Occurrence of False Smut on Date Palm (*Phaenix dacyilifera* L.) in the Southern Coastal Plain of Yemen

M. H. Abdul Sattar[1], Watheq A. Aulaqi[1] & A. Rashid Yassin Ibrahim[1]

[1] AREA, Elkod Agricultural Research Station, Abyan, Yemen

Correspondence: M. H. Abdul Sattar, AREA, Elkod Agricultural Research Station, Abyan, Yemen. Tel: 967-733-678-944. E-mail: ghassanms007@yahoo.com

Abstract

Twelve date palm cultivars were evaluated for resistance to Graphiola leaf spot caused by *Graphiola phaenicis* (Moug) poit. The disease incidence and number of sori were compared on both surface of leaf, pinnae position on leaves and plant age. Cultivars Gizaz, Tha'al and Khodari showed negligable infection and fewer number of sori on the leaf surface and rachis. Symptom of disease was absent on leaves and rachis in cultivar Sagaee. These cultivars differed significantly from susceptible cultivars Shahree, Soqotree and Khalas (P = 0.01). Abundant distribution of sori caused a drastic reduction of the leaf area covered by the fungus. Adaxial leaf surface trapped more number of sporidia and significant differences were detected among test cultivars (P = 0.05). The temperature ranging between 32°C-38°C in summer and humidity accompanied by heavy dew in the night and early morning favored the development of infection. Correlation of age on cultivar "Shahree" and disease incidence revealed that older trees are more susceptible to disease.

Keywords: date palm, *Graphiola phaenicis*, southern coastal plain, Yemen

1. Introduction

Leaf spot caused by *Graphiola phaenicis* (Moug) poit. Infects older leaflets and rachis of the date palm (*Phaenix dactilifera*) and causes serious loss in yield (Guar, 2000).

Graphiola phaenicis has been extensively studied and reported from United States (Simone, 2004). Qatar (Abbas & Abdulla, 2004), Libya (Edongali, 1996), Canary Island (Cabrera et al., 1990) and India (Guar, 2000). Attempts have been made to control false smut by application of fungicides (Mehta, Gupta, Tharija, & Dang, 1989). This is not desirable due to its negative impact on public health and environment. The reliance on cultivation of resistant and high yielding cultivars is the safe alternative to minimize pesticide use and consequently reduce the cost of production. Several reports indicated that date palm cultivars differ in their susceptibility to false smut disease (Mehta et al., 1989; Lodha, 2003).

This study is directed to identify the existing date palm cultivars in southern coastal plain and their susceptibility to false smut disease, and the age of plants in terms of disease incidence.

2. Materials and Methods

Present study was conducted during 2006/2007 and involved several visits to date palm orchards in Lahej and Abyan Governorates which constitute the southern coastal plain of the Republic of Yemen. The date palm cultivars in each orchard were identified. Eight trees for each cultivar were randomly selected (Table 1). Leaflets from the apical, middle and base of the rachis were examined for infection by *Graphiola phaenicis*. The number of sori were counted and recorded. Parts of these samples were transported to the laboratory, El Kod Agricultural Research Station for microscopic examination of basidiocarp and sporidia. Readings for incidence of disease for each cultivar were also taken by counting the number of infected trees for a given cultivar divided by total number of trees of a given cultivar in the orchard and expressed as percentage. A total of 360 samples representing the leaves and rachis were collected from three positions of pinnae were examined. The effect of age on the susceptibility of cultivars to false smut was studied utilizing the cultivar "Shahree" which is highly susceptible and widely grown in these areas. Trees 2, 12, 20, and 70 years old were selected for this study.

2.1 Statistical Analysis

All data were analyzed following standard procedures for analysis of variance and differences between means were compared for significance at P = 0.05 and P = 0.01. Correlation and regression analysis were conducted following standard procedures (Steel & Torrie, 1980). In all cases, the data were analyzed utilizing genstat program (genestat 5, No 3.1, 1996).

