International Journal of Horticultural Science and Technology
Vol. 2, No. 2; December 2015, pp 213-218

Influence of Meteorological Factors on Date Bunch Fading Disorder

Mahmood Izadi [1*] and Ali Reza Shahsavar[2]
1. Scientific Faculty of Agricultural and Natural Resources Research and Education Center, Fars, Iran.
2. Department of Horticultural Science, College of Agriculture, Shiraz University, Shiraz, Iran

(Received: 23 September 2015, Accepted: 28 December 2015)

Abstract
Date bunch fading disorder (DBFD) has been one of the major issues facing date palm growers in recent decades. This order has caused high and non-compensable losses to date palm product. Despite numerous studies, predominantly focusing on the causes and mitigation methods of this disorder, no precise influencing factors have been established and practices which can completely control it are not available. Increased temperature and low RH have been mentioned as factors responsible for inducing this disorder, other probable factors are biotic stresses, especially fungal infections. Present research was carried out to determine the effects of climatic factors on DBFD occurrence. For this purpose, ten orchards of ‘Kabkab’ cultivar of date palm with a history of previous symptoms of DBFD were selected in Bushehr province during 2012-13. 20 trees in each orchard were selected and 100 fruits on each tree were chosen. Numbers of faded and non-faded fruits were counted and disorder percentage was calculated. The daily meteorological data at meteorological stations near the experimental locations were recorded. Results showed that the damage rate was higher in the first year compared to the second one. Furthermore, in 2013, there was a decrease in temperature and concomitant increase in relative humidity from 2012. This condition leads to excess surface evaporation from the fruits and causes fruit wilting, which is referred to as DBFD.

Keywords: Bushehr, Climatic factors, ‘Kabkab’, Phoenix dactylifera L.

Introduction

Date palm is a unique, sacred, and ancient tree which bears fruits of high nutritional value. Unfortunately, in recent decades, date bunch fading disorder (DBFD) has caused devastating losses on date palm. It was first reported in 1988 on cultivar 'Mozafati' from Kerman province and gradually spread out to the other main date growing provinces of Iran, such as Hormozgan, Bushehr, and Khuzestan (Pezhman et al., 2005).

Many studies dealing with the causes and mitigation methods of associated losses resulted neither to precise causal factors, nor to practices which can completely inhibit the damage. Increased temperature and low RH have been initially mentioned as factors responsible for inducing this disorder, other probable factors are biotic stresses, especially fungal infections. DBFD usually occurs during conversion from Khalal to Rutab stage. It is often found on soft and semi-dry cultivars, such as ‘Mozafati’, ‘Kabkab’, ‘Mordaseng’, ‘Kalotae’, ‘Sayer’, ‘Barhee’, and ‘Khasee’. Unfortunately, most of the

[*]Corresponding author Email: m.izadi2003@gmail.com

affected cultivars are commercially important in Iran and are vastly under cultivation (Pezhman et al., 2005; Mohebi, 2010). Fungi spores, bacteria, heavy crop loads per tree, lack of proper thinning, and climate changes are among the prospective influencing factors (Karampoor and Pejman, 2007; Mansoori, 2012; Izadi and Aslmoshtaghi, 2015), though none of them proved to be the main cause (Pezhman et al., 2005).

Among the meteorological factors, reduction of air relative humidity, wind speed, and temperature increment have the most impact on DBFD respectively (Pouzesh Shirazi et al., 2008). Some field reports have shown that harsh weather conditions, especially high temperature and wind fires, could spur the DBFD (Alavi, 2000). It has also been reported that the occurrence and severity of this disorder are promoted by low percentage of RH along with high temperature and hot and dry winds (Pouzesh Shirazi et al., 2008; Mohebi, 2010).

The mechanism underlying the effects of living agents on DBFD is not well understood. It is likely that phytotoxin of *Fusarium prolifolium* induces DBFD through elicitation of the ethylene synthesis, bringing about gums deposition in xylem. The xylem blockage or clogging limits the water supply to fruits, which becomes more devastating once the water stress takes place and leads to fruit shriveling and fading (Mansoori, 2012). Of several fungi, such as *Thielaviopsis paradoxa*, isolated from faded bunches of different cultivars, none have been demonstrated to be a causal agent of the disorder. Such fungi may act as secondary factors that infect the trees under stress conditions (Pezhman et al., 2003). It appears that even living agents play a role in the incidence and severity of disorder, but the environmental factors, especially climatic factors, could directly or indirectly (interaction of these factors with living agents) influence the DBFD damages. In terms of the methods of reducing DBFD, practices such as bunch thinning and coverage have been reported beneficial in cultivars 'Kabkab', 'Mozafatee', and 'Khassi' (Pezhman, 2003). Therefore, these findings warrant a research on the effect of climatic factors to provide better understanding of this disorder.

