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REGULAR ARTICLE

Impact of date palm borer species in Iraqi agroecosystems

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ABSTRACT

Insect borers are serious pests of date palms in Iraq and many other date-palm growing countries. These pests severely damage palms, reduce the quantity and quality of date fruits and weaken the trunks which eventually fall and die. Field surveys were conducted during 2011-2013 to explore the presence and distribution of different date palm borers in governorates with significant date palm orchards. Results indicated the presence of six different borers, causing significant damages to date palms: Phonapate frontalis F., *Jebusaea hammerschmidtii* Reich., and four belonging to Oryctes: *O. elegans Prell, O. agamemnon Burmeister, O. agamemnon* matthiesseni Reitter and *O. agamemnon arabicus* Fairmaire, the latter recorded for the first time in Iraq. The occurrence and population densities of these species were described and vary at different locations of date palm orchards.

Keywords: Date palms; Distribution; Iraq; *Jebusaea hammerschmidtii*; *Oryctes* spp; Palm borers; *Phonapate frontalis*

INTRODUCTION

Date palm tree, *Phoenix dactylifera* L., is one of the most economically important crops in Iraq and several other Arabian countries (Hussain, 1974). These trees are subject to attack by various pests and diseases (Bedford, 1980; Zaid, 2002 and De wet Albahely, 2004; Khalaf et al., 2010). Among the major insect pests are the palm borers which cause significant damage to trees, especially weakening and destroying the trunk (Khalaf et al., 2012; Soltani, 2012). The presence of certain species and the level of damage inflicted varies among countries. The well-recognized species are the palm frond borer, *Phonapate frontalis* F. and the long horn stem borer *Jebusaea hammerschmidtii*, both present in Iraq and some Arabian Gulf countries (Dhiab et al., 1979; Abass, 2000; Atia et al., 2009; Khalaf et al., 2012). The fruit stalk borer, Oryctes elegans was recorded attacking date palms in Iraq, Iran and the Arabian Gulf countries (De Mire, 1960; Al-Bayti and Ba-Angood, 2009; Kaaka, 2009; Khalaf et al., 2011).

Soltani (2012) mentioned that the root borer, *O. agamemnon* Burmeister was present in Tunisia, Oman, Saudi Arabia and Iran. The Arabian rhinoceros beetle *O. agamemnon arabicus* was observed in Tunisia, United Arab Emirates, Saudi Arabia, Oman, India and Iraq (Al-Deeb et al., 2011; Soltani 2012; Khalaf et al., 2013). *O. agamemnon matthiesseni* was recorded in Iraq as infesting dates in Basrah governorate as early as 1935 (Cornish, 2013). Other species like *O. rhinoceros* and *O. nasicornis* were found infesting date palms in Iran, Saudi Arabia, United Arab Emirates, Oman, Tunisia and on coconut palms in Malaysia, Australia, India, Sumatra, Philippines, Hong Kong, Myanmar, Thailand and Sri Lanka (Bedford, 1980).

The larvae and adult borers appear to be the developmental stages that cause damage to date palms by feeding on green leaves, especially in the central region of Iraq; larvae usually feed inside tunnels and excrete sticky material at the entrance holes. The infestation from this pest results in either leaf and bunch breakage or gradually drying and trunks filled with holes; the estimated economic impact is 28-32% of the palms (Khalaf et al., 2014).

The present investigation was conducted to study the presence of date palm borer damages caused by them and their distribution in Iraqi agroecosystems.

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MATERIALS AND METHODS

Sites of the research

The work was conducted for three years from 2011 to 2013, at date palm orchards in the following governorates/district: Baghdad/Almadain; Wast/Alnoaamanya, Krbala/Oon; Aldywania and Basrah/Abu Alkhasyb, Shatt Alarab and Alqurna. Three orchards, each with 1 hectare land area were randomly selected at each site to collect data. Selected orchards were of old (more than 40 year) and medium age (20-30 year), planted with mostly common date palm fruit varieties such as: Zahdi, Khastawi, Barhee, Hellawi, Omrani, Khadhrawi, Brem and Sukri (Fig. 1).