3. Results and Discussion

Variation in the incidence of Graphiola leaf spot was clearly observed in 12 cultivars. Pathogen and symptom development appeared to be affected by the cultivar, age and position of leaf. Cultivars Gizaz, Tha'al and Khodari showed negligable infection and consequently less number of sori on the leaf surface (Table 1). Symptoms of the disease were almost absent on leaves and rachis in cultivar Sagaee, despite the present of source of inoculum in the proximity of the cultivar. Although no significant differences (P = 0.05) were detected among these highly resistant cultivars, but they differed significantly with the susceptible cultivars (P = 0.01). The symptoms (sori) exhibited a drastic reduction of the leaf area covered by the fungus. This is confirmed by Singh et al. (1970), which reported reduction in leaf area and decline in chlorophyll level in the leaves due to infection by *Graphiola phaenicis*. Comparison of leaf surface revealed that the adaxial leaf surface trapped more number of sporidia than the abaxial surface (Table 1) and therefore, the number of sori was higher and showed significant variation among test cultivars (P = 0.05). The distribution of sori in terms of leaf position was random (Table 2) and contradicts the trend reported by Lodha (2003) which stated higher number of sori at the base on both the abaxial and adaxial surface of leaflets. Temperature ranging from 32-38°C in summer and 18-27°C in winter accompanied by heavy dew in the night and early morning hours regardless of duration are favorable for subsequent development of infection. Comparing this situation with Seiyun, Hadhramout governorate which constitute the eastern plateau and is a major date palm cultivation areain Yemen, It is characterized by dry climate with low humidity and therefore, no false smut are reported in this area (Personal communication, Ashoor AlZubeiri, 2009).This observation is confirmed by Elliot (2006). Regression of age of cultivar "Shahree" on disease incidence and the number of sori gave the highest coefficient of determination (r^2) (Table 3), where the disease incidence was highest in 70 years old trees. Although the coefficient of determination are high and the slopes of the regressions are quite similar, the regressions differ principally in intercept values (Table 3). This explains that older trees are more susceptible to graphiola leaf spot than younger trees.

Table 1. Disease incidence and number of sori at both surface of date palm leaves

No	Cultivar	Disease incidence (%)	Number of sori on leaves		Disease Reaction to false smut
			Abaxial	Adaxial	
1	Shahree	95.0	75.8	83.7	Highly susceptible
2	Medini	9.0	19.5	39.1	Resistant
3	Soqotree	65.0	24.9	30.4	Highly susceptible
4	Barhee	6.0	5.8	12.9	Resistant
5	Gizaz	1.0	1.2	1.86	Highly resistant
6	Zabidi	10.67	4.3	7.1	Resistant
7	Mashtaf	4.0	7.8	12.3	Resistant
8	Tha'al	2.0	5.4	8.9	Highly resistant
9	Khodari	1.67	4.0	6.2	Highly resistant
10	Ghahree	16.7	7.7	11.8	Resistant
11	Khalas	40.0	32.0	44.3	Highly susceptible
12	Sagaee	0.0	0.0	0.0	Highly resistant
	LSD (P= 0.05)	12.26	10.76	20.48	
	LSD (P=0.01)	16.61	14.58	27.76	
	CV	25.42	19.94	25.68	

Table 2. Position of leaves on the pinnae and number of sori on the leaves of date palm

No	Cultivar	Abaxial (Number of sori)			Adaxial (number of sori)		
		Apical	Mid	Base	Apical	Mid	Base
1	Shahree	75.0	108.1	44.3	84.4	119.6	52.1
2	Medini	15.1	19.7	23.6	16.5	20.8	29.5
3	Soqotree	18.3	31.0	25.4	19.8	36.7	34.4
4	Barhee	4.8	5.7	7.0	12.3	13.7	12.7
5	Gizaz	0.9	1.4	1.2	2.0	1.9	1.7
6	Zabidi	4.0	3.9	5.0	6.7	7.0	7.5
7	Mashtaf	3.9	8.2	11.2	7.2	11.6	18.2
8	Tha'al	3.7	4.8	7.7	6.3	8.2	12.3
9	Khodari	5.9	3.1	3.1	8.2	5.2	5.0
10	Ghahree	5.5	8.9	8.8	8.7	15.8	10.8
11	Khalas	23.1	54.7	18.3	29.2	77.1	26.8
12	Sagaee	0.0	0.0	0.0	0.0	0.0	0.0
	LSD (P=0.05)	12.19	24.17	18.25	11.11	32.15	23.81
	LSD (P=0.01)	16.52	32.76	24.73	15.06	43.56	32.26
	CV	23.0	27.85	32.58	21.51	28.66	34.86

