed by *A. alternata*. Data also indicated that values of disease severity during 2021/2022 were highest than those estimated during 2022/2023 under artificial inoculation in pathogenicity tests. Moreover, little amounts of the diseases were appeared on the unwounded inoculated leaves, inflorescences and fruits by using spore suspension of each of *Alternaria alternata* and *Monilinia fructicola* during or after the incubation period (Fig.8). No symptoms of the diseases were appeared on the unwounded leaves, inflorescences and fruits when inoculated by spore suspension of *Fusarium solani* after the incubation period.

**Table (3):** % Frequency of fungi isolated from loquat trees infected by inflorescence blight, leaf spot and fruit rot diseases during 2021/2022 and 2022/2023.

| Isolated fungi | Frequency % with | | | | | |
|---|---|---|---|---|---|---|
| | Inflorescence blight | | Leaf spot | | Fruit rot | |
| | 2021/2022 | 2022/2023 | 2021/2022 | 2022/2023 | 2021/2022 | 2022/2023 |
| ***Alternaria alternata*** | 48.15b | 40.74b | 44.44b | 37.04b | 55.56a | 51.85a |
| ***Monilinia fructicola*** | 51.85a | 59.26a | 48.15a | 55.55a | 44.44b | 48.15b |
| ***Fusarium solani*** | 0.0 | 0.0 | 7.41c | 7.41c | 0.0 | 0.0 |
| **Total** | 100 | 100 | 100 | 100 | 100 | 100 |

*****No significant differences between the treatments with the same letter/s in the same column at P≤0.05

**Table (4):** Disease severity (%) of inflorescence blight, leaf spot and fruit rot caused by the tested fungi, under artificial inoculation during 2021/2022 and 2022/2023 on loquat cv. Emanuel.

| Isolated fungi | Disease severity (%) on | | | | | |
|---|---|---|---|---|---|---|
| | Inflorescence blight | | Leaf spot | | Fruit rot | |
| | 2021/2022 | 2022/2023 | 2021/2022 | 2022/2023 | 2021/2022 | 2022/2023 |
| *Alternaria alternata* | 34.00b | 26.00b | 16.00b | 14.00b | 38.00b | 33.00b |
| *Monilinia fructicola* | 49.00a | 44.00a | 22.00a | 20.00a | 48.00a | 40.00a |
| *Fusarium solani* | 0.0 | 0.0 | 8.00c | 6.00c | 0.0 | 0.0 |
| Control | 00c | 00 c | 00d | 00d | 00c | 00c |

*No significant differences between the treatments with the same letter/s in the same column at P≤0.05