Materials and Methods

This research was conducted in Dashtestan state of Bushehr province (29° 26′ 29″ N, 151° 17′ 18″ E), where the date bunch fading and drying disorder was previously reported and has had the highest rate of incidence. All horticultural practices including pollination, thinning, and arrangement of bunch, pest, disease and weed control, irrigation, and fertilization were conducted conventionally, but based on the results of the studies conducted. For this purpose, 10 orchards with previous symptoms were chosen and 20 trees in each orchard were randomly selected. A sample of 100 fruits was collected from each tree, healthy and damaged fruits were counted, and the average severity of disorder was estimated in both orchard and region.

All meteorological parameters, including maximum, minimum, and average temperature, relative humidity (RH), wind velocity, radiation intensity, and precipitations were recorded for 2 years of experiment by installing a portable data logger at Agricultural and Natural Resources Research Center of Bushehr.

Results

The Damage Rate of Disorder

The results for two years of experiment showed that the DBFD percentage in year 2012 was higher than that of 2013. For example, the damage for cultivar 'Kabkab' was 54.8% and 16.7% for the first and second years, respectively (Fig. 1). According to the unpublished statistics, the damage rate in Bushehr province was higher in the first year compared to the second year, even in some regions with previous incidence of disorder, there was no signs of disorder in 2013.

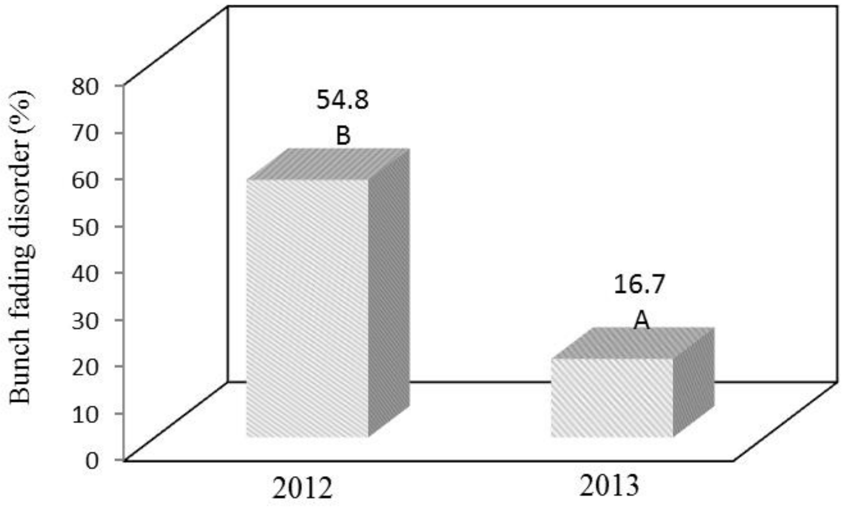

Fig. 1. Percentages of the date palm bunch fading disorder in 2012 and 2013

Meteorological Parameters

The review of the meteorological parameters for two years of experiment (Tables 1 and 2; Fig. 2) indicates that the maximum and average temperatures of 2012 were higher than those of 2013, while the average percentage of RH was lower with the wider ranges of difference at the exact time of disorder incidence (i.e., July and August). The maximum of temperature in July and August of 2012 reached above 50 °C, while at the same period in 2013, the maximum of temperature was recorded as 48.8 and 46.3 °C, respectively. Unlike temperature, the average percentage of RH, especially in June, July, August, and September of 2012 was notably lower than that of 2013; the average of RH% in these 4 months was 19.4, 20.6, 24.6, and 29.3% while for the same period of 2013, it was recorded as 21.9, 27.2, 33.3, 37.3%, respectively. The average of wind speed in July and August of 2012 (1.1 and 0.93 ms^{-1}, respectively) was also higher than those of the same period in 2013 (0.92 and 0.87 ms^{-1}, respectively).

Considering the severity of disorder in the two years of the experiment along with meteorological parameters, it was revealed that temperature, percentage of RH and wind speed had the highest association with the severity of disorder. Therefore, the temperature and wind speed being higher and percentage of RH being lower in 2012 compared with 2013 at the time of disorder incidence was likely to cause the significant increase in DBFD and drying in the first year.

Discussion

The results of this study showed that the severity of disorder varied year to year (Fig. 1). Assessment of the meteorological parameters (Fig. 2, Tables 1 and 2) indicated that in 2012 the average temperature in July, August, and September (i.e., the beginning and progress time of disorder) was higher and percentage of RH was dramatically lower than that of the same period in 2013, with the severity of disorder in the first year being significantly higher. Therefore, it is concluded that the severity of disorder is driven by climatic factors, especially temperature and percentage of RH; the damage level is increased with decreased percentage of RH and increased temperature.