Table 3. Relationship between different variables (Y) and age of date palm trees cultivar "Shahree" (X)

Variables	R^2	Fpr	$\hat{Y}= a+ b (x)$
Disease incidence (%)	94.0	< 0.001	$\hat{Y}= 6.26 +1.2784\ x$
No of sori on upper surface of leaf	83.6	< 0.001	$\hat{Y}= 7.00 + 0.978\ x$
No of sori on lower surface of leaf	74.9	< 0.001	$\hat{Y} = 13.09 + 1.028\ x$
No of sori on apical upper surface of leaf	69.9	< 0.001	$\hat{Y} = 11.12 +0.939\ x$
No of sori on mid-upper surface of leaf	80.6	< 0.001	$\hat{Y} = - 0.40 +1.510\ x$
No of sori on basal upper surface of leaf	30.1	0.038	$\hat{Y} = 10.41+ 0.483\ x$
No of sori on apical lower surface of leaf	65.8	< 0.001	$\hat{Y}= 16.36+ 0.999\ x$
No of sori on mid-lower surface of leaf	69.7	< 0.001	$\hat{Y}= 6.8+ 1.574\ x$
No of sori on basal lower surface of leaf	19.8	0.083	$\hat{Y}= 16.09+ 0.510\ x$

Table 4. Relationship between plant age and disease parameters on date palm cv. Shahree

Age of plant (years)	Disease incidence (%)	Average number of sori on upper leaf surface	Average number of sori on lower leaf surface
70	95.0	75.8	85.4
20	30.0	18.3	22.1
12	30.0	31.1	44.1
2	3.0	4.5	7.8
CV	17.5	28.120	16.596
LSD P=0.05	14.2	17.172	20.669
LSD P= 0.01	20.73	24.983	30.072

Reference

Abbas, E. H., & Abdulla, A. S. (2004). First report of false smut disease caused by *Graphiola phaenicis* on date palm trees in Qatar. *Plant Pathology, 53*(6), 815. http://dx.doi.org/10.1111/j.1365-3059.2004.01084.x

Cabrera, R., Hodgson, F., Armas, M. D., Santiago, C. T., Lorenzo, C. D., Prendes, C., & Plata, P. (1990). A fungus disease of canary palm (*Phoenix canariensis* chab.) produced by *Graphiola phaenicis* (Mong)Poit. Fisher in the Canary Islands. *Phytoma Espana, 18*, 21-25.

Edongali, E. A. (1996). Disease of date palms (*Phoenix dactilifera* L.) of Libya. *Arab Journal of Plant Protection, 14*, 41- 43.

Elliot, M. L. (2006). Graphiola leaf spot (False smut of palm). *Florida Cooperative Extension Service*. Retrieved from http://edis.ifas.ufl.edu

Guar, V. K. (2000). Studies on Graphiola leaf spot disease of date palm. *Proceedings of International Conference on "Integrated Plant Disease Management for Sustainable Agriculture", I*, 471-472., New Delhi, India.

Lodha, S. (2003). Influence of pinnae position, leaf age and some fungicides on the Development of graphiola leaf spot on date palm. *Arab Journal of Plant Protection, 21*, 162-165.

Mehta. N., Gupta, P. C., Tharija, R. K., & Dang, J. K. (1989). Varietal behavior and Efficacy of different fungicides for the control of date palm leaf spot caused by *Graphiola phaenicis*. *Tropical Pest Management, 35*, 117-119. http://dx.doi.org/10.1080/09670878909371336

Simone, G. W. (2004). Graphiola leaf spot (false smut). In M. L. Elliot, T. K. Broschat, J. Y. Uchida, & G. W. Simone (Eds.), *Conpendium Of ornamental palm diseases and disorders* (pp. 26-27). St. Paul.MN: American Phytopathological Society.

Singh, M. K., Singh, R., & Jeyarjan, R. (1970). Graphiola leaf spot on date palm (*Phoenix dactilifera*), susceptibility of date varieties and effect on chlorophyll Control. *Plant Disease Reporter, 54*, 617- 619.

Steel, R. G. D., & Torrie, J. H. (1980). Principles and procedures of STATISTICS. A Biometrical approach (2nd Ed.). Mc. Graw Hill Book Company.