Methods of field surveys

Hand collection

This method was used to collect immature stages (larvae and pupae) between November and the end of April of the following year (2012), this period coincide with the period of annual regular service work of palm orchards, such as pruning the old dry fronds (Fig. 2 Khalaf and Al-Taweel 2015). The collected individuals were placed in a plastic container (5 L) supplied weekly with pieces of fresh distal part of fronds used as food. Containers were kept under rearing room conditions (27C° ± 2, 70% RH± 5 and complete darkness).

Light traps

Magna Light traps (Russell IPM, UK) supplemented with solar cells and lights (350-420 nm wave length) (Fig. 3a Khalaf and Al-Taweel 2015) and similar traps produced by Directorate of Renewable Energy, Iraqi Ministry of Science & Technology were used to catch adults borer (Fig. 3a Khalaf and Al-Taweel 2015). The traps were placed inside orchards during the period of adult activity, from April till October (Khalaf et al., 2011).

Pheromone traps

Plastic bucket (20 L) with lid and three openings (5cm diameter) supplied with a pheromone sputa of *Oryctes elegans* (Russell IPM, UK) hanged inside the trap, were used to catch adults. Each bucket was also surrounded with palm fibers to assist adult borer to clamp. Pheromone traps were fixed on date palm tree trunk or fronds at 1.5-2 m height.

Trunk cutting

Chain saw was used to cut old damaged trees which normally were heavily infested with borers. Trunks are crossed and longitudinally cut into small pieces to reveal borer tunnels. All borers individuals found were counted, marked and transferred to the laboratory for rearing.

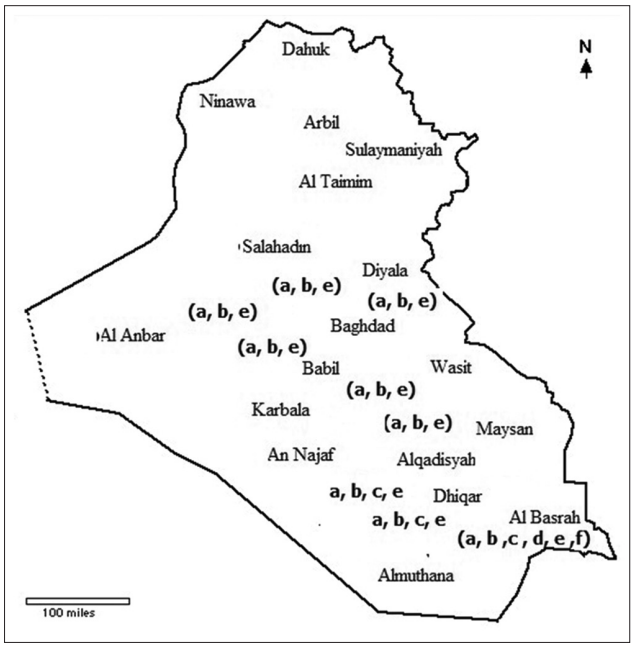

Fig 1. Map of Iraq showing the dispersal of date palm borers in Iraq. (a) *Phonapate frontalis*, (b) *Jebusaea hammerschmidtii*, (c) *Oryctes elegans*, (d) *Oryctes agamemnon*, (e) *Orycte agamemnon arabicus*, (f) *Orycte agamemnon matthiesseni.*

Species identification

All collected adult beetles from orchards and from laboratory breeding were separated into two groups, the first one contained individuals that could be identified into species in our laboratory depending on morphological characters of each species using published references in this field and related scientific literatures (Khalaf et al., 2013 and references sited). The second group contained specimen having high phenotypic similarities was send to the British Natural History Museum/Anglia Marmot Center for Biodiversity, for farther critical identification.

RESULTS AND DISCUSSION

Identification and spread of date palm borer species

Field surveys and identification processes indicated the presence of six different insect borers infested date palm trees in studied Iraq agro-ecosystems. They are: Palm frond borer, *Phonapate frontalis* F. (Coleoptea: Bostrychidae) (Fig. 4); Long horn palm stem (trunk) borer, *Jebusaea hammerschmidtii* Reich. (Coleoptera: Cerambycidae) (Fig. 5 Khalaf and Al-Taweel 2015); and four different species of Coleoptera: Scarabaeidae including Fruit stalk borer (Bunch), *Oryctes elegans* Prell.; Root borer, *Oryctes agamemnon* Burmeister with two subspecies: *O. agamemnon matthiesseni* Reitter and Arabian rhinoceros beetle, *O. agamemnon arabicus* Fairmaire, which consider first record for Iraq (Fig. 6 Khalaf and Al-Taweel).

