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## Summary

Potato (*Solanum tuberosum*) is considered one of the most economically important solanaceous crops in Egypt. It occupies wide area of the total area cultivated in Egypt. Potato are attacked with several diseases which causing destructive losses in yield. Early blight caused by *Alternaria solani* is one of the most economic and important diseases. So early blight disease prevention is very important. The obtained results could be summarized as follow:

1- Disease survey mentioned that the most infection percent age of potato plants was occurred by leaf spots, stem canker, seed piece decay, *Verticillum* wilt and *Sclerotium* rot. The percentages of disease incidence were recorded in five Egyptian Governorates, i.e. El-Ismailia (Wadi- El-Mollak), El-Sharkia (El-Salehia), El-Minia (Etledem), El-Bhaira (El-Nubaria) and El-Menofia (Sheben El-Koam and El-Bagor).

2- Six fungi belonging to five genera such as (*Aternaria*, *Rhizoctonia*, *Fusarium*, *Verticillum* and *Sclerotium*) were frequently isolated from each of different potato varieties, i.e. Spunta, Kara and Lady Rositta.

3- From the obtained results it could be noticed generally that all the soil fungi, *R. solani*, *V. albo atrum*, *S.*

*rolfsii* and *F. oxysporum* were significantly varied in their effectiveness on (cv. Spunta ). These fungi severally caused pre-emergence damping-off on the (c.v. Spunta), in contrast to check plants. As regards *R. solani* recorded the highest percentage of pre – emerged seedlings followed by *F. oxysporum*, *V. alboatrum* and *S.rolfsii*). On the other hand, leaf spotting study declared that *A. solani* was the most pathogenic causal agent followed by *A. aternata* at the summer season. So, early blight was chosen to study in this investigation.

4- All the tested isolates of *A. solani* were pathogenic to potato (cv. Spunta) plants causing typical symptoms of the early blight disease. El-Nubaria isolate obtained from El-Behaira proved to be the most aggressive isolate, which caused the highest percentage of disease incidence and disease severity followed by both isolates of El-Salehia which obtained from El-Sharkia and Wadi -El-Mollak which obtained from El-Ismailia. Meanwhile, the other isolates (Sheben- El-Koam and El-Bagor isolates which obtained from El-Menofia ) and ( Etledem isolate which obtained from El-Minia ) gave the lowest disease incidence and disease severity. Therefore this considered as the least aggressive ones.

5- The highly susceptible potato cultivar to *A. solani* was Spunta which gave the highest disease incidence and disease severity followed by Lady Rositta, Baraka, Hermes and Mondial, while the other tested cultivars showed moderate reaction to *A. solani*, which somewhat affected with the disease. Cultivar Burrn was the least one.

6- All the tested plant species which belonging to difference families were actually susceptible to infection with *A. solani* and caused typical symptoms of early blight disease with different degrees according to host species, Tomato, Potato, Eggplant and Carrot were strongly affected by the disease, while Spinach, Cucmber and Pepper were less sensitive to the disease.

7- Potato agar (PA) and tomato agar (TA) were the most favorable for *A. solani* growth. These media gave vigorous and rapid growth compared with vegetable juice (V-8 agar) media.

8- Best sporulation was obtained on V-8 media followed by TA agar media. Moreover, after scratching of 7 day old mycelial growth, the tested isolates were differed in their sporulation on different tested media where the best sporulation was obtained by the most *A. solani* aggressive isolate (from El-Nubaria) followed by El-Salehia and Wadi-

El-Mollak isolates which recorded less sporulation, while no sporulation was recorded on PDA and PA media for all isolates.

9- Six isolates of *A. solani* were evaluated for their ability to produce mycotoxin (s), under laboratory conditions. The obtained data showed that the culture filtrate of some *A. solani* isolates affect on cowpea seed germination and root development reduction % under laboratory conditions.

10- Concentration increasing of *A. solani* culture filtrate, led to decrease potato tuber germination, sprouts and increased leaf spotting %. The most aggressive *A. solani* isolate (from El-Nubaria) had the capability to produce toxic materials.

11- The electrophoresis profile of fungal separated protein with (PAGE) showed differences in the number of bands and molecular weight of *A. solani* proteins. Concerning electrophoresis paterins, protein profiles obtained from six isolates of *A. solani* were separated by SDS-PAGE. Grouping the isolates was not related to their pathogenicity. The highest SL of 72% was observed between the moderately pathogenic isolate No. (4), El-Menofia (Sheben- El-Koam). Similarly, isolates (5), El-Menofia (El-

Bagor) and (4): Sheben- El-Koam).No correlation between protein types of the isolates and their pathogenicity.

12- Plant oils of *Dianthus caryophyllus* and *Cinnamon zylanicum* at different concentrations proved an inhibitory effect against the fungal growth of *A. solani* under *in vitro* conditions. Approximately, effect of the two oils did not varied between the concentrations. While, *Eucalyptus globulus*, *Nigella sativa* and *Ricinus communis* oils had approximately equal effect for each concentration against the fungus under studying, *A. solani*.

13- All the tested different plant extracts of *Eucalyptus globulus*, *Morus alba*, *Rosmarinus officinalis*, *Mentha spicata*, *Innula helelnium* and *Psidium guajava* with different concentrations proved high inhibitory effects against *A. solani* growth under *in vitro* concentrations. Continuance, the plant extract inhibitory effect increased with increasing the concentration of each one .

14-All the tested salts, Sodium bicarbonate, Sodium carbonate, Calcium sulphate and Magnesium sulphate with all different concentrations had approximately equal effect on the mycelial growth of *A. solani in vitro*.



