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Occurrence of Apical Bud Rot Disease on Ornamental Palm (*Pritchardia filifera*) in Egypt and its Control

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THIRTEEN bacterial isolates were isolated from collected ornamental palm samples showing apical bud rot symptoms . Only three isolates were able to cause identical bacterial rot on palm leaf rachides tissues *in vitro*. These isolates were identified as *Pseudomonas solanacearum* . It is believed that the present study is the first report that *P. solanacearum* cause apical bud rot infection to the ornamental palm (*Pritchardia filifera*) in Egypt. *In vitro* tests, Acetylsalicylic acid; Salicylic acid; Streptomycin sulphate ; Copper sulphate and Kocide 101 showed high inhibitory effect on the growth of the highly pathogenic bacterial isolate . Moderate inhibitory effect on bacterial growth was observed with Tetracycline and Chloramphenicol, while Borax had no inhibiting effect. Mixing Acetylsalicylic acid with Streptomycin sulphate (Strepto–Acetyle) inhibited bacterial rot development on palm leaf rachides slices *in vitro*. Strepto-Acetyle mixtures were more effective than each compound alone. In greenhouse experiment, application of these mixtures at the same time of bacterial inoculation gave complete reduction (100%) of rot development when compared with their application before (80%) and/or after (60%) bacterial inoculation. It is recommended that the application of Strepto-Acetyle mixture (800 ppm + 60 mM) at the appearance of first sign of disease symptoms might be useful as control measure for apical bud rot of ornamental palm caused by *P. solanacearum* .

Keywords: Acetylsalicylic acid, Apical bud rot, Ornamental palm (*Pritchardia filifera*), *Pseudomonas solanacearum*, Salicylic acid, Streptomycin.

Ornamental plants had received a great attention in the last decades. They represent great commercial value because of their usage for gardens decoration in museums; hotels; touristic villages; private villas and public gardens. They are also considered as raw material for some medicinal and industrial purposes.

Ornamental palm (*Pritchardia filifera*) is restricted to the subtropical region in the world. The knowledge about diseases affecting this plant is somewhat limited. The available literature revealed that some attention was paid to date palm in the last decades . However, some bacterial diseases were reported on palm trees in certain countries to cause great losses. Akiew and Hans (1990) stated that *Pseudomonas solanacearum* infecting a number of palms. The

pathogen infects Alexandra palm trees (*Archontophoenix alexandrae* H.Wendl. & Drude) in a commercial palm nursery in Australia , exhibit wilt, desiccated leaves with brown-black vascular, discoloration and death premature. The isolated bacteria were identified as *Pseudomonas solanacearum*. They added that this is the first report of a member of the Palmae as a host for *P. solanacearum* in Australia and elsewhere. Miller (1992) recorded that bacterial blight disease caused by *Pseudomonas avenae* occurred on the ornamental palm in North America. Moreover, apical bud rot of date palm caused by *Serratia marcesens* was also reported by Al-Rokibah (1996). On the other hand , bacterial blight of Kiwifruit caused by *Pseudomonas syringae* and *P. viridiflava* was reported in California (Conn *et al.*, 1993) . These isolates also caused flower bud rot and blossom blight .

It is interesting to note here that during the authors survey of different palm nurseries located in Delta region , the bacterial apical bud rot disease was found to affect ornamental palm (*P.filifera*) in Egypt. Investigation of this disease is considered important especially in view of the wide prevalence of ornamental palm plantation in Egypt. The objective of the present study was to isolate and identify the pathogen from naturally infected palm (*P. filifera*) and to study their sensitivity to different chemicals and antibiotics as control measures under laboratory and field conditions.

Material and Methods

Isolation and identification of the causal pathogen

Samples of ornamental palm *(P. filifera*) showing apical bud rot symptoms were collected from some private nurseries for palm species production located at Cairo-Alexandria & Cairo-Ismailia desert highways. The percentage of disease incidence of different palm species was estimated.

Isolation of the pathogen was carried out by cutting diseased samples (leaf rachides tissues) to small pieces, surface disinfected in 1% sodium hypochlorite solution for 2 min., then washed in sterilized water and left between two folds of sterilized filter paper to remove the excess water. Specimens were finally placed onto plates containing nutrient agar (NA) medium and incubated at 28 $^{\pm}$ 1° C for five days .The growing bacterial colonies were picked up , streaked on NA slants and then maintained for further studies .

