



SHORT NOTE

Oviposition preference of red palm weevil, *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) to date palm cultivars

MANSOUR AL-BAGSHI¹, ABDULLAH AL-SHAGAG¹, SAMI AL-SAROJ¹,
SALIM AL-BATHER¹, ABDUL MONEIM AL-SHAWAF¹, ABDEL MONEIM AL-DANDAN¹,
YASSER AL-SULEIMAN¹, EMAD AL-ABDALLAH¹ and ABDALLAH BEN ABDALLAH^{2*}

¹Date Palm Research Centre (DPRC), P. O. Box 43, Al-Hassa - 31982, Kingdom of Saudi Arabia.

²FAO Project (UTFN/SAU/043/SAU), DPRC, P. O. Box 43, Al-Hassa-31982, Kingdom of Saudi Arabia

*E-mail: Abdallah.BenAbdallah@fao.org

Date palm (*Phoenix dactylifera* L.) is one of the oldest fruit trees of the world and is closely associated with the life of the people in the Middle East since ancient times. The Kingdom of Saudi Arabia produces over a million tones of dates annually from an estimated 25 million palms (FAO, 2010). The crop has a high socioeconomic importance not only due to its food value, but also its capacity to provide shelter, fiber, aesthetic beauty and furniture (Mousavi *et al.*, 2009). Worldwide, 2000 or more date cultivars are known to exist (Ali-Mohamed and Khamis, 2004). More than 400 different date palm cultivars are reported from Saudi Arabia (Anonymous, 2006). With an estimated three million palms, the Al-Hassa oasis (25°19' 60"N latitude and 49° 37' 60" E longitude) in the Eastern Province is the largest date palm grown area in the Kingdom. The crop is attacked by several insect pests of which the red palm weevil (RPW) *Rhynchophorus ferrugineus* (Olivier), (Coleoptera: Curculionidae) is the most serious one. It has been identified as a category-1 pest of date palm in the Middle-East by the Food and Agriculture Organization of the UN and is reported from over 50 per cent of the date growing countries worldwide (Faleiro, 2006). RPW was first recorded in the Middle East from Rass-El-Khaima in the United Arab Emirates during 1985 from where it spread to all the Gulf countries infesting 5 to 6 per cent palms in the region (Zaid *et al.*, 2002). The RPW has a wide geographical and host range and is reported to infest 40 palm species worldwide (Anonymous, 2013). Studies carried out in China (Ju *et al.*, 2011), showed that *Phoenix canariensis* and *Washingtonia filifera* were more suitable hosts for RPW while *P. sylvestris* was the least preferred. Barranco *et al.* (2000) and Dembilio *et al.* (2009) reported antibiotic and antixenotic mechanisms in some palm species. *Washingtonia filifera* and

Chamaerops humilis could not be naturally infested by RPW adult females and antibiosis was found to be the main mechanism operating in *W. filifera* (Dembilio *et al.*, 2009). RPW is known to mostly attack young date palm of less than 20 years old (Abraham *et al.*, 1998). Farazmand (2002) and Al-Ayedh (2008) found that date palm cultivars with high sugar content enhanced growth of RPW. Infestation begins with gravid female weevils getting attracted to palm volatiles for laying eggs which hatch into damage inflicting larvae. Infested date palms exhibit several symptoms depending on the stage of attack *viz.* oozing of brownish fluid mixed with palm tissue excreted by feeding larvae that has a typical fermented odor, tunneling of palm tissue by larvae, presence of adults and pupae at the base of fronds, drying of infested offshoots, fallen pupae around an infested palm, drying of outer leaves and fruit bunches and toppling of the trunk in case of very severe and extensive tissue damage (Abraham *et al.*, 1998). Early detection of infested palms is very difficult but essential in order to take appropriate measures at the earliest (Faleiro, 2006; Dembilio and Jacas, 2011). The pest is currently managed mainly through a pheromone based Integrated Pest Management (IPM). As the oviposition is the first event in the infestation cycle, exploiting host plant resistance to oviposition would be of immense help in developing resistant varieties. With this objective, we assessed the extent of egg laying by RPW in 25 important Saudi Arabian cultivars.

The Date Palm Research Centre (DPRC), Ministry of Agriculture, Al-Hassa, Saudi Arabia has a diverse genetic pool of over 100 date palm cultivars of national, regional and international date collections planted in the gene bank. Twenty five date palm cultivars (Table 1) from the Kingdom of Saudi Arabia were assessed for

