Control of inflorescence rot of date palm by low rate trunk injection with Difenoconazole in a large scale field trial

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Abstract

This work was carried out in Kut Province, 250 km south east of Baghdad, Iraq during 2004-2005-2006 in highly infested plantations. Incidence of disease was recorded in 5136 date palms of many varieties growing in 30 orchards and disease incidence in some varieties was estimated on Feb., 2004. The fungicide Score 250 EC (Difenoconazole) was injected in trunks of palms (n=1386) in low rates (1.2 , 1.5 or 1.7 ml/palm mixed with 50 ml water) during Dec.,2005 – Jan.,2006. Incidence and severity of disease in treated palms were recorded on April, 2006. Results showed that all date palm varieties were susceptible with disease incidence ranged between 48.6 % (var. Zehdi) to 90.6 % (var. Braim) with a mean of 75.5 % , treatment with the fungicide reduced the mean of disease incidence from 75.5 % in untreated palms to 11.7 % with mean control efficacy of 83.9 %. Incidence of disease was reduced by fungicide application (1.7 ml/palm) from 90.6 % in untreated palms to 5.7 % with control efficacy of 93.7 %. These results permit recommendation an effective control of inflorescence rot of date palm by low rate (1.7 ml/palm) trunk injection of the fungicide Score 250 EC a systemic fungicide with high IPM fitness. Injection of fungicide in trees extremely minimizes pollution consequences associated with traditional chemical control applications.

Introduction

Inflorescence rot of date palms (Khamedj) has been discovered by Cavara in Libya, 1925.Since then it was recorded in Egypt and other North African countries, Iraq, Saudi Arabia (Allison, 1952; Hussain, 1958; Al-Ani *et al*., 1971) and recently in South East Spain (Abdullah *et al*., 2005). It is the most dangerous disease of date palms all over the world causing annual losses of about 2 – 15% that increases seriously under conducing environmental conditions reaching 70 – 80% of yield (Zaid *et al*., 2002). The disease is caused primarily by *Mauginiella scaettae* an anamorphic fungus that reproduce by 1 – 6 celled arthroconidia. Other fungi have been found associated with the diseased spathes include *F.oxysporum* , *F.moniliforme*, *F.solani*, *Trichothecium roseum*, *Botrytis aclada*, *Thielaviopsis paradoxa*, *Acremonium strictum* and *Memmoniella sp*. These fungi are considered of minor importance. Primary infections are initiated by hyhpae growing in early season at leaf bases that penetrate flower bud before formation of spathes(Abdullah *et al*.,2005 ; Abdullah *et al*.,2010). The fungus causes partial or complete rot of inflorescence and strands. External symptoms may appear on the spathes as brown or rusty lesions on regions facing the infected floral structures.

Control measures include cultural and sanitary management in addition to chemical spray of palm heads by 3% dichlone or 4% thirame at rate of 8 liters per individual palm (Al Hassan *et al*., 1977; Abdullah *et al*., 2010). The fungicide Score 250 EC (Difenoconazole) was shown to be the most effective out of ten fungicides in control of *Fusarium avenaceum* on chrysanthemum (*Dendranthema grandiflora* Tzvelev) (Kopacki & Wagnar,2006). It was shown to be effective in control of rice blight caused by *Magnaporthe grisea*(Ghazanfar *et al*.,2009). Used as top spray the fungicide Score 250 EC was shown to be the most effective out

of four fungicides against *Mauginiella scaettae* on date palms in small scale experiment during 2003-2005(Al-Yaseri *et al*., 2011). This study was performed to achieve an effective control of the disease by a feasible, less labor and eco-friendly method through injection of palm trunk with low rate of a potent systemic fungicide in large scale field trials.

Materials and Methods

Plant:

Mature date palms *Phoenix dactylifera* L. Cultivars included beside others: Berhie, Braim, Maktom, Khestawi, Zahdi, Jamalalden and Umraney. The date palm trees were 15 – 20 years old with 2 – 6 m tall. The trees were maintained by usual horticultural measures practiced by the growers.

Survey:

Survey was conducted on number of date palm trees at Kut province, 250 km south east of Baghdad in a dominated area by well known varieties to evaluate the incidence of inflorescence rot in 30 orchards.

Fungicide:

Score 250 EC (Difenoconazole) supplied by Syngenta (Swiss Company).

Treatments:

The fungicide was applied once in three concentrations: 1.2, 1.5 and 1.7 ml mixed with 50 ml water /tree by trunk injection started on 1st Dec., 2005 to 1st Jan, 2006. Total number of treated palms is 1386 (Table 3). Application equipment: Hammer drill with borer tube, 19 mm diameter, 20 cm length, solid plastic tube 20 cm length, funnel and beaker 50 ml size. The fungicide was poured into the pores made in the trunk of date palm tree, 1 m above soil surface (Fig. 1).