Pathogenicity test and identification of pathogen

The isolated bacteria were tested for their pathogenic ability on palm ,using leaf rachides cuttings of young off-shoots and potato tuber, under laboratory conditions . Koch's postulates were followed in this test.

Leaf rachides cuttings of young ornamental palm (*P. filifera*) off-shoots and potato tuber were surface disinfected by flaming , then cut into 2 cm thick slices with almost equal diameter . Each slice was placed on the surface of moistened filter paper in a Petri-dish. A 0.5 ml of previously prepared suspension (10^7 cfu)

of tested isolates was used for inoculation, and placed at the center of each slice. Five slices were used as replicates as well as control. All treatments were incubated at 28 ± 1°C for 5 days, then examined. Disease readings were expressed as percentage of rotted tissue area (mm^2) relative to the whole tissue area of each tested item .

Bacterial isolates which could invade and colonize tissues of palm (*P.filifera*) slices, were identified according to Lelliott and Dicky (1984). Morphological, physiological and biochemical characteristics of tested bacteria were determined following the methods of Gerhardt (1981); Bradbury (1986); Lelliott & Stead (1987) and Schaad (1980 &1988).

Sensitivity test against chemical compounds

The inhibitory effect of some chemical compounds on bacterial growth was tested *in vitro*. Different concentrations, *i.e.* 0, 25, 50, 100, 200, 400 and 800 ppm based on the active ingredient of each of Streptomycin sulphate, Tetracycline, Chloramphenicol, Copper sulphate, Borax and Kocide 101 were used. Concentrations of Acetylsalicylic acid and Salicylic acid were based on their molecular weight , *i.e.* 0, 10, 20, 30, 40, 50 and 60 mM. A volume of 500 ml NA medium was seeded with 20 ml of bacterial suspension before solidifying, then poured into Petri-dishes. Wells (0.5 cm diameter) were made into solidified medium using cork borer (four wells/plate). Equal volume (0.1ml) of each chemical compound concentration was poured into each well. Four wells were used for each tested concentration as replicates. All plates were left for 15 min. in refrigerator before being incubated at 28 ± 1°C for 72 hr, then the diameter of zone of inhibited bacterial growth was measured.

Disease control

Acetylsalicylic acid and Streptomycin sulphate were tested for their effect on rot development of palm leaf rachides cuttings of young ornamental palm (*P. filifera*) off-shoots inoculated with the pathogenic bacteria. Six mixtures containing equal volumes of various concentrations of each Acetylsalicylic acid and Streptomycin sulphate were used as follows :

1-Acetylsalicylic acid (60 mM)
2-Streptomycin sulphate (800 ppm)
3-Acetylsalicylic acid (60 mM) and Streptomycin sulphate (400 ppm)
4-Acetylsalicylic acid (30 mM) and Streptomycin sulphate (800 ppm)
5-Acetylsalicylic acid (30 mM0 and Streptomycin sulphate (400 ppm)
6-Acetylsalicylic acid (60 mM) and Streptomycin sulphate (800 ppm)

Slices, nearly equal in diameter, of ornamental palm leaf rachides (*P.filifera*) and bacterial suspension were prepared as previously described. A volume of 0.5 ml of each tested concentration was placed on the center of each slice for 12 hrs before and/or after as well as at the same time of artificial bacterial inoculation. Both chemical concentrations and bacterial inoculation were applied at the same site of each tested slice. Another set of slices inoculated only with bacteria served as comparison treatment. Five replicates were used for each particular

treatment . All treatments were incubated at 28 ± 1° C for 4 days then examined . Observations of rot incidence and its development was calculated as percentage of rotted tissue area per tested item .

Bactericidal application as therapy treatment was carried out under natural conditions at private nursery located at the Cairo-Alexandria desert highway. The applied treatments were Acetylsalicylic acid (60 mM); Streptomycin sulphate (800 ppm) and their mixture of equal volumes of each at concentrations of 60 mM and 800 ppm , respectively .

Ornamental palm off-shoots (*P. filifera*), of one year old, artificially inoculated with the pathogenic bacteria through stem injection, 24 hr before and after, as well as at the same time of chemical application .The rate of five ml/ palm of each chemical and bacterial suspension were applied at the same site of tested palm trees. Another set of palm trees were injected only with sterile water and served as control treatment . Five trees were used as replicates for each particular treatment and control as well. Observations for disease symptoms were recorded , then the percentage of infected palm was calculated after three weeks from application time .