Table 1. Oviposition preference of red palm weevil to date palm cultivars

S. No.	Cultivar	Mean number of eggs laid / week		
		Trial -I	Trial-II	Cumulative Mean
1	Murheim	4.80 ^{hi}	4.80 ^{efg}	4.80 ^{jkl}
2	Hilali	6.80 ^{fghi}	6.60 ^{efg}	6.90 ^{ijkl}
3	Shahal	3.60 ⁱ	0.00 ^g	1.80 ^l
4	Barhei	1.20 ⁱ	4.60 ^{efg}	2.80 ^{kl}
5	Sheshi	1.20 ⁱ	2.60 ^{fg}	1.90 ^l
6	Shabibi	2.00 ⁱ	5.80 ^{efg}	3.90 ^{jkl}
7	Hatmi	2.40 ⁱ	7.60 ^{efg}	5.00 ^{jkl}
8	Reziz	10.80 ^{fghi}	1.00 ^{fg}	6.90 ^{ijkl}
9	Gaar	6.00 ^{ghi}	0.00 ^g	3.00 ^{kl}
10	Kheneizi	45.20 ^{ab}	13.80 ^{def}	31.30 ^b
11	Voseili	33.20 ^{bc}	0.00 ^g	16.60 ^{defgh}
12	Khalas	26.40 ^{cde}	11.00 ^{efg}	18.70 ^{defg}
13	Tanajib	17.60 ^{defgh}	11.80 ^{efg}	14.70 ^{efghi}
14	Taiar	9.60 ^{fghi}	5.60 ^{efg}	7.60 ^{hijkl}
15	Khasab	30.40 ^{cd}	12.20 ^{efg}	21.30 ^{cdef}
16	Sukari Ahmer	7.60 ^{fghi}	15.80 ^{cde}	11.70 ^{ghijk}
17	Rotana	18.80 ^{defg}	5.20 ^{efg}	12.20 ^{fghijk}
18	Sugai	12.40 ^{fghi}	14.00 ^{def}	13.20 ^{fghij}
19	Ajwa	48.80 ^a	56.60 ^a	48.97 ^a
20	Dinari	19.60 ^{def}	28.40 ^{bc}	24.00 ^{bcde}
21	Anbara	16.80 ^{efgh}	26.40 ^{bcd}	21.60 ^{cdef}
22	Nabat Sultana	5.20 ^{hi}	46.00 ^a	25.60 ^{bcd}
23	Zamli	6.40 ^{jhi}	4.00 ^{efg}	5.20 ^{jkl}
24	Majnaz	3.20 ⁱ	3.20 ^{efg}	3.20 ^{kl}
25	Turi	27.60 ^{cde}	31.20 ^b	29.40 ^{bc}
	CD (p=0.05)	13.15	13.07	9.42

Values followed by different letters within the same column are significantly different at 5% significance level.

their preference for egg laying by the red palm weevil. Adult RPW male and females were obtained from the 'whole palm' insect rearing facility at DPRC. Newly emerged adult weevils (1:1) selected for the trial were reared as a primary culture in perforated plastic boxes (40x25x30cm) with sugarcane pieces to feed on. This ensured mating and fertility of the adult female weevils. Subsequently, three to four week old fertile female

weevils were selected for the egg laying trial. Ten gravid females and six mature males were released in a round perforated plastic box (diameter: 24 cm; height: 8cm) containing petiole bits (1x1x1 inch each) of the selected date cultivars. Freshly pruned petiole surface releases palm volatiles that attracts adult female weevils for oviposition (Abraham *et al.*, 1998) and was therefore offered for egg laying to female weevils in this trial. Male

