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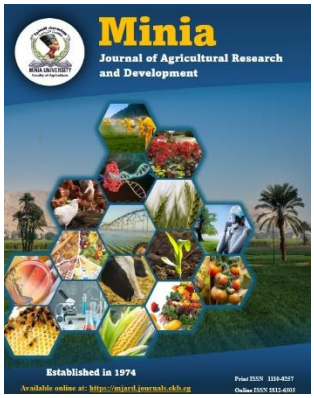

Damage on date palms caused by red palm weevil and its correlation with black rat occurrence under Minia Governorate conditions

Hassan H. M.[1] and Salama, Magdy. N. R[2] and Samouny, Mona, T.[2]

[1]Plant Protection Department, Faculty of Agriculture Minia University Egypt.
[2]Central Laboratory for research and development of date palm, Giza agriculture research center, Egypt.

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ABSTRACT

A date palm farm was chosen in the Mattay district in Minia Governorate to study the damage to palm trees by black rat and red palm weevil infestations, the extent of the relationship between them, and the effectiveness of some rodenticides in reducing the infestation and increasing the yield. The results showed the superiority of coumarin in combating the black rat, followed by Tomorate and then Zinc phosphide, where the decrease in the black rat population with (Barhi CV.) in 2023 was 88, 66 and 40%, versus 91,70 and 42% in 2024, respectively. Reductions in rat's population with Medjool CV.). By these rodenticides were 82, 60 and 40 in 2023 versus 88,68 and 41 % in 2024, respectively. In untreated (Barhi CV.). Palms by rodenticides in 2023 the damage percentages by black rat and red palm weevil were 75 and 80 %, respectively in comparison with the damage of 65 and 70% with Medjool CV. As for data of 2024 Barhi damaged by black rats and red palm weevil by 78 and 76 %, respectively versus the damage 60 and 65% in Medjool CV.) untreated palms

In 2023 season the damage percentages appeared in (Barhi CV.) . by black rat and red palm weevil were 75 and 80%, respectively in comparison with the damage 65 and 70% with Medjool cv.. As for data of 2024, Barhi damaged by black rats and red palm weevil by 78 and 76 %, respectively versus the damage 60 and 65% in Medjool CV.) untreated palms. These damages reduced with the use of different rodenticides whereas Racoumin significantly surpassed other rodenticides

Positive and high correlation between the damage caused by black rat and the damage caused by red palm weevil was observed, whereas the correlation coefficient in 2023 was high r= + 0.9938 with (Barhi CV.) . And r=+0.9777 with Medjool CV.) while these values of correlation were r=+0.8234 with Barhi and r=+ 0.9496 with Medjool in 2024 season

Yield of (Barhi CV.) as well as of Medjool correlated with damage caused by black rats. It was obvious negative and high correlation between the damage caused by black rat and the yield of date palm during 2023 and 2024 seasons recording r= -0.9784 and r= -0.8837, with Barhi, respectively. On the other hand the correlation between black rat infestation and the yield of Medjool was also high negative correlation coefficient in 2023 and 2024 seasons recording r=-0.988 and r=-0.8835, respectively. As for the correlation between the infestation of red palm weevil and the yield it was clear negative and high correlation coefficients r= -0.9628 and -0.9760 as well as r=-0.8982 and -0.7812 were recorded in 2023 and 2024 seasons with Barhi and Medjool CV.) respectively.

Keywords: Date palm, Black rat, Red palm weevil, Rodenticides, Racumin, Barhi, Medjool, Correlation, and Yield.

* Corresponding author: Salama, Magdy. N. R
E-mail address: magdynaguib452@gmial.com

INTRODUCTION

The Red palm weevil, *Rhynchophorus ferrugineus*, (Olivier) (Family: Curculionidae, Order: Coleoptera) is a voracious pest on the different palm species in the world and are extensively spread in all the continents (Saleem *et al., 2022*). Red palm weevil was recorded for first time in Egypt in date palm plantations at Sharkia and Ismailia Governorates (Saleh, 1992 and Saleh & Gouhar, 1993).This weevil is the most distractive to palm trees between the different pests. Varieties of date palms differed in their susceptibility to red palm weevil infestation (Abdel-Salam et al., 2008 and Mesallam, 2010). Wounds and pruning contributed the high infestation by red palm weevil (El-Lakwah *et al.* 2011).The red palm weevil infests palms below the age of 20 years, where the stem of the young palm is soft, juicy and easily penetrated. (Al-Ajlan, 2008). On the other hands Black rat is reported to feed on the soft apical meristem of the date palm (El-Shafie and. Abdel-Banat, 2018). This research aims to found the relationship between red palm weevil infestation and black rat (the dominant pest on date palms) under Minia, Egypt conditions. Also the affecting of two date palm varieties i.e. Mejdool and Barhi by these pests.