Statistical analysis

Data obtained were statistically analyzed according to Steel and Torrie (1960) .

Results and Discussion

Disease symptoms

Infected palm trees, 3-5 years old, (Fig. 1) exhibit wilt symptoms . Wilted leaves showed yellowish color, almost turned to light brown. Apical bud and vascular tissues showed brown-black discoloration, and died prematurely. Copious, milky white droplets of bacterial ooze then formed on freshly cut vascular tissues. Furthermore, the stem apex became decayed as a result of infection development. Under severe infection, the pseudostem, consisting of leaf bases, may fall down leaving naked stem apex .

The occurrence of apical bud rot disease on different palm species was surveyed at different private palm production nurseries located at Cairo-Alexandria & Cairo-Ismailia desert high ways. It was found that among different examined palm species only few numbers of ornamental palm (*P. filifera*) showed disease symptoms. The calculated percentage of diseased palms was 1-3 % at all surveyed locations.

Isolation ; identification and pathogenicity test of causal organisms

Isolation trials from collected palm (*P. filifera*) samples showing apical bud rot symptoms resulted in 13 bacterial isolates. These isolates were tested for their ability to cause rot infection on palm tissues and potato slices under laboratory conditions (Table 1). Data in Table 1 indicate that only three bacterial isolates were able to cause rot symptoms on palm leaf rachides slices tested . No damage

was observed on subjected tissues when artificially inoculated with the remaining 10 of bacterial isolates as well as uninoculated control treatments. Therefore, they were omitted from data presentation and further studies . The importance of bacterial rot has been well documented in studies completed in major areas of the world. Pathogenicity to plant tissues causing rot is considered a positive reaction indicating virulence of bacterial isolates (Alcorn *et al.*,1991).

Fig. 1. Disease symptoms of Apical bud rot on ornamental palm (*Pritchardia filifera*).
(A) Healthy palm . (B &C) Disease development on palm .

TABLE 1. Rot incidence on slices of palm leaf rachides (*P.filifera*) and potato artificially inoculated with some bacterial isolates *in vitro*.

Bacterial isolates	Rotted tissue area %	
	Palm leaf rachides	Potato
Isolate No.1	82.6	0
Isolate No.2	58.4	0
Isolate No.3	62.8	0

LSD at 5% for Isolate (I) : 3.8
Host (H) : 1.6
Between (I x H) : 4.7

In the present study several bacteria were isolated from decayed samples of ornamental palm (*P.filifera*). Three isolates found to be pathogenic and causing rot on palm slices tissues. In this regard, *Pseudomonas* spp. recorded as a pathogen to numbers of palm trees causing wilt symptoms ; flower bud rot and blossom blight diseases (Akiew & Hans,1990 ; Miller, 1992 and Conn *et al.*, 1993).

The pathogenic bacterial isolates were identified according to their morphological, physiological and biochemical characteristics (Table 2 and 3).

Presented data (Table 2) revealed that on solid medium (NGA) the colonies of stated bacteria were round , convex, mucoid with entire margins , white and circular. These isolates were gram negative, non spore former, rods, motile and could grow at 37°C . They could not grow on YDC or MS media , while on KB agar medium , they were not able to produce fluorescent pigment . These isolates showed positive reaction for gelatin liquefaction , O_2 requirements , production of acid from sucrose and in denitrification test. Findings were negative for starch hydrolysis, arginine dihydrolase and H_2S production as well as the ability to macerate potato slices.

Results presented in Table 2 revealed that the three pathogenic bacterial isolates are identified as *Pseudomonas* spp. according to traditional methods adopted for this purpose and introduced by several workers (Gerhardt, 1981 ; Bradbury , 1986; Lelliott & Stead , 1987 and Schaad , 1980 & 1988).

These isolates were kindly completely identified , as shown in Table 3, by Prof. Kamilia M. Osman, Microbiology Dept. Faculty of Veterinary Midicine , Cairo University. The identified bacteria were isolates of *Pseudomonas solanacearum* which recently has a new scientific name as *Ralstonia soranacearum* .

In this respect, similar results were reported by Akiew and Hams (1990) who reported that the isolated bacteria from the infecting dying prematurely Alexandra palm trees (*Archontophoenix alexandrae*) were identified as *Pseudomonas solanacearum* (Smith) based on the scheme presented Sneath *et al.* (1984). They added that the isolates were classified as biovar III on the basis of their ability to utilize three hexose alcohols (manitol, sorbitol and dulcitol) and to produce acid from three disaccharides (cellobiose, maltose and lactose). These reports confirmed the obtained results represented in Table 3 .