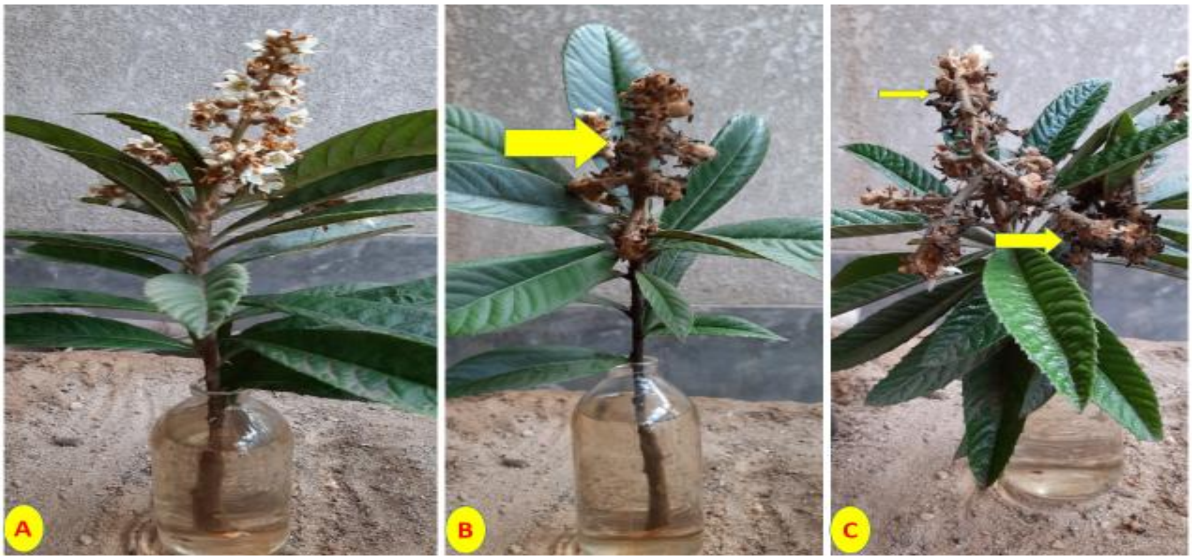


Fig. (4): Healthy loquat inflorescence (A); Symptoms caused by *Alternaria alternata* infection (B) and by *Monilinia fructicola* infection (C) on artificially inoculated loquat inflorescence.

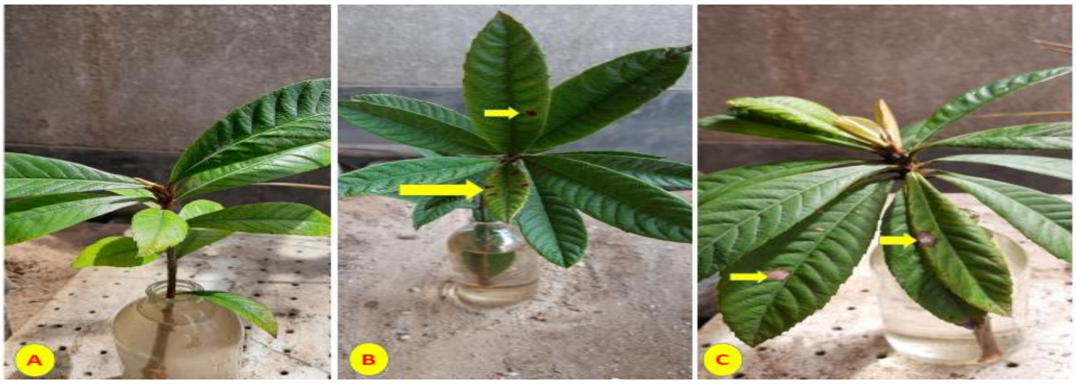


**Fig. (5):** Healthy loquat leaves (A); Symptoms caused by *Alternaria alternata* infection (B) and by *Monilinia fructicola* infection (C) on artificially inoculated loquat leaves.

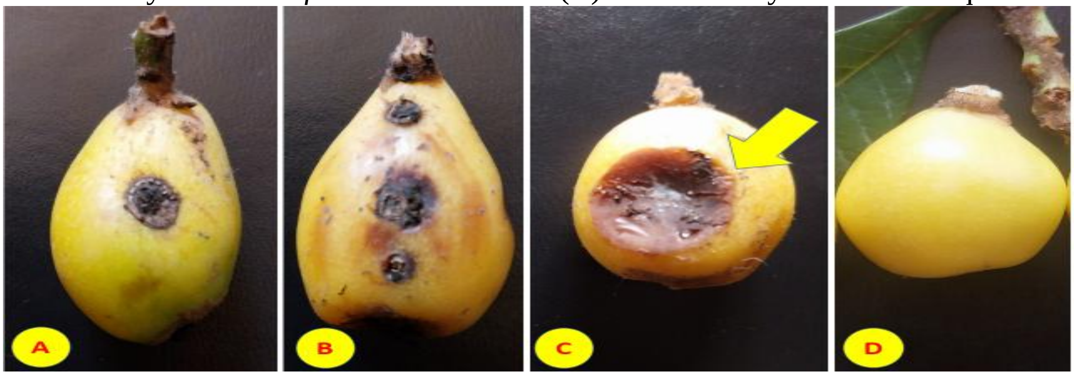


**Fig. (6):** Symptoms caused by *Alternaria alternata* on artificially inoculated loquat fruits (A, B and C) and control (D).


**Fig. (7):** Symptoms caused by *Monilinia fructicola* on artificially inoculated loquat fruits (A) and control (B).


**Fig. (8):** Little amounts of the disease on the unwounded leaves, inflorescences and fruits after inoculation by spore suspension using each of *Alternaria alternata* (A, B and C) and *Monilinia fructicola* (D, E and F) after the incubation period.