The results presented here for increased damage rate by increased temperature and reduced RH% are in line with results of Mirzaee et al. (2001), Pezhman et al. (2005), Pouzesh Shirazi et al. (2008), and Izadi and Pouzesh Shirazi (2010), reporting the increase of disorder incidence with reduced percentage of RH and increased temperature, but do not confirm these

Table 1. Values for meteorological parameters from April to September 2012

Month	Air temperature (°C)			Relative humidity (%)			Wind speed (m s^{-1})			Solar radiation (W m^{-2})			Soil temperature (°C)			Precipitations (mm)
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
April	36.1	6.2	22.7	71.1	23.0	40.5	7.7	0.59	0.95	295	66	215.7	31.5	17.4	24.8	5.2
May	44.3	15.6	31.5	45.9	12.0	20.4	9.0	0.58	1.15	313	122	261.2	38.9	25.6	32.7	2.6
June	47.1	20.1	34.1	30.8	10.7	19.4	7.9	0.63	1.19	333	201	293.5	41.9	32.4	34.7	0
July	50.6	24.4	35.9	36.7	9.2	20.6	7.3	0.67	1.10	331	248	282.0	43.6	35.6	39.3	0
August	50.8	25.5	37.3	40.0	10.5	24.6	6.3	0.62	0.93	307	238	264.0	44.6	37.2	41.0	2.2
September	47.1	22.4	33.9	29.1	11.9	29.3	8.2	0.47	0.96	251	195	223.0	42.6	34.0	38.2	22.6
Mean	46.0	19.0	32.6	42.3	12.9	25.8	7.7	0.59	1.00	305	178.3	256.5	40.5	30.4	35.1	5.4

Table 2. Values for meteorological parameters from April to September 2013.

Month	Air temperature (°C)			Relative humidity (%)			Wind speed (m s^{-1})			Solar radiation (w m^{-2})			Soil temperature (°C)			Precipitations (mm)
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
April	40.0	9.1	24.3	76.1	22.5	41.75	4.22	0.51	1.06	298	72	249.2	34.7	21.5	27.1	166.8
May	42.7	13.1	26.8	89.2	17.2	38.93	4.36	0.53	1.07	338	82	279.3	37.8	24.3	31.2	14.2
June	44.9	19.7	32.6	32.5	15.1	21.89	4.45	0.59	1.15	346	277	324.3	38.4	33.2	37.3	0
July	48.8	23.0	35.6	47.5	11.9	27.21	3.83	0.58	0.92	322	283	309.1	44.8	36.6	40.8	0
August	46.3	24.9	34.9	61.6	16.7	32.28	3.83	0.51	0.87	300	246	274.1	44.2	37.9	41.1	0
September	39.2	21.6	33.3	59.3	15.2	37.69	3.93	0.47	0.83	275	213	241.6	43.6	35.1	39.4	0
Mean	43.7	18.6	31.3	61.0	16.4	33.46	4.10	0.53	0.98	313	196	279.6	40.6	31.4	36.2	30.2