TABLE 2.Morphological, physiological and biological characters of three pathogenic bacterial isolates caused apical bud rot on palm (*P.filifera*) .

Test	*Pseudomonas* spp .*		
	Isolate (1)	Isolate (2)	Isolate (3)
Colonies color	White	White	White
Gram stain	-	-	-
Shape	Short rod	Short rod	Short rod
Sporulation	-	-	-
Motility	+	+	+
Growth at 35°C	+	+	+
Growth on MS medium	-	-	-
Growth on YDC medium	-	-	-
Fluorescent pigments on KB agar medium	-	-	-
Maceration of potato slices	-	-	-
Gelatin liquefaction	-	-	-
Starch hydrolysis	-	-	-
Acid from sucrose	+	+	+
Denitrification	+	+	+
O_2 requirements	+	+	+
H_2S production with peptone	-	-	-
Arginine dihydrolase	-	-	-

(+) = Positive reaction , (-) = No reaction .
* This identification was made up after purification and pathogenicity test.

TABLE 3. General and biochemical characteristics of three isolates of *Pseudomonas solanacearum* .

Test		Isolates of *Pseudomonas solanacearum*		
		No. 1	No. 2	No. 3
Mol. % G + C of DNA		66.5	66.5	66.5
Number of polar flagella		1	1	1
Production of brown diffusible pigment		+	+	+
Autotrophic growth with H_2		-	-	-
Oxidase reaction		+	+	+
Pyoverdin production		-	-	-
Pyocyanin production		-	-	-
Growth at 40 °C		-	-	-
Utilization of :	Glucose	+	+	+
	Gluconate	+	+	+
	Glycerol	+	+	+
	Ribose	+	+	+
	Manitol	+	+	+
	Sorbitol	+	+	+
	L-arabinose	-	-	-
	Maltose	+	+	+
	Cellobiose	+	+	+
	Lactose	+	+	+
	D-xylose	-	-	-
	Glycine	-	-	-
	D-galactose	-	-	-
	Sucrose	+	+	+
	D-tryptophan	-	-	-
	Asparagine	+	+	+
	L-histidine	+	+	+

Sensitivity test against chemical compounds

The inhibitory effect of some chemical compounds as well as antibiotics on bacterial growth was evaluated *in vitro* . Data presented in Table 4 show that all tested chemicals, except borax, and antibiotics caused clear inhibition zone of bacterial growth. These zones varied depending on the compound tested. Acetylsalicylic acid and salicylic acid had pronounced inhibitory effect on bacterial growth, over the other tested compounds, at all concentrations used .

The measured diameter of the inhibited growth zone increased as the concentrations of tested chemicals are increased to reach the maximum (25 and 21) mm at concentrations of 60 mM of Acetylsalicylic acid and Salicylic acid, respectively. Several attempts were carried out by many investigators to study the direct effect of Acetylsalicylic acid and Salicylic acid on growth of various bacteria *in vitro* . Rosini and Standardi (1991) stated that concentrations of 100 and 200 mg/liter (0.7 & 1.4 mM) of Salicylic acid were effective against bacterial contamination in liquid solution. Also, Corthout *et al.* (1994) reported that salicylic acid exhibited potent antibacterial activities against *Bacillus cereus, Streptococcus pyogenes* and *Mycobacterium fortuitum*. They added that the minimum inhibitive concentration was 3.25 mg/ml (23 mM). Furthermore, Lopez-Lopez *et al.*(1995) recorded that concentrations of Acetylsalicylic acid more than 0.04% (30 mM) caused complete inhibition to *Erwinia cartovora* subsp. *cartovora in vitro* .

The present study revealed that concentrations of 10 up to 60 mM of both Acetylsalicylic acid and Salicylic acid were able to inhibit the growth of *Pseudomonas solanacearum* in different extents increasing with the increase in concentrations in an ascending order . Similar effect against the bacterial growth was also observed with both tested antibiotics (tetracycline; chloramphinicol) and copper compounds (copper sulphate; kocide 101) . Data in Table 4 show that the antibiotics have superior inhibiting effect on bacterial growth comparing with copper compounds. Streptomycin sulphate at a concentration of 800 ppm caused the largest inhibition zone measured as 20 mm followed by 15 and 14 mm caused by Chloramphenicol and Tetracycline at the same concentration , respectively . On the other hand , data in Table 4 also show the inhibitory effect of copper compounds on the growth of *Pseudomonas solanacearum* which has been evaluated at different concentrations from 25 up to 800 ppm of active ingredient. It is quite obvious that a high concentration of the copper compound is needed to cause inhibition of the growth of tested bacterium . It was noticed that Copper sulphate and kocide 101 have weak inhibitory effect starting only at concentration of 400 ppm , while no inhibitory effect was observed at all concentrations of borax added to the growth medium . It could be concluded that the suppressive effect of copper compounds may be achieved only at high concentrations. Similar results are also reported by El-Helaly *et al.* (1969); Rushdi *et al.*(1972) and Abdel-Kader *et al.*(1998) .