Disease Incidence:

Disease incidence in untreated palms was surveyed by inspection palm's head for presence of infected spathes with inflorescence rot in 5136 palm in 30 orchards on Feb., 2004(table 1). After treatment with the fungicide, disease incidence was scored on April 2006. Disease incidence was estimated according to the formula:

Disease incidence = (number of infected date palms / total number of date palms) × 100

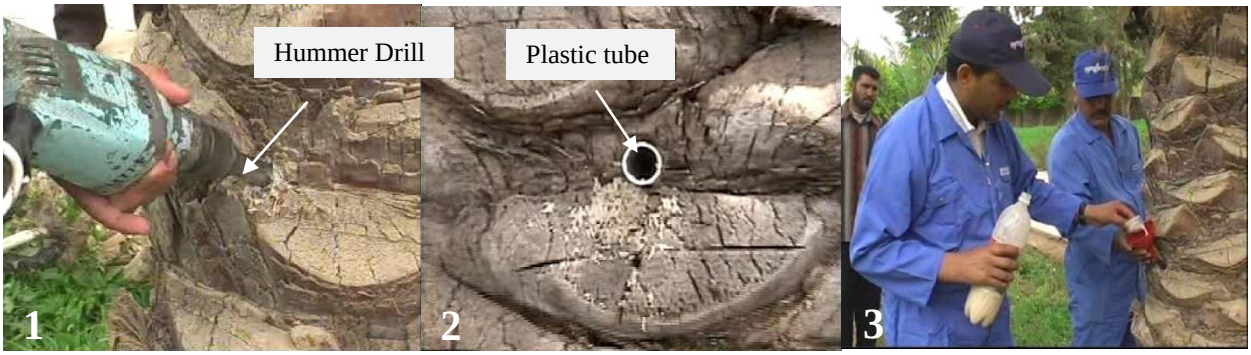


Fig. 1. Mode of application of the fungicide

Percentage of infection:

Percentage of infection was estimated in 4-5 of untreated palms of certain varieties on April, 2004 (table 2) and untreated or treated palms for each variety on April, 2006 (Table 3). Infection percent was scored according to the formula:

% infection = (number of infected spathes / total number of spathes) × 100

Schneider and Orell equation was used to estimate relative efficacy control percent (Dalaly *et al*., 2002) of Score 250 EC on disease incidence for each variety during April, 2006 (table 1).
All other agricultural practices were made as recommended by the farmers.

Pathogen:

Pathogenic fungus was isolated from partially opened spathes showing characteristic symptoms (Fig. 2). Under aseptic conditions , the spathes was opened , the exposed infected strands were released and a loopful of internal fungal growth was transferred to potato dextrose agar plate , incubated at 25-28 °C for 5-7 days. The fungus was identified according to characteristic colony morphology and microscopic examination of mycelium and arthroconidia (Sharif, F. M. *et al*.,2003;Abdulla *et al*.,2005) . This experiment was repeated four times on different spathes.



Results and Discussion:

Survey of inflorescence rot on large number (5136) of date palm cultivated in 30 orchards at Kut Province showed that all varieties are susceptible to disease. Susceptibility is different among date palm cultivars, Zehdi being less susceptible while Berhei and male date palms are the most susceptible. Disease incidence ranged between 48.6 % (var. Zehdi) to 90.6 % (var. Braim) with a mean of 75.5 % (table 1). A comparable disease incidence of 77.71 % was reported on Khistawi variety in Zufurania, Baghdad (Sharif *et al*., 2003). Results are in line with the note reported by (Zaid *et al*., 2002) about varietal susceptibility to disease where Zehdi is among the less susceptible varieties.

Table 1: Effect of Score 250 EC on disease incidence of inflorescence rot caused by *Mauginiella scaettae*, on some date palm varieties

Variety	Total No. of Palms	Total No. of Infected Palms	% infection	% Efficacy

		BT * 2004	AT * 2005-2006	BT 2004	AT 2005-2006	Control **
Berhei	840	700	85	83.3	10.1	87.9
Braim	530	480	30	90.6	5.7	93.7
Jamalaldin	160	90	30	56.3	18.8	66.6
Khistawi	850	700	100	82.4	11.8	85.7
Mactoom	600	480	80	80.0	13.3	83.4
Umrani	90	70	10	77.8	11.1	85.7
Zehdi	350	170	20	48.6	5.7	88.3
Other varieties	1416	1000	216	70.6	15.3	78.3
Male palms	300	270	40	90.0	13.3	85.2
Total or Mean	5136	3960	611	75.5	11.7	83.9

*** BT= Before Treatment, AT= After Treatment. / Dosage rate used 1.7 ml /date palm tree**

**** Schneider & Orell equation was used to estimate relative efficacy percent (Dalaly *et al*., 2002).**

Disease incidence of certain varieties including male date palms is shown in Table 2. All varieties show high disease incidence, Khistawi and Zahdi being the least 60.4 and 68.4 % respectively, while Berhei and male palms show the highest values of 86.3 and 100 % respectively. The mean disease incidence was 78.8 % (Table 2). In a previous work disease severity of inflorescence rot of Khistawi date palms in Zufarania , Baghdad was shown to be 21.67 %(Sharif *et al*.,2003).