MATERIALS AND METHODS

Experimental area :

A farm of date palm *Phoenix dactylifera* sex years old planted in clay soil at the distances of 8*8 meters by two varieties (Medjool and Barhi) located at Matai district Minia Governorate had been subjected for testing certain rodenticides on rat population and damage caused by black rat and red palm weevil during 2023 and 2024 seasons.

Control of black rat:

The used rodenticides:

a- Zinc phosphide: acute poison zinc phosphide (94**%** active ingredient),.

b- Racumin, Common name: coumatetralyl, anticoagulant, readymade bait

c-Tomorat ,common name: bromadiolone, anticoagulant as tracks powder

Percent reduction in black rat population as a result of these rodenticides:

The reduction in population density of black rat, *Rattus rattus* (the dominant species) was estimated by using food consumption method (crushed maize used one day before the treatment and after two weeks from application) by estimating the amount (g) of the consumption of the free baits pre and post treatments according to the following Dubock (1984) equation.

Population reduction % of black rats = [Pretreatment consumption (g) - Post treatment consumption (g) / Pretreatment consumption (g)] × 100

Treatment with zinc phosphide using 200 grams of zinc phosphide as a bait loaded on ground corn (30% zinc phosphide) was placed in the bait station under each two palm trees, alternating in the form of zigzags. Twenty palm trees of each variety (Medjool and Barhi) were subjected to this treatment. Other 20 palms of each variety were treated with Racumin , 200 grams per palm similarly to the above application. The third rodenticide was Tomorat placed underneath palm trees in circle shape.

Zinc phosphide left for three days without increased. Racumin increased through three days. The population reduction percentage calculated as following equation.

Assessment of rat control on black rat infestation as well as red palm weevil infestation:

For assessment the damage in date palm.

Damages of black rat were observed after harvesting from each treated and untreated plots (Each plot 20 palms).

As for the damage caused by red palm weevil, the damage observed post harvesting. Damage was categorized by the presence of tunnels on the trunk and base of leaf petiole, oozing out of thick yellow brown fluid from the tunnels, appearance of frass in and around the openings of tunnels, fermented odor of the fluid inside the infested tunnels as summarized by Kaakeh *et. al*. (2001).

The percentage of damage of rats or red palm weevil recorded using the following equation**:**

Damage % of date = (Number of infested palms / Total number of the infested palms) ×100.

Yield of clusters at harvest time were weighted per non-infested or infested palms by red palm weevil and black rat for both varieties Medjool and Barhi the reduction in the yield resultant treatments were recorded.

RESULTS AND DISCUSSIONS

The data obtained and shown in Table (1) indicate the superiority of Coumarin in combating the black rat, followed by Tomorate and then Zinc phosphide, where the decrease in the black rat population was 88, 66 and 40%, respectively in 2023 season experiment. Reductions caused by these rodenticides in 2024experiment with (Barhi CV.) . were 91, 70 and 40 %, respectively. As for Medjool cv. in 2023 control experiment, reduction in black rat population by these rodenticides *i.e.* Coumarin, Tomorate and Zinc phosphide were 82, 60 and 40 % versus 88, 68 and 41%, recorded in 2024 experiment, respectively. These results could be attributed that successive control gave good results in reducing rats population.

These results were somewhat consistent with the results found by Ali (2019) who found that Coumarin was the best rodenticide in reducing rats population.

Table (2) explains that in untreated (Barhi CV.) . palms by rodenticides in 2023 the damage percentages by black rat and red palm weevil were 75 and 80 %, respectively in comparison with the damage of 65 and 70% with Medjool cv. As for data of 2024 Barhi damaged by black rats and red palm weevil by 78 and 76 %, respectively versus the damage 60 and 65% in Medjool untreated palms. These damage reduced with the use of different rodenticides whereas Racoumin significantly surpassed other rodenticides.