Control of bacterial diseases in practice, has been carried out by different means. One of the most important methods all over the world is the chemical

method. It was reported that bacterial rot diseases could be successfully controlled by streptomycin sulphate (Smith, 1955; Tatsumi & Miyaura, 1964 and Farag *et al.*,1984) .

TABLE 4. Growth inhibition of *Pseudomonas solanacearum* in response to different chemical compounds and antibiotics.

Tested compounds	Concentrations (ppm)						
	0	25	50	100	200	400	800
Streptomycin sulphate	0*	0	6	8	10	16	20
Tetracycline	0	0	0	0	8	11	14
Chloramphinicol	0	0	0	0	9	12	15
Copper sulphate	0	0	0	0	0	8	10
Kocide 101	0	0	0	0	0	7	9
Borax	0	0	0	0	0	0	0
	Cocentrations (mM)						
	0	10	20	30	40	50	60
Acetylsalicylic acid	0	11	13	15	18	21	25
Salicylic acid	0	8	10	12	14	18	21

* Average measured diameter (mm) of inhibition zone of bacterial growth

Disease control

In present study Streptomycin sulphate at 800 ppm showed the highest inhibitory effect among all treatments. Such concentration is not practical under field conditions. Moreover, high concentrations of Streptomycin sulphate might have phytotoxic effect. Therefore, mixtures of Streptomycin sulphate and Acetylsalicylic acid were evaluated for their efficacy on rot development on leaf rachides of palm (*P.filifera*) off-shoots *in vitro* and under greenhouse conditions. The results presented in Table 5 show obviously that mixing of Streptomycin sulphate with Acetylsalicylic acid has improved the efficacy of Streptomycin against rot development caused by *Pseudomonas solanacearum* .

Strepto–Acetyl mixtures were more effective than each compound alone. This efficacy was increased by increasing the ratio of Acetylsalicylic acid in the mixture. Small amount of Acetylsalicylic acid could be quite effective in disease control when mixed with Streptomycin . Data also indicate that , application of all tested chemicals alone or in mixtures at inoculation time with bacterial inoculation resulted in the highest reduction in rotted tissue area comparing with the two other treatments, although chemicals applied before bacterial inoculation had superior effect ,on disease development, than that after bacterial inoculation .

Application of Strepto-Acetyl mixture (800ppm-60mM) caused the highest reduction in rotted tissue area (71.7 %). Parallel reduction in rotted tissue area was observed by decreasing the ratio of either Streptomycin or Acetylsalicylic acid in the mixture, which ranged between 60.1-63.2 %. On the other hand , application of either Streptomycin or Acetylsalicylic acid alone resulted in the minimum reduction in rotted tissue area of 54.9 and 58.2 % , respectively .

TABLE 5. Rotted tissue area (mm^2) of apical bud rot disease on palm (*P.filifera*) caused by *P. solanacearum* in response to treatments of Streptomycin sulphate , Acetylsalicylic acid and their mixtures *in vitro*.

Tested mixtures	Time of application					
	A	B	C	A	B	C
	Rotted tissue area %			Reduction %		
Streptomycin sulphate 800 ppm	46.3	32.6	58.4	35.9	54.9	19.2
Acetylsalicylic acid 60 mM	40.2	30.2	48.6	44.3	58.2	32.7
Streptomycin sulphate 800 ppm + Acetylsalicylic acid 60 mM	26.6	20.4	38.6	63.2	71.7	46.6
Streptomycin sulphate 800 ppm + Acetylsalicylic acid 30 mM	32.7	26.6	36.4	54.7	63.2	49.6
Streptomycin sulphate 400 ppm + Acetylsalicylic acid 60 mM	29.4	22.8	34.2	59.3	68.4	52.6
Streptomycin sulphate 400 ppm + Acetylsalicylic acid 30 mM	34.4	28.8	40.2	52.4	60.1	44.3
Control	72.3			-		

A : before bacterial inoculation (12 hrs).
B : at the time of bacterial inoculation.
C : after bacterial inoculation (12 hrs).
LSD at 5 % for Chemical compound (C) : 1.8
Time of application (T) : 4.1
Between (C x T) : 6.2

Strepto- Acetyl mixture (800 ppm- 60 mM) which proved to be the most effective treatment against disease development was evaluated under greenhouse conditions.

