

# Effect of Irrigation on Within-Grove Distribution of Red Palm Weevil *Rhynchophorous ferrugineus*

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تأثير طريقة الري على سلوك إنتشار الإصابة بسوسة النخيل الحمراء

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**خلاصة:** تعتبر سوسة النخيل الحمراء من أكثر الآفات التي تصيب أشجار نخيل التمر. تهدف هذه الدراسة لمعرفة تأثير طريقة الري (الغمر أو التنقيط) على توزيع الإصابة حقلياً. بدأت الدراسة مع أول ظهور الإصابة وحتى اختفائها. أوضحت النتائج زيادة الإصابة في الأحواض التي تروى بالغمر حيث بلغت نسبة أشجار النخيل المصابة 89% من إجمالي عدد الأشجار المصابة. وتدلل هذه النتائج على أن طريقة الري ومعدل الرطوبة الأرضية من العوامل الأساسية المؤثرة على انتشار الإصابة بهذه الحشرة إذ يمكن استخدامها كإحدى أدوات الإدارة المتكاملة لمكافحة هذه الآفة.

**ABSTRACT:** The red palm weevil (RPW) *Rhynchophorous ferrugineus* (Oliv.) is the most important pest attacking date palm trees. The objective of this study was to determine the effect of drip and flood irrigation on the within-grove distribution of RPW. The current study was started with the first appearance of the infestation to almost disappearance of the infestation. Results showed that more infested trees were detected in plots with flood irrigation. The number of infested trees in these plots represented 89% of the total infested trees. This study suggested that irrigation management and soil moisture are key factors in the dispersion of the RPW infestation and could be used as one of the integrated pest management tools.

**Keywords:** Red palm weevil, integrated pest management, irrigation, soil moisture, infestation control.

The red palm weevil (RPW) *Rhynchophorous ferrugineus* (Oliv.) is the most important pest of the date palm in the Middle-East (Abraham *et al.*, 1998). The insect was discovered in Saudi Arabia in the mid-1980s (Gush, 1997; Abraham *et al.*, 1998; Faleiro *et al.*, 1999). Since then it has spread over most of the date palm areas (Bokhari and Abuzuhira 1992; Vidyasagar *et al.*, 2000), due to the transfer of infested offshoots and palm trees.

RPW infestation is lethal to date trees. This is due to a lack of early and apparent external signs of the infestation. Infestation occurs mostly in young trees of age 5-15 years (Sathiamma *et al.* 1992; Aldryhim, unpub. observation). Several control methods have been applied within an IPM (i.e. integrated pest management) strategy. The main components of IPM are phyto-sanitation, which involves cutting down and burning the infested trees, use of insecticides, and use of pheromone traps for monitoring and mass trapping of adult RPWs.

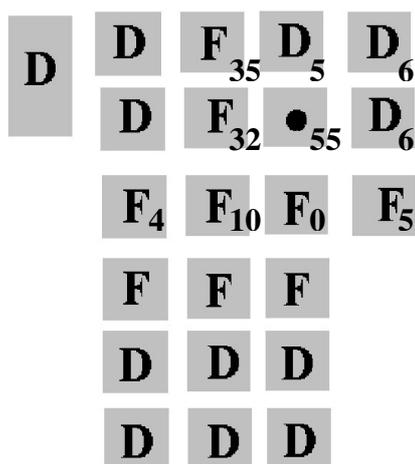
Phyto-sanitation is crucial in preventing or reducing subsequent infestations (Murphy and Briscoe, 1999).

There have been no reports on the within-grove distribution of RPW infestations under different watering regimes. The objective of the present work was focused on the effect of the types of irrigation on the distribution of RPW infestation in date palms within a grove.

## Materials and Methods

This study was conducted in a 16,000 date palm farm in Al-Karaj oasis, 80 km south of Riyadh. It was started with the first appearance of infestation in May 1998 and ran to October 1999 when the level of RPW infestation became low and almost disappeared. The major cultivars were: Nepoot Seif, Khalass, Sagai and Berhi. The age of the trees varied from 5 to 25 years. Leaf pruning (Takreeb) was carried out in late autumn.

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**Figure 1.** Outline of field showing plots and type of irrigation. D = dripping irrigation, F = flooding irrigation. Numbers refer to infested trees in plot.