Table 2: Incidence of disease indicated by percentage of infected spathes on some date palm varieties during April, 2006

Variety	No. of palms	Total No. of spathes	Total No. of spathes		% Infected spathes
			Infected	healthy	
Berhei	4	35	26	9	86.3
Khistawi	4	41	25	16	60.4
Zehdi	5	50	30	20	68.4
Male palms	4	16	16	0	100
Total of mean	17	142	97	45	78.8

Treatment with the fungicide Score 250 EC reduced the mean of disease incidence from 75.5 % to 11.7 % with mean control efficacy of 83.9 % (table 1). It was reported that application of three fungicides : Benomyl (2g/L) , Bayfidan (2.5g/L) or Topas-Captan (2g/L) as top spray (6 L/palm) or trunk injection (7-10 L/palm) gave non significant reduction in incidence of inflorescence rot on Khistawi palms(Sharif *et al*.,2003).

However, Al-Yaseri *et al*. (2011) showed that Score 250EC used as top spray was the best out of four fungicides in controlling the disease during two successive seasons (2003-2004 and 2004-2005). The fungicide reduced disease incidence from 34.1% in the untreated control to 7.92%.

Disease incidence indicated by percentage of infected spathes was ranged in untreated palms between 60 % (var. Zehdi) to 87.32 % (var. Berhei). Treatment of date palms with Score 250EC

trunk injection (1.2 ml/palm) reduced disease incidence from 87.32 % to 11.1 %. Injection of fungicide by 1.5 ml/palm reduced disease incidence from 74.3 %, 61% and 60 % to 6.25 %, 7.8 % and 8.2 % respectively. Use of 1.7 ml/palm reduced disease incidence from 60 % to 6.6 %. Efficacy control of disease incidence increased with increasing fungicide rate. It was 68.3 % (1.2 ml/palm), 79.2 to 86.3 % (1.5 ml/palm) and 89 % (1.7 mL/palm) (Table 3). It was shown that Benomyl injected in date palm trunk but with larger volume (2 g/L, 7-10 L/palm) significantly reduced disease severity (Sharif *et al*., 2003). Results presented by this study clearly shown that use of low rate (1.7 ml/palm) injection of the fungicide Score 250EC in date palm trunk efficiently reduced both disease incidence and severity of inflorescence rot caused by *Mauginiella scaettae*.

Table 3: Effect of Score 250EC injection on incidence of inflorescence rot caused by *Mauginiella scaettae* on spathe of certain date palm varieties during April, 2006

Variety	Treatment Score 250EC ml/palm	Number of treated palms	Sample size	Number of spathes	% Infected spathes	% Efficacy Control
Berhei	1.2	256	5	72	11.1	68.3
	0.0	4	4	71	87.32	
Zehdi	1.5	350	10	122	8.2	86.3
	0.0	5	5	50	60	
Khistawi	1.5	300	5	64	7.8	84.4
	0.0	4	4	41	61	
Berhei	1.5	390	5	80	6.25	79.2
	0.0	5	4	35	74.3	
Zehdi	1.7	90	5	76	6.6	89
	0.0	5	5	50	60	

- Data was recorded 2 months after treatment

The fungus isolated from all infected spathes by inflorescence rot was *Mauginiella scaettae*. It forms white yellowish colony after 5 days of incubation at 25 - 28 °C. Microscopic examination showed a septate mycelium with abundant 1, 2 or many celled arthroconidia.

The used fungicide Score 250EC is systemic and its mode of action is based on inhibition of steroid biosynthesis of the fungus. It is of the third generation of fungicides with high activity at low application rate, good IPM fitness and waiting period not exceeding 21 days (Pichon, 2001). The low rate and its mode of application as injection provide a safer, environmentally friendly control measure of the disease. Our results showed for the first time the high activity of this fungicide against inflorescence rot on date palm by low rate application as trunk injection. This because the fungicide has not been known to control inflorescence rot and even date palm has not been listed among plants treated by this fungicide in the technical information sheet provided by the producing company (Pichon, 2001).

This study presents an applicable, low cost and safe method for field control of the disease on large scale basis under Iraqi environmental conditions.

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