Data presented in Table 6 revealed that the applied treatments on palm off-shoots showed similar effect on disease development as that recorded *in vitro* experiment . Application of Strepto-Acetyl mixture (800ppm-60mM) at the same time of bacterial inoculation could completely suppress infection . On the other hand, no considerable differences in disease incidence were observed when Strepto-Acetyl mixture was applied either before or after bacterial inoculation , whereas the percentage of infected palm (*P. filifera*) off-shoots was recorded as 20 and 40 % , respectively .

Recorded results, in the present study, indicate that the application of tested chemical compounds and their mixtures at the same time of bacterial inoculation has a direct effect on tested bacteria which was reflected on the presence of smallest rotted area of palm rachides tissues (*in vitro* test) and complete suppression of disease infection of palm off-shoots (in greenhouse experiment) , when compared with the other two times of applications .These results could be attributed to the direct effects of the used compounds on the causal bacteria before setting the infection. The presence of Streptomycin may have a direct effect on bacterial cell permeability which increase the diffusion of the

Acetylsalicylic acid particles and consequently its toxicity to the viable cell. This conclusions is in a harmony with those reported by many researchers that Streptomycin inhibits protein synthesis in bacteria by attaching to the bacterial ribosomes, thus inhibiting their function (Smith, 1955 and Norelli & Gilatrick, 1982).

TABLE 6. Efficacy of streptomycin sulphate and acetylsalicylic acid on the percentage of infected palm (*P.filifera*) off-shoots with apical bud rot disease under artificial inoculation with *Pseudomonas solanacearum*.

Tested mixtures	Time of application					
	A	B	C	A	B	C
	Disease incidence %			Disease reduction %		
Streptomycin sulphate 800 ppm	40	20	80	60	80	20
Acetylsalicylic acid 60 mM	40	20	80	60	80	20
Streptomycin sulphate 800 ppm + Acetylsalicylic acid 60 mM	20	0	40	80	100	60
Control	100	100	100	-	-	-

* percentage of infected palm
A : before bacterial inoculation (24 hr).
B : at the time of bacterial inoculation.
C : after bacterial inoculation (24 hr).

However, Streptomycin may inhibit enzyme activity, therefore the bacterial cell becomes more weak and sensitive to Acetylsalicylic acid. On the other hand, in the present study, remarkable reduction (80%) in disease infection was observed when Strepto-Acetyl compounds applied 24 hr before bacterial inoculation. This observed phenomenon could be attributed to the fact that Acetylsalicylic is one of chemical inducers for plant resistance . In this regard , Salicylic acid and its ester Acetylsalicylic acid were used for induction of resistance in many host-pathogen systems (Dennis and Guest , 1995 & Reglinski *et al.*, 1997) . It was postulated that Salicylic acid may act as transmissible signal for induction of resistance and that have a crucial role in the induction of SAR-gene expression (Neunschwander *et al.*,1995) . Furthermore , it was found that Salicylic acid and Acetylsalicylic acid play their role in inducing SAR by stimulation of biosynthesis of pathogenesis-related proteins (White, 1979 and Raskin, 1992). These reports may explain the recorded findings in the present study .

It could be suggested that application of Strepto- Acetyl mixture (800 ppm-60mM) at the appearance of first sign of disease symptoms might be used as control measure for apical bud rot of ornamental palm (*P. filifera*) caused by *P.solanacearum* under field conditions .

References

Abdel-Kader, M.M., Ashour, A.M.A. and Morsy, A.A. (1998) Studies on soft rot disease of Cactus (*Lemareocereus marginatus* Berger) . *Egypt. J. Phytopathol.* , **26,** 77.

Akiew, E. and Hans, F. (1990) *Archontophoenix alexandrae* , a new host of *Pseudomonas solanacearum* in Australia . *Plant Dis* ., **74** , 615.