Data presented in Table (3) show positive and high correlation between the damage caused by black rat and the damage caused by red palm weevil whereas the correlation coefficient was positive and high r= + 0.9938 with (Barhi CV.) . and r=0.9777 with Medjool cv., in 2023 season. On the other hands there is positive correlation r=+0.8234 and r= +0.9496 between black rat damage and red palm weevil damage achieved with Barhi and Medjool in 2024 season, respectively . This result may be attributed to wounds caused by rats gnawing similar to pruning of date palms. EL-Lakwah *et al*. (2011) mentioned that palm tree pruning without dusting with agricultural sulfur showed the highest infestation rate while, pruning of date palm and dusting with agricultural sulfur resulted in lower infestation rate. Golomb (2015) reported that red palm weevil (RPW) is a palm borer insect that develops within the soft tissues of the trunk and crown. Also Al-Ajlan (2008) reported that the red palm weevil infests palms below the age of 20 years, where the stem of the young palm is soft, juicy and easily penetrated. Black rat was reported to feed on the soft apical

meristem of at the date palm (El-Shafie and Abdel-Banat, 2018).

Yield of (Barhi CV.) . as well as of Medjool correlated with damage caused by black rats. It was obvious negative and high correlation between the damage caused by black rat and the yield of date palm during 2023 and 2024 seasons recording r= -0.9784 and r= -0.8837, with Barhi, respectively. On the other hand the correlation between black rat infestation and the yield of Medjool was also high negative correlation coefficient in 2023and 2024 seasons recording r=-0.988 and r=-0.8835, respectively (Table, 4). As for the correlation between the infestation of red palm weevil and the yield it was clear negative and high correlation coefficient r= -0.9628 and -0.9760 as well as r=-0.8982 and -0.7812 were recorded in 2023 and 2024 seasons with Barhi and Medjool cv., respectively (Table, 5). Alia *et al*. (2018) reported that damages of black rat on date palm could be summed up in a deterioration of the inflorescences (spathes) before and after their opening. On the other hand the economic loss due to eradication of severely infested palms between 1 and 5% infestation is estimated to range from 5.18 and 25.92 million USD, respectively. Besides this, the indirect losses would increase this several fold (El-Sabea *et.al.*,2009)

Table (1): Reduction % in rat population after the treatment by certain rodenticides in date palm farm at Matay, Minia Governorate during 2023 and 2024 seasons .

Rodenticides	Reduction % of black rat			
	Barhi		Medjool	
	2023	2024	2023	2024
Zinc phosphide	40 c	42 c	40 c	41 c
Tomorat	66 b	70 b	60 b	68 b
Racoumin	88 a	91 a	82 a	88 a

Reduction percentages followed by the same letters in the same column not significantly differed according to Chi square test.

Table (2): The average damage percentage of date palms by black rats and red palm weevil after using certain rodenticides at the end fruiting during 2023 and 2024 seasons .

Rodenticides	Damage% by black rat				Damage % by red weevil			
	Barhi		Medjool		Barhi		Medjool	
	2023	2024	2023	2024	2023	2024	2023	2024
Zinc phosphide	45 b	41 b	35 b	32 b	50 b	48 b	45 b	42 b
Tomorin	25 c	23 c	25 c	22 c	35 c	32 c	25 c	22 c
Racoumin	15 d	13 d	10 d	9 d	20 d	18 d	20 d	18 d
Control (Untreated palms)	75a	78a	65 a	60a	80 a	76 a	70 a	66 a

Damage percentages followed by the same letters in the same column not significantly differed according to Chi square test.

Table (3): Correlation between the number of damage symptoms on date palms (cv. Mejdool and Barhi) caused by black rat and red palm weevil during 2023 and 2024 seasons.

Rodenticides	Barhi				Medjool			
	2023		2024		2023		2024	
	Damaged palms by black rat	Damaged palms by red weevil	Damaged palms by black rat	Damaged palms by red weevil	Damaged palms by black rat	Damaged palms by red weevil	Damaged palms by black rat	Damaged palms by red weevil
Zinc phosphide	9	10	8	8	7	9	6	8
Tomorin	5	7	4	6	5	5	5	4
Racoumin	3	4	2	3	2	4	2	3
Control Untreated palms	15	15	13	12	13	14	12	12
Correlation coefficient (r)	r = +0.9938		r=-0.8234		r = +0.9777		r=+0.9496	

Table (4): Yield of date palms and its correlation with damage caused by black rat in treated and untreated palms during 2023 and 2024 seasons .