The farm was divided into 22 plots, each contained  $650 \pm 50$  trees, each plot was  $6500 \pm 500 \text{ m}^2$ . The distance between trees in the same row and the distance between rows was 10 m. Flood (F) and drip (D) irrigation were used (Fig. 1). The rate of drip irrigation was  $0.5\text{-}1 \text{ m}^3$  per tree per week and per two weeks in the summer and in the winter, respectively. The rate of flood irrigation was  $4\text{-}8 \text{ m}^3$  per tree per week and per two weeks in the summer and in the winter, respectively.

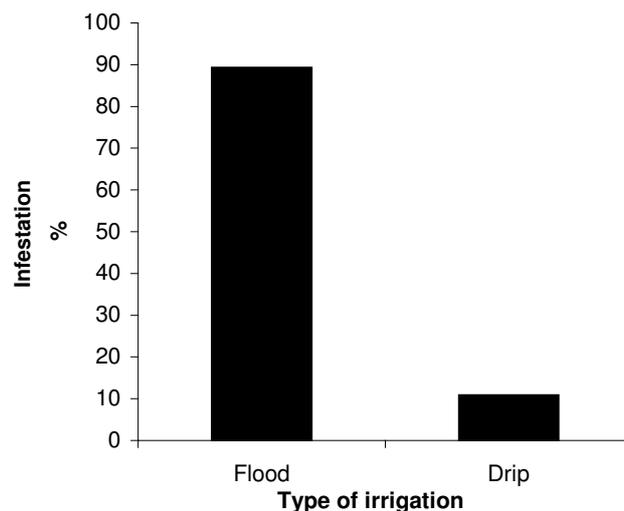
Since there is no early and clear sign for infested trees, detection of the infested trees was totally depended on the scout's efforts. Once an infested tree was observed, it was cut-down and dissected to small pieces that were packed into sacks and were burned in a special incinerator. Data were taken for each infested tree such as the date on which infestation was observed, plot number and type of irrigation.

## Results

Infested trees were first detected in a plot with flood irrigation. RPW spread from the hot spot, where the infestation was first appeared in May 1988, to the neighboring plots with clear preference to plots with flood irrigation (Fig. 1). Infestations were detected in six plots with flood irrigation and three plots with drip irrigation. Number of infested trees were 55, 32, 35, 5, 10, and 4 in six plots of flood irrigation and 5, 6 and 6 in three plots of drip irrigation. The number of infested trees that were detected in flood irrigation plots was 141, representing 89 % of total infested trees. Whereas, 17 infested trees were detected in drip irrigation plots that representing 10 % of total infested trees (Fig. 2).

## Discussion

Flood irrigation created a more suitable microhabitat for RPW. It increased soil moisture contents which appears to be preferable to RPW and allows grasses to grow



**Figure 2.** Distribution of infested trees in plots with flood and drip irrigation.

to a high density. The groves provide shade and reduce the evaporation rate of water from the soil. Leefmans (1920) reported that adults of RPW seek moist harborages till they find a new host. Aldryhim and Kalial (unpublished data) found that RPW adults survived up to three and 39 days in dry and moist peat moss, respectively, in the absence of the food. Also, they found that RPW adults could penetrate 20 cm deep in the moist peat moss; where no attempt for penetration occurred when adults were placed on dry peat moss. Giblin-Davis and Howard (1989) found that adults of a closely related species, *R. cruentatus*, suffered from high mortality when placed in petri-dishes that lacked moisture. This weevil has high cuticular permeability and is susceptible to significant water loss in dry environments (Weissling and Giblin-Davis, 1993). It chooses high relative humidity over low relative humidity in choice tests (Weissling and Giblin-Davis, 1993) and plant tissues with minimal moisture content are significantly less attractive (Giblin-Davis *et al.*, 1994).

## Conclusion

The response of RPW adults to moisture is probably an important part of the insect behavioral selection but this deserves further study. It will be useful to do more research on the use of irrigation types and soil moisture as important tools in the IPM of RPW. The results obtained may help in detection of infested trees by concentrating inspection on farms that used flood irrigation.

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EFFECT OF IRRIGATION ON WITHIN-GROVE DISTRIBUTION OF RED PALM WEEVIL  
*RHYNCHOPHOROUS FERRUGINEUS*

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