Alcorn, S.M. , Orum, T.V., Steigerwalt, A.G. , Foster, J.L.M. , Fogleman, J.C. and Brenner, D.J. (1991) Taxonomy and pathogenicity of *Erwinia cacticida* sp. *Nov. Int. Systematic Bacteria* , **41** , 197 .

Al-Rokibah , A.A. (1996) Apical bud rot of date palm in Al-Qassim, Saudi Arabia . *Bul. Fac. Agric.* Cairo Univ., **47** , 639 .

Bradbury, J.F. (1986) *Guide to Plant Pathogenic Bacteria.* CAB International Mycological Institute , Slough , UK., 254 p.

Conn, K.E. m Gubler, W.D. and Hasey, J.K. (1993) Bacterial blight of Kiwifruit in California . *Plant Dis*., **77** , 228.

Corthout, J., Pieters, L., Claeys, M. , Geerts, S., Berghe-D.,Vanden, Vlietinck, A. and Vanden, Berghe-D. (1994) Antimicrobial and molluscicidal phenolic acids from *Spondias momin* . *Planta Medica* ., **60** , 460.

Dennis, J.J.C. and Guest, D.I. (1995) Acetylsalicylic acid and betaionone decreased the susceptibility of tobacco to tobacco necrosis virus and *Phytophthora parasitica* var *nicotianae* . *Australian Plant Pathology* , **24** , 57.

El-Helaly, A.F., Abo-El-Dahab, M.K. and El-Kazzaz, M.K. (1969) Effect of some fungicides on certain phytopathogenic bacteria. *Egypt. J. Phytopathol.*, **1** , 81.

Farag, N.S. , Lashin, S.M. Abd El-All, R.S. , Shatta, M.H. and Seif El-Yazal, A.M. (1984) Antibiotics and control of potato black-leg and brown rot disease . *Agric. Res. Rev.*, **60** , 149.

Gerhardt, P. (1981) *Manual of Methods for General Bacteriology.* Americ.Soc. Microbiol., Washington, D.C.

Lelliott, R.A. and Dicky, R.S. (1984) Genus VII.Erwinia spp. Pages 469-476 in : Krieg, N.R. and Holt, J.G.(eds.), *Bergey's Manual of Systemic Bacteriology.* Vol.(1)Williams and Wilkins, Baltimore, London. 386 pp.

Lelliott, R.A. and Stead, D.E. (1987) *Methods for the Diagnosis of Bacterial Diseases of Plants.* Blackwell Scientific Publications , Oxford, London, 216 pp.

Lopez-Lopez, M.J., Liebana, E., Marcilla, P. and Beltra, R. (1995) Resistance induced in potato tubers by treatment with acetylsalicylic acid to soft rot produced by *Erwinia cartovora supsp. cartovora* . *J. Phytopathol.*, **143** , 719.

Miller, J.W. (1992) Bacterial blight of fishtail palm caused by *Pseudomonas avenae. Plant Pathology*, **355** , 12.

Neunschwander, M., Vernooij, B., Friedrich, L., Uknes, S., Kessmann, H. and Ryals, J. (1995) Is hydrogen peroxide a second messenger of salicylic acid in systemic aquired resistance ? *Plant Journal* , **8** , 227.

Norelli, J.L. and Gilatric, D.J. (1982) Techniques for screening chemicals for fire blight control .*Plant Dis.*, **66**, 1962.

Raskin, I. (1992) Role of salicylic acid in plants . *Ann. Rev. Plant Physiol.*, **43** , 439.

Reglinski,T. , Pool, P.R. , Whitaker, G. and H oyte, S.M. (1997) Induced resistance against *Sclerotinia sclerotioum* in Kiwifruit leaves . *Plant Pathology*, **46** , 716.

Rosini, G. and Standardi, A. (1991) Decontamination of shoots of apple rootstock "M27" cultivated *in vitro* , by the use of common antiseptic substances. *Rivista-di-Frutticoltura-e- di- Ortofloricoltura* , **53** , 79.

Rushdi, M.H. , Darweish, F.A. and Sellam, M.A. (1972) Toxicity of some gungicides and antibiotics to soft rot inducing *Erwinia* species . *Egypt. J. Phytopathol.* , **4** , 9.

Schaad, N.W. (1980) Laboratory Guide for Identification of Plant Pathgenic Bacteria. pp. 23-39. *Americ. Phytopathol. Soc.*, St. Paul, Minnesota .