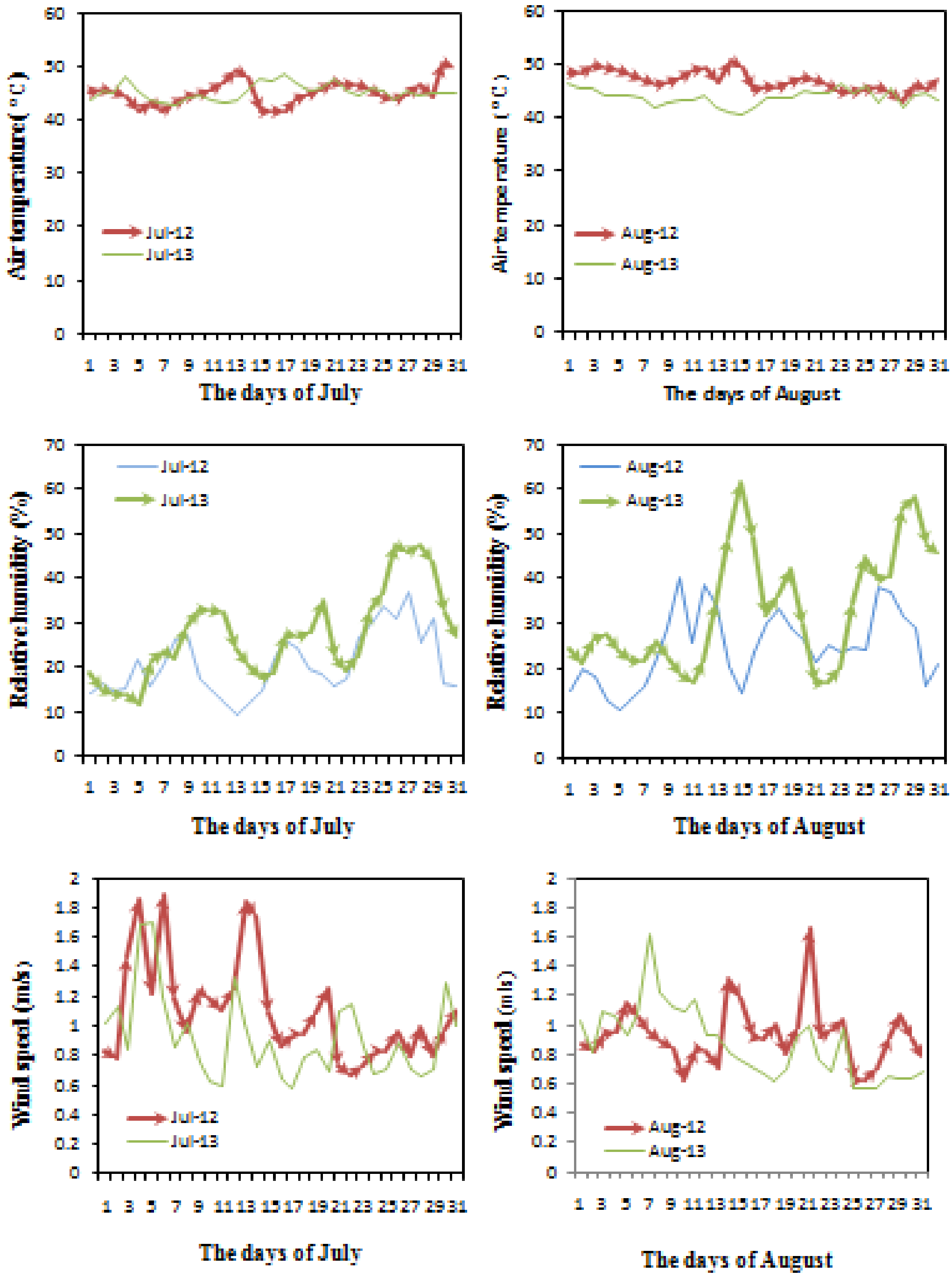

Fig. 2. The mean of air temperature, relative humidity (RH) and wind velocity in July and August of 2012 and 2013

researchers' opinion in identifying the low RH% and high temperature as the primary (main) cause of the disorder. Our explanation would be that although this disorder is happened at high temperature and low RH%, the role of living agents, such as fungi and also the vascular occlusion and the vascular disorder could not be ruled out. To support such idea, some researchers (Karampour and Pejman, 2007; Mansoori, 2012) believe that the main causes of the disorder are the occlusion of vascular bundles by fungi or their toxicity effects. Thus, it is likely that climatic factors play a secondary role in the incidence of the disorder.

References

Alavi, A. 2000. Fading Disaster. 14th Iranian Plant Protection. Isfahan Technical University. p.124 (in Farsi).

Izadi, M. and M. Pouzesh Shirazi. 2010. Effects of Thinning Methods on Date Bunch Disorder at Pollination and Kimri Stages. Acta Hort. 882:899-902.

Izadi, M., and E. Aslemoshtaghi. 2015. Orchard Management for Decreasing Date Palm Bunch Fading Disorder. Int. J. Hort. Sci. Technol., 2(1): 27-32.

Karampour, F., and H. Pejman. 2007. Study on Possible Influence of Pathogenic Fungi on Date Bunch Fading Disorder in Iran. Acta Hort. 739:431-439.

Mansoori, B. 2012. Fusarium Proliferatum Induces Gum in Xylem Vessels as the Cause of Date Bunch Fading in Iran. J. Agr. Sci. and Technol. 14(5):1133-1140.

Mirzaei, M., A. Davoodian and F. Karampour. 2001. Study on Influence of Management Measures of Date Palm Orchards on the Incidence of DBF Disorder. The Final Report Research Project. Agricultural Research Center of Hormozgan Province, Iran. 5p. (in Farsi).

Mohebi, A. 2010. Mineral Elements Concentration in Healthy and Infected Date Bunch Fading Disorder. Acta Hort. 882:345- 352.

Pezhman, H., V. Roshan, and E. Rahkhodaei. 2005. Effects of Cultural Practices on Date Bunch Fading Disorder. Abstracts of the International Conference on Date Palm. Published by King Saud University. 46 p.

Pouzesh Shirazi, M., M. Izadi, and R. Khademi. 2008. Study the Climatical Factors Effects on Bunch Fading Disorder of Date Palm in Southern Iran and the Methods of its Control. American-Eurasian J. Agr. Environ. Sci. 4:570-574.