**Evaluation of the tested agrochemical products:**

The efficacy of four agrochemical products namely, score 25% EC, Scar Nat 70% WP, Pyrmadol 40% SC and Decent 32.5 % EC was tested *in vitro* to evaluate their effect on the growth of the tested fungi as well as their active ingredient was used *in vivo* to control loquat inflorescence blight, leaf spot and fruit rot diseases.

***In vitro* test:**

Data in Table (5) reveal that all tested treatments reduced the linear growth of *M. fructicola* and *A. alternata* compared with control. Increasing the concentration from 0.5 to 1 ml or 1g of the treatments increased their effects in inhibiting the growth of the tested pathogens. Generally, a complete reduction in colony growth of the tested fungi was observed at the higher concentration (1ml or 1g /L of any tested agrochemical treatment). The highest reduction was recorded by a score of 25% EC and Decent 23.5% EC compared to Scar Nat 70% WP and Pyrmadol 40% SC.

**Table (5):** Efficacy of four commercial agrochemical products on the linear growth of the isolated fungi *in vitro*.

| Treatment | Con./L | *Monilinia fructicola* | | *Alternaria alternata* | | Mean | |
|---|---|---|---|---|---|---|---|
| | | GR (mm) | RD% | GR (mm) | RD% | GR (mm) | RD% |
| Score 25% EC | 0.5 ml | 8.0d | 91.11 | 8.0d | 91.11 | 8.0d | 91.11 |
| | 1 ml | 00.0e | 100 | 00.0e | 100 | 00.0e | 100 |
| Scar Nat 70% WP | 0.5 g | 10.0c | 88.88 | 12.0c | 86.66 | 11.0c | 87.77 |
| | 1 g | 00.0e | 100 | 00.0e | 100 | 00.0e | 100 |
| Pyrmadol 40% SC | 0.5 ml | 13.0b | 85.55 | 15.0b | 83.33 | 14.0b | 84.44 |
| | 1 ml | 00.0e | 100 | 00.0e | 100 | 00.0e | 100 |
| Decent 32.5% EC | 0.5 ml | 8.0d | 91.11 | 8.0d | 91.11 | 8.0d | 91.11 |
| | 1 ml | 00.0e | 100 | 00.0e | 100 | 00.0e | 100 |
| Control | - | 90a | - | 90a | - | 90a | - |

* No significant differences between the treatments with the same letter/s in the same column at P≤0.05. GR= growth & RD= reduction

***In vivo* experiment:**

Efficacy of the tested agrochemical products was evaluated for the control of loquat inflorescence blight, leaf spot and fruit rot diseases under field conditions. Data in Tables (6 and 7) show that 1ml/ L water of Score 25% EC was the best treatment that recorded efficacy 69.99, 68.00 and 75.00 and 80.00, 69.99 and 72.09 % against inflorescence blight, leaf spot and fruit rot during 2021/2022 and 2022/2023 respectively, followed by 1ml/ L Decent 32.5% EC that recorded efficacy 65.00, 63.98 and 70.00 and 76.70, 65.00 and 67.44 % against inflorescence blight, leaf spot and fruit rot during 2021/2022 and 2022/2023 seasons, respectively.

**Table (6):** Efficacy of four commercial agrochemical products on disease severity (%) of loquat inflorescence blight, leaf spot and fruit rot diseases, during 2021/2022 season.

| Treatment | Con./L | 2021/2022 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Inflorescence blight | | Leaf spot | | Fruit rot | |
| | | DS% | Eff.% | DS% | Eff.% | DS% | Eff.% |
| Score 25% EC | 1ml | 8.00d | 69.99 | 5.33e | 68.00 | 6.00e | 75.00 |
| Scar Nat 70% WP | 1g | 13.33b | 50.00 | 6.66c | 60.02 | 9.60b | 60.00 |
| Pyrmadol 40%SC | 1ml | 13.33b | 50.00 | 7.00b | 57.98 | 8.00c | 66.66 |
| Decent 32.5% EC | 1ml | 9.33c | 65.00 | 6.00d | 63.98 | 7.20d | 70.00 |
| Water | -- | 26.66a | -- | 16.66a | -- | 24.00a | -- |

*No significant differences between the treatments with the same letter/s in the same column at P≤0.05
DS =Disease severity & Eff. = Efficacy of tested product

The lowest efficacy was recorded when loquat trees were sprayed with 1ml/ L Pyrmadol 40% SC. In general, all the tested commercial agrochemicals reduced inflorescence blight, leaf spot and fruit rot diseases compared with control treatment in both seasons.