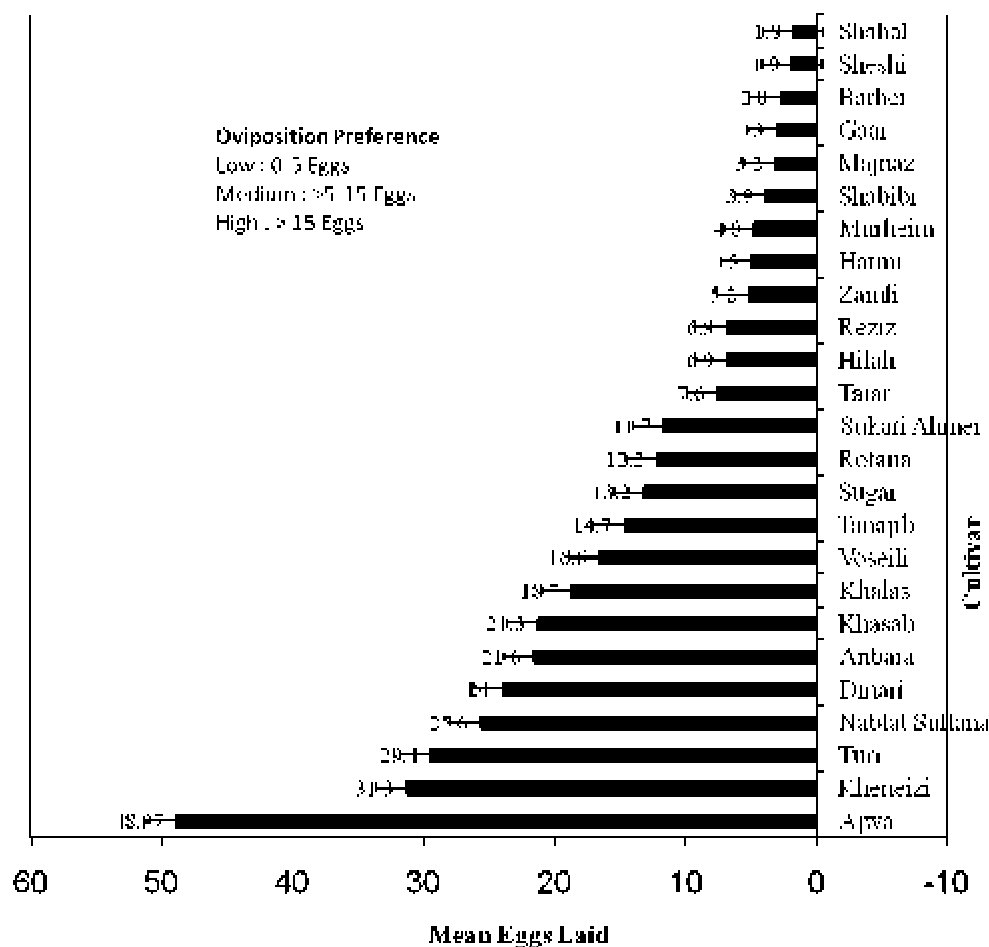


Fig. 1. Oviposition preference in date palm cultivars by *R. ferrugineus*

weevils were released with the female weevils to ensure mating and sustain fertility of female weevils (Faleiro *et al.*, 2003). Three petiole bits of each cultivar were offered for egg laying to the above mentioned gravid adult females in the box. One box contained five cultivars. The boxes containing the adult weevils and date petiole bits were covered with a perforated lid and kept in a dark room (25°C; 75 % RH) for a week to facilitate oviposition. Number of eggs laid/larvae hatched in each petiole bit was recorded on the 7th day after start of trial by carefully peeling the petiole fibre. The treatments were replicated five times and the trial was repeated twice. The experiment was laid out in the Completely Randomized Design. Data on mean egg laying was subjected to ANOVA. Means were separated by LSD at $t_{5\%}$.

Significant differences were recorded in the number of eggs laid by RPW in the date palm cultivars tested (Table 1 and Figure 1). Least mean number of eggs laid was in the cultivar 'Shahal', while the highest oviposition was recorded in the cultivar 'Ajwa'. Al-Baqshi *et al.*

(2008) recorded high degree of antixenosis (non-preference) for egg laying in the cultivars 'Shahal', 'Murheim', 'Gaar' and 'Sheshi' with the cultivar 'Khalas' exhibiting a low degree of antixenosis for egg laying by RPW. This is in agreement with our findings. Al-Ayedh (2008) recorded significantly greater numbers of eggs of RPW in the cultivar 'Sukkary' as compared to the cultivar 'Khalas' which was attributed to the higher sugar content in 'Sukkary'. Based on cumulative analysis (Fig.1), eight cultivars (Shahal>Sheshi>Barhei >Gaar >Majnaz> Shabibi> Murheim>Hatmi) with a mean egg laying of 0-5 were considered to exhibit high degree of antixenosis or non-preference for oviposition by RPW. Further, eight cultivars (Zamli>Reziz>Hilali>Taiari>Sukkari Ahmer>Rotana>Sugai>Tanjib) recording a mean egg lay of more than 5 to 15 eggs showed moderate antixenosis while nine cultivars (Voseili>Khalas>Khasab>Anbara>Dinari>Nabat Sultana>Turi>Kheneizi>Ajwa) with more than 15 eggs were most preferred and exhibited a low degree of antixenosis for egg laying by RPW.

Studies carried out in Spain revealed that the palm species *Chamaerops humilis* and *Phoenix theophrasti* showed antixenotic and antibiotic mechanisms of resistance, respectively against RPW (Dembilio *et al.*, 2009). The coconut cultivar, 'Malayan Yellow Dwarf' was least preferred for egg laying by RPW while, maximum number of eggs were laid in 'Chowghat Green Dwarf' (Faleiro and Rangnekar, 2001). Reports from Iran suggest that sugar in date palm varieties enhanced growth, daily oviposition and reduced mortality of RPW while, calcium was found to inhibit the growth of RPW (Farazmand, 2002). 'Khalas' is a premier date palm cultivar of Saudi Arabia (Al-Abdoulhadi *et al.*, 2011) predominant in the Eastern Province of the Kingdom (Al-Abbad *et al.*, 2011) and as indicated above, is among the most preferred for egg laying by RPW. The study provides a valuable insight into the inherent risk level the farmers of the region encounter based on the date palm cultivar grown and should adopt the necessary control measures (Abraham *et al.*, 1998) especially in young plantations where RPW preferred cultivars like Khalas that belong to the high risk category are grown. The findings of this study also provides a base line for breeding date palm cultivars resistant to RPW for incorporating host plant resistance as a component of the RPW-IPM strategy in the future, as proposed previously by Abraham *et al.* (2002).

ACKNOWLEDGEMENT

Facilities provided by the Date Palm Research Centre, Ministry of Agriculture, Al Hassa to conduct this study through the FAO project UTF/SAU/043/SAU are gratefully acknowledged.

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MS Received : 30 April 2013

MS Accepted : 10 June 2013