Rodenticides	Barhi				Medjool			
	2023		2024		2023		2024	
	Damaged palms by black rat	Av. yield (Kg) /palm	Damaged palms by black rat	Average yield (Kg) /palm	Damaged palms by black rat	Average yield (Kg) /palm	Damaged palms by black rat	Average yield (Kg) /palm
Zinc phosphide	9	96	7	98	7	56	6	60
Tomorin	5	112	4	116	5	62	4	64
Racoumin	3	112	2	116	2	76	2	78
Control (Untreated palms)	15	88	12	92	13	54	11	58
(non-infested palms)	0	120	0	125	0	80	0	85
Correlation coefficient (r)	r = -0.9784		r=-0.8837		r= -0.9088		r=-0.8835	

Table (5): Yield of date palms and its correlation with damage caused by red palm weevil in treated and untreated palms during 2023 and 2024 seasons .

Rodenticides	Barhi				Medjool			
	2023		2024		2023		2024	
	Damaged palms by red palm weevil	Average yield (Kg) /palm	Damaged palms by red palm weevil	Average yield (Kg) /palm	Damaged palms by red palm weevil	Average yield (Kg) /palm	Damaged palms by red palm weevil	Average yield (Kg) /palm
Zinc-phosphide	10	96	9	98	9	56	7	58
Tomorin	7	112	6	114	5	62	4	65
Racoumin	4	112	3	115	4	76	3	79
Control (Untreated 1palms)	15	88	13	90	14	54	12	58
(non-infested palms)	0	120	0	125	0	80	0	90
Correlation coefficient (r)	r=-0.9628		r=-0.9760		r=-0.8982		r=-0.7812	

REFERENCES

Abdel-Salam, A. H.; Awadalla1 S.S. and Abdel-Hamid K. M. (2008). Evaluation of infestation degrees, age, stem height and occurrence of the red palm weevil, *Rhynchophorus ferrugineus* (coleoptera: curculionidae) on certain date palm ultivars in Egypt. Agric. Sci. Mansoura Univ., 33 (10): 7549 – 7567.

Al-Ajlan, A.M. (2008). Red Palm Weevil, *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae). In: Capinera, J.L. (eds) Encyclopedia of Entomology. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-6359-6_3325

Ali, A.F. (2019). Ecological studies on Nile rat, *Arvicanthus niloticus* Desmaret and its integrated control in Minia Governorate118 pp.

Alia A. Z1; Amara D. G; Chemsa A. E.; Eddoud A.; Souttou K. and Sekour M. (2018). Annual and Stationary Variation of Black Rat *Rattus Rattus* (Linnaeus, 1758) Damage on Date Palm Inflorescences in Southeastern. World J Environ Biosci., 7 (2):102-107.

El-Lakwah, F. A. M.1; El-Banna A. A.; Rasha A. El-Hosary and El-Shafei W.K.M. (2011). Impact of certain factors and agricultural practices on infestation of date palm trees by the red palm weevil (*Rhynchophorus ferrugineus* (Oliv.). Egypt. J. Agric. Res., 89 (3),1119-1127.

El-Sabea A. M. R.; Faleiro J. R and Abo-El-Saad M. M. (2009). The threat of red palm weevil *Rhynchophorus ferrugineus* to date plantations of the Gulf region in the Middle-East: An economic perspective. Outlooks on Pest Management 20(3):131-134.

El-Shafie A.F, and Abdel-Banat B.M.A (2018). Non-arthropod pests of date palm and their management. CABI Reviews, No. 20: pp.1-13. https://doi.org/10.1079/PAVSNNR201813020

Golomb O; Alchanatis V.; Cohen Y.; Levin N.; Cohen Y., and Soroker V. (2015). Detection of Red Palm Weevil infected trees using thermal imaging. In book: Precision agriculture '15 DOI: 10.3920/978-90-8686-814-8_80. pp.1-8.

Kaakeh, W., A. A. Khamis and M. M. Aboul-Nour. (2001). The Red Palm Weevil: The Most Dangerous Agricultural Pest. UAE University Printing Press, 165 pp.

Mesallam, T.I.I. (2010). Effect of different date palm varieties on some biological aspects of the red palm weevil, *Rynchophourus ferrugineus* (Olivier) and its control Ph.D.Thesis, Faculty of Agriculture, Zagazig University: 293 pp.