**Table (7):** Efficacy of four commercial agrochemicals products on disease severity (%) of loquat inflorescence blight, leaf spot and fruit rot diseases, during 2022/2023 season.

| Treatment | Con./L | 2022/2023 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Inflorescence blight | | Leaf spot | | Fruit rot | |
| | | DS% | Eff.% | DS% | Eff.% | DS% | Eff.% |
| **Score 25% EC** | 1ml | 4.00e | 80.00 | 4.00d | 69.99 | 4.80e | 72.09 |
| **Scar Nat 70% WP** | 1g | 5.33c | 73.35 | 5.33b | 60.01 | 6.00c | 65.11 |
| **Pyrmadol 40%SC** | 1ml | 6.60b | 67.00 | 5.33b | 60.01 | 7.20b | 58.13 |
| **Decent 32.5% EC** | 1ml | 4.66d | 76.70 | 4.66c | 65.00 | 5.60d | 67.44 |
| **Water** | -- | 20.00a | -- | 13.33a | -- | 17.20a | -- |

* No significant differences between the treatments with the same letter/s in the same column at P≤0.05
DS =disease severity & Eff. = Efficacy of tested product

## DISCUSSION

The fruit of the subtropical loquat tree (*Eriobotria japonica* Lindl.) blossoms in the fall, grows throughout the winter, and ripens in the spring before any other fruit, which closes a market gap. Because there aren't many competing fruits on the market in the spring, loquat fruits can be sold for more money (Sultan *et al*., 2015). In addition to being consumed raw, loquat is currently used in the production of jam and jellies (Koba *et al*., 2007; Delfanian, 2015 and Alwash, 2017). In China and Japan, loquat is widely recognized as a medicinal plant (Fouedjou *et al*., 2016) and has been a part of traditional medicine for a millennium (Alwash, 2017). While, loquat fruits are perishable with a postharvest shelf life about 10 days at room temperature because of decay and browning rot which causes economic losses during handling and storage or in marketing (Cao *et al*., 2014). In the present study, results indicated that disease incidence and disease severity of loquat inflorescence blight, leaf spot and fruit rot diseases under natural infection were higher during 2022/2023 than 2021/2022. Fruit rot and inflorescence blight showed the highest average of disease severity in first and second seasons. Leaf spot showed the lowest disease incidence and severity in first and second seasons. Also, in this study *Alternaria alternata* and *Monilinia fructicola* were isolated from plant material infected by inflorescence blight, leaf spot and fruit rot. Furthermore, *Fusarium solani* was isolated only from diseased leaves. *M. fructicola* was the highest fungus isolated from inflorescence blight and leaf spot but *A. alternata* was the highest isolated fungus from rotted fruits during the two years of the present investigation. *Alternaria alternata* and *M. fructicola* were able to induce inflorescence blight, leaf spot and fruit rot diseases on loquat with different degrees. On the other hand, little spots were appeared on leaves inoculated by *F. solani*. The highest values of disease severity due to inflorescence blight, leaf spot and fruit rot on loquat cv. Emanuel were obtained from those infected by *M. fructicola* followed by those infected by *A. alternata*. The obtained results are consistent with Cao *et al*., (2014) Numerous reports have indicated that *Monilinia fructicola* is the cause of brown rot disease on a wide variety of fruits across the globe. On peaches, apricots, apples, pears, and loquats, reports have been made. Serious losses have been reported in Europe, Asia, and South America due to brown rot on apples, pears, and stone fruit caused by Monilinia sp.