15-In antagonistic experiments, *Trichoderma harzianum* and *T. koningii* were the strongest in antagonistic effect if compared with the other tested antagonisms (*T.hamatum*, *T. longibrachiatum*, *Bacillus subtilis* and *B. sp.* (1, 2 and 3) where the first fungi proved the highest inhibition zone either against the most or the least aggressive *A. solani* isolate, followed by *B. subtilis*, *B. sp.* (1) and *B. sp.* (2), whilst, *B.sp.* (3) had lowest effect against the fungus under studying, *A. solani in vitro*.

16-Disease control experiments revealed that all the tested fungicides caused different inhibitory degrees effect to the linear growth of *A. solani in vitro*.

17-In greenhouse experiments oil concentrations (50.00 and 400.0 ppm) of *Dianthus caryophyllus* and *Cinnamon zylanicum*, respectively lessen the percentage of potato plant infected with early blight disease comparing with that the untreated plants. Efficiency of plant oil treatments increased by increasing thier concentrations while, spraying potato (cv. Spunta) plants by high concentration of oil, *Dianthus caryophyllus* under field conditions decreased the incidence and severity% of the disease comparing with untreated plants.

18- All plant extract concentrations *Eucalyptus globulus*, *Morus alba*, *Rosmarinus officinalis*, *Mentha spicata*, *Innula heleinium* and *Psidium guajava* reduced the percentage of the disease comparing with the control. Furthermore, the results also indicated that the highest reduction of early blight disease proved by *Eucalyptus globulus* followed by *Morus alb* extracts.

19-The results showed that the tested salts of Sodium bicarbonate and Sodium carbonate at the concentrations (0.5 and 5.0 mM), respectively were effective against potato early blight disease comparing with untreated plants (cv. Spunta).

Furthermore, the results indicated a view reduction of the disease by Sodium bicarbonate particularly under field conditions when spraying potato (cv. Spunta) plants by high concentration.

20-All the tested microorganisms either in cultures of *T.harazianum*, *T. koningii* or *Bacillus. subtilis* and *B. sp.*(1) decreased the percentage of potato (cv. Spunta) plants early blight disease comparing with that on the untreated plants either before or after inoculation. Furthermore, the results indicated that the best control of the disease was proved by using *T.harzanum* against the fungus *A. solani* when spraying potato (cv. Spunta) plants under field conditions. In point, the

treatments which were added before infection gave the best results in reduction of the disease if compared with that were added after infection.

21-The early blight disease severity was highly decreased by spraying potato plants (cv. Spunta) with the concentration of 10.0mM Salicylic acid under greenhouse or field conditions.

22-Results indicated that the systemic fungicides which were added before infection gave the best results in reduction of the disease where they were more effective than contact ones in this concern. So, Score 50% EC was the most effective one, followed by Vingoran 77% OH, when sprayed on potato plants (cv. Spunta).

Pervious results declared that there is a correlation between early blight disease and tuber yield loss according to relation between weather elements and early blight infection. When Spraying plants (cv. Spunta) by Score 50% EC (a systemic fungicide) at the rate of 50 cm<sup>3</sup>/100 Liters of water during the 2 years of this work, 2009 and 2010 growing seasons, the experiments were carried out on the summer plantation at Etledem locality, Minia governorate. Data were recorded at March and April of each year. Four replicate plots (1/4 feddan) were kept unsprayed with any fungicide.

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Disease readings were recorded from area ( $6 \times 7 \text{m}^2$ ) in the center of each plot to avoid contamination with the fungicidal treatments of the neighboring treated areas. Potato tuber yield loss due to early blight infection was estimated as complete randomized blocks and divided into 5 treatments and tuber yield in each replicate was determined and average percent tuber yield loss was calculated.

### Recommendations

- Spraying leaves of potato (cv. Spunta) plants by 400.0 ppm of essential plant oils of Carnation (*Dianthus caryophyllus*) and Cinnamon (*Cinnamomum zylanicum*) greatly decreased the percentage of infected plants with early blight disease and disease severity (39.76, 22.07% and 45.81, 27.53%, respectively) comparing with untreated plants (70.21, 54.49%, respectively).
- Spraying leaves of potato (cv. Spunta) plants by 5.0 mM of Sodium bicarbonate greatly decreased the percentage of infected plants with early blight disease and disease severity % (38.8 , 20.47%) comparing with untreated plants (63.93, 50.17), respectively).
- Spraying leaves of potato (cv. Spunta) plants by 75% of aqueous extracts of *Eucalyptus globulus* and *Morus alba* greatly decreased the percentage of infected plants with early blight disease and disease severity % (29.04, 27.45% and 35.85, 22.23%, respectively) comparing with untreated plants 70.56, 51.00% ,respectively).
- Spraying leaves of potato (cv. Spunta) plants by *T. harazianum* reduced the percentage of infected plants

of potato (cv. Spunta) before and after natural infection with early blight disease and disease severity% ( 33.00, 54.50% and 12.49, 21.08%, respectively) comparing with untreated plants particularly before natural infection.

- Spraying leaves of potato (cv. Spunta) plants by 10.0 mM solution of Salicylic acid decreased the percentage of infected plants with early blight disease and disease severity % ( 34.78, 19.80% ,respectively) comparing with untreated plants(66.58, 45.21%,respectively) .
- Spraying leaves of potato (cv.Spunta) plants before and after natural infection with early blight by 50 cm<sup>3</sup>/100 Liters of water from solution of Score 50% EC decreased the percentage of infected plants and disease severity (26.11, 27.90% and 6.55, 9.90%, respectively) comparing with untreated plants particularly before natural infection.