Saleem M. A., Javaria Nazir J, Raza I, Rau A., Hameed O., Abdul Qayyum M., Alum A and Saeed (2022). Global threat to date palm plantations: red palm weevil-distribution, biology, and management tactics: a review Acta Botanica Plantae : 10–24. DOI:http://dx.doi.org/10.5281/zenodo.7265222

Saleh, M.R.A. (1992). Red palm weevil, *Rhynchophorus ferrugineus* (Olivier). The first record for Egypt and indeed the African Continent, List No. 10634 Africa, Collection No. 22563. British Museum Report of International Institute of Entomology, 56 Queen's Gate, London, SW 75 JR UK: 1p.

Saleh, M.R.A. and Gouhar K.A. (1993). Red palm weevil attacking date palm trees in limited areas of Egypt at the present time and how can be eradicated from these areas. Report of Plant Protection Department, Faculty of Agriculture, Zagazig University: 20 pp (Arabic Language).

الملخص العربى

الأضرار التي تصيب نخيل التمر بسبب سوسة النخيل الحمراء وعلاقتها بوجود الفأر الأسود في ظروف محافظة المنيا

حسن محمد حسن [1]، مجدى نجيب رزق سلامه[2] ، منى طه سمعونى[2]

1-قسم وقاية النبات –كلية الزراعة –جامعة المنيا - مصر
2-مركز البحوث الزراعيه بالجيزة - مصر

تم إختيار مزرعة نخيل للتمر في مركز مطاي بمحافظة المنيا لدراسة تأثر النخيل بإصابات الفأر الأسود وسوسة النخيل الحمراء ومدى العلاقة بينهما وفعالية بعض مبيدات القوارض فى تقليل الإصابة وزيادة المحصول وأوضحت النتائج تفوق الكومارين في مكافحة الفأر الأسود، يليه التومورات ثم فوسفيد الزنك، حيث انخفض تعداد الفأر الأسود مع صنف البارحي. في عام 2023 حيث كانت نسب الخفض 88 و66 و40%، مقابل 91,70 و42% في عام 2024 على التوالي.تم انخفاض في تعداد الفئران المصاحبة لصنف المدجول وبلغت نسب الخفض 82 و60 و40 عام 2023 مقابل 88,68 و41% عام 2024 على التوالي.

في صنف البرحي غير المعامل بمبيدات القوارض عام 2023 بلغت نسب الضرر بالفأر الأسود وسوسة النخيل الحمراء 75 و80% على التوالي مقارنة مع الضرر 65 و70% بصنف المجدول. أما بيانات 2024 أوضحت أن صنف البارحي تضررت بالفأر الأسود وسوسة النخيل الحمراء بنسبة 78 و76% على التوالي مقابل الضرر 60 و65% في نخيل المدجول غير المعالجة. انخفضت هذه الأضرار باستخدام مبيدات القوارض المختلفة، في حين تفوق الراكومين بشكل ملحوظ على مبيدات القوارض الأخرى.

لوحظ وجود علاقة ارتباط موجبة وعالية بين الأضرار الناجمة عن الفأر الأسود والأضرار الناجمة عن سوسة النخيل الحمراء، حيث كان معامل الارتباط في عام 2023 مرتفعاً r=+0.9938 مع صنف البرحي. و r=+0.9777 مع صنف المجدول. بينما كانت قيم الارتباط r=+0.8234 مع البرحي و r=+ 0.9496 مع المجدول في موسم 2024

كان الارتباط واضحاً سلبياً ومرتفعاً بين الضرر الذي يسببه الفأر الأسود ومحصول نخيل التمر خلال موسمي 2023 و2024 حيث سجل r=-0.9784 و r=-0.8837 مع البرحي على التوالي. ومن ناحية أخرى هناك علاقة بين الإصابة بالفأر الأسود ومحصول صنف المجدول. فقد كان معامل الارتباط سلبياً ومرتفعا في موسمي 2023 و 2024 مسجلا r=-0.988 و r=-0.8835 على التوالي. أما بالنسبة للارتباط بين الإصابة بسوسة النخيل الحمراء والمحصول فقد كان واضحا سلبيا وسجلت معاملات ارتباط عالية r= -0.9628 و -0.9760 وكذلك r=-0.8982 و -0.7812 في موسمي 2023 و 2024 مع البرحي والمجدول على التوالى .

الكلمات الدالة : نخيل البلح، الفأر الأسود، سوسة النخيل الحمراء، المبيدات القارضة، راكومين، البرحي، الميدجول، العلاقة الارتباطية، الإنتاجية.