(Ogawa and English, 1991). Snowdon (1990) reported that *Alternaria alternata* caused serious damage on pears in Korea and Japan. Li *et al*., (2007) reported that *A. alternata* can cause fruit rot on pear in China. *A. alternata* can infect fruits before or after harvest through weak or injured tissue associated with chemical or mechanical injury (Jones and Aldwinckle, 1990). Many reports are published about *Alternaria* sp. causing leaf spot and fruit rot on loquat in Florida, Japan, Mexico and Taiwan (Ko *et al*., 2010 and Farr and Rossman, 2013). In Iran, Brown rot and leaf spots of loquat trees are caused by *Monilinia fructigena* and *Spilocea pyracanthae*, respectively (Ershad, 2009). *A. alternata* was isolated from loquat leaves and fruits, and its pathogenicity was confirmed (Mirhosseini *et al*., 2015). Our results showed that all tested treatments reduced the linear growth of *M. fructicola* and *A. alternata* on PDA media compared with control. The highest reduction was recorded by Score 25% EC and Decent 23.5 % EC compared to Scar Nat 70% WP and Pyrmadol 40% SC. *In vivo* experiment 1ml/ L water of Score 25% EC was the best treatment followed by 1ml/ L Decent 32.5 EC. While the lowest efficacy was recorded when loquat trees were sprayed with 1ml/ L Pyrmadol 40% SC. In general, all treatments reduced infection by inflorescence blight, leaf spot and fruit rot compared with control treatment in both investigating seasons. These results are in agreement with those recorded by Batta (2005) who found that Score (Difenoconazole) and Switch (cyprodinil+flodioxonil) significantly reduced the lesion diameter of *A. alternata* on treated loquat fruits and leaf discs compared to the control fruits and leaf discs. Also, application these compounds completely inhibited the sporulation of *A. alternata* compared to the untreated control. Chemical fungicides were significantly more effective than the biofungicides, and all the tested compounds particularly Score, 25% SC (Difenoconazole), Amistar 25% SC (Azoxystrobin) and Ridomil 68% WP (Metalaxyl + Mancozeb) significantly reduced incidence and severity of early blight and increased fruits in tomato yields in comparison with control (El-Kholy *et al*., 2021). Score25% SC (Difenoconazole) and Eminent (Tetraconaeole) were the most effective commercial products in controlling leaf spot of sugar beet (El-Sayed *et al*., 2017). Score 25% EC (Difenoconazole 25%) and Bellis 38% WG (25.2% boscalid+12.8% pyraclostrobin) had more effect on apple scab infections and yield productivity (kg/tree), followed by Occidor 50%SC (Carbendazim 50%) and Topsin M-70WP (Thiophanate- methyl 70%)(Radwan and Hassan, 2019). Benzimidazole group is a systemic fungicides such as (Thiophanate-methyl) against a lot of fungal diseases (Morsy and EL-Hefny 2017). Azoxystrobin at 2 and 4 ml/l significantly reduced the development of both panicle and leaf anthracnose of mango trees in field experiment (Sundravadana *et al.,* 2007). Hassan *et al*., (2024) found that, 0.5ml/L Difenoconazole 25 % (Score 25% EC), 0.5g/L Boscalid 25.2 % + Pyraclostrobin 12.8% (Bellis 38%WG) and 1ml/L Thiabendazole (Tekto 50 % SC) completely inhibited the linear growth of all the isolated fungi. Under filed conditions Score 25% EC gave the highest efficacy for controlling fruit drop of mango during the two seasons of investigation on both tested cultivars cv. Montakhab El-Qanater and cv. Ewais, followed by Bellis 38% WG and Tekto 50% SC. While 40 ml/100L water Difenoconazole 15%+ Propiconazole 15% (Craft 30% EC) and 25ml/100 L water Azoxystrobin 20% +Tebuconazole 30 % (Dovex 50% SC) gave the lowest efficacy.

## CONCLUSIONS

This study suggests that *Monilinia fructicola* and *Alternaria alternata* are the main pathogens causing loquat inflorescence blight, leaf spot and fruit rot diseases during 2021/2022 and 2022/2023 in Egypt. Artificial inoculation using these fungi induced typical disease symptoms. Also, loquat trees pre-harvest sprayed three times with 15 days intervals using the tested commercial products, the first application was sprayed at fruit set and also treatments were sprayed twice, 25 and 15 days before harvest with the best concentration of Score 25% EC (Difenoconazole) 1ml/litre, Scar Nat 70% WP (Thiophanate-methyl) 1g / litre, Pyrmadol 40% SC (Pyrimethanil)1ml/litre and Decent 32.5EC (Azoxystrobin 20% + Difenoconazole 12.5%)1ml/litre may help in the control of loquat of inflorescence blight, leaf spot and fruit rot diseases.

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