Schaad, N.W. (1988) Laboratory Guide for Identification of Plant Pathgenic Bacteria. pp. 44-58. *Americ. Phytopathol. Soc.* , St. Paul, Minnesota .

Smith, W.L. (1955) Streptomycin sulphate for the reduction of bacterial soft rot of Peaked Spinach . *Phytopathology* , **45**, 88.

Sneath , P.A. , Mair , N.S. , Sharpe , M.E. and Holt , J.G. (1984) *Bergey's Manual of Systemic Bacteriology* . vol.II , Willims and Wilkins , Baltimore , pp. 1123 .

Steel, P.G.D. and Torrie, J.H. (1960) *Principles and Procedures of Statistics* . McGraw-Hill Book Company Inc. New York , 488 pp.

Tatsumi,C. and Miyaura, J. (1964) An antibiotic from actinomycetes . II: Effectiveness of some antibiotics against *E. cartovora* . *J. Ferment. Technol.*, **32** , 16 .

White, R.F. (1979) Acetylsalicylic acid (aspirin) induces resistance to tobacco mosaic virus in tobacco . *Virology* , **99** , 410.

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ظهور مـــرض عفن القمة النامية على نخيل الـــزينة " برتشارديا فليفيرا "

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تم عزل بكتيريا سيدوموناس سولاناسيرم مسبب مرض عفن القمة النامية وذلك من نخيل الزينة "برتشارديا فليفيرا " .

تعتبر هذه الدراسة أول تسجيل لاصابة نخيل الزينة "برتشارديا فليفيرا " بمرض عفن القمة النامية المتسبب عن البكتيريا سيدوموناس سولاناسيرم .

تم الحصول على عدد ١٣ عزلة بكتيريا من عينات من اشجار نخيل الزينة تظهر عليها أعراض الإصابة بمرض عفن القمة النامية تم جمعها من مشاتل إنتاج النخيل الموجودة بطريق القاهرة – الإسماعيلية و القاهرة – الإسكندرية الصحراوي .

تم اختبار القدرة المرضيه لهذه العـزلات على إصابـــة شـــرائح النخـــيل و البطاطس وذلك تحت ظروف المعمل ، ووجد أن ثلاث عزلات فقط لها المقدرة على إصابة شرائح النخيل بالعفن بينما فشلت في إحداث ذلك على شرائح البطاطس ، وتم تعريفها كعزلات من البكتيريا سيدوموناس سولاناسيرم .

تم دراسة تأثير بعض المضادات الحيوية و المركبات النحاسية و كذلك أحماض الساليسيلك و الاسيتيل ساليسيلك على تثبيط نمو عزلات سيدوموناس سولاناسيرم تحت ظروف المعمل .

أظهرت كل التركيزات المستخدمة من أحماض الساليسيلك و الاسيتيل ساليسيلك قدرة عالية على تثبيط نمو البكتيريا بينما كانت التركيزات العالية فقط من الاستربتوميسين وكبريتات النحاس و الكوسيد ١٠١ لها نفس التاثير و لم يظهر البوراكس أي تأثير مثبط على نمـــو البكتيريا عند كل التركيزات المستخدمة .

تم دراسة مخلوط من الاستربتوميسين و حمض اسيتيل ساليسيلك على تطور الإصابة المرضية تحت ظروف المعمل على شرائح النخيل و كذلك تحت ظروف الصوبة على أشجار النخيل .. وقد وجد أن عملية الخلط بين المركبين السابقين اكثر كفاءة في خفض تطور الاصابة المرضية عما في حالة استخدام كل مركب على حدة و تزداد هذه الكفاءة بزيادة تركيز حمض اسيتيل ساليسيلك فى الخليط .

وجد ان استخدام خليط من الاستربتوميسين و حمض اسيتيل ساليسيلك فى نفس وقت اجراء العدوى الصناعية بالبكتيريا تحت ظروف الحقل ادى الى مقاومة مرض عفن القمة النامية بنسبة ١٠٠ % وذلك مقارنة بإجراء هذه المعاملة قبل أو بعد العدوى حيث قدرت نسبة خفض الاصابة بـــ ٨٠ % ، ٦٠ % على التوالي .

التوصية باستخدام خليط من " ستربتوميسين – اسيتيل ساليسيلك "(٨٠٠ جزء في المليون– ٦٠ ملليمول) عند بداية ظهور الأعراض المرضية من الممكن ان تفيد في مكافحة مرض عفن القمة النامية في نخيل الزينة " برتشارديا فليفيرا " .