Fig 2. Parts of annual fronds pruning (a and c before pruning, b and d after pruning).

Fig 3. Light traps with solar energy (a- UK design, b- Iraqi design).

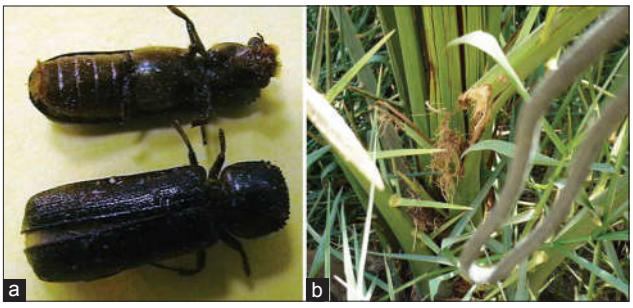

Fig 4. Frond borer, *Phonapate frontalis*, at (a) adults stage, (b) damages inflected.

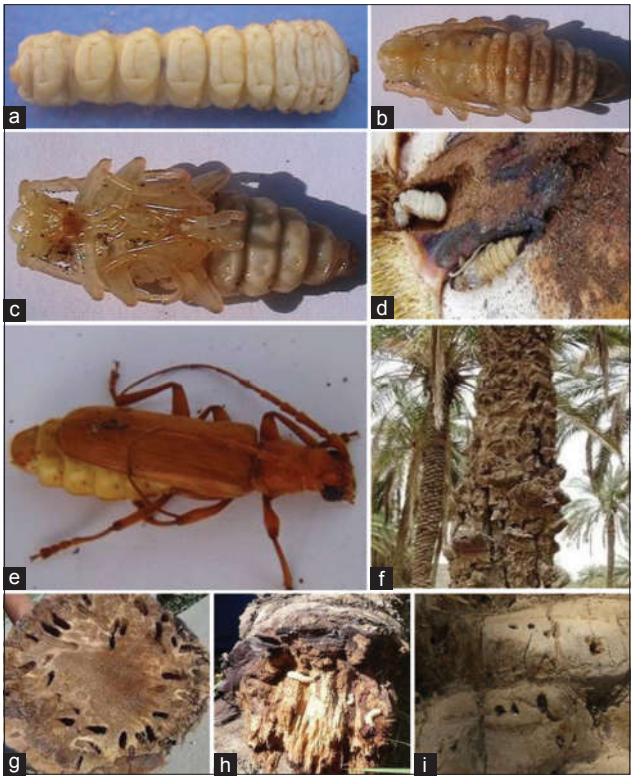

Fig 5. Long horn palm stem (trunk) borer, *Jebusaea hammerschmidtii.* (a) larva, (b, c, d) pupae, (e) adult, (f, g, h, i) damages in stem (Trunk).

The geographical distribution of these species is shown in Table 1. Results indicated that *P. frontalis* and *O. a. arabicus* were spread in all visited date palm orchards, while *J. hammerschmidtii* was absent from Baghdad orchards only. However, *O. elegans*, *O. agamemnon* and *O. agamemnon matthiesseni* were found only in Basrah orchards.

Damage caused by borers

Results in Table 2 indicates that *P. frontalis* infest fronds and bunches, which eventually broken especially at high infestation level (Fig. 4). Infestations were mainly localized on mid of the fronds or on bunches near the crown. Long horn palm stem borer, *J. hammerschmidtii* larvae are found all along the tree trunk and could be found in tree crown causing heavy damage. This borer enters in tree crown through circular holes of around. It was recorded presence of 265 holes in one meter long of the trunk (Fig. 5 f, g, h, i). Infestation by *O. elegans* larvae characterized by that the opining in the trunk led to a pit, its size differs with the intensity of infestation. In addition, this species might found infesting the fronds at high infestation levels, in such cases high winds could broken the trunk. Recorded infestation by *O. agamemnon* larvae was fond to be only on tree trunk. The same was applied for *O. a. arabicus*, which at high levels of infestation caused formation of cavities of different sizes inside the trunk and might led to broken the trunk, especially at high winds (Fig. 6h, i, j). Such cases were obvious in Waset/Alnoaamanya orchards. Infested trunks were only recorded for *O. a. matthiesseni* in all Basrah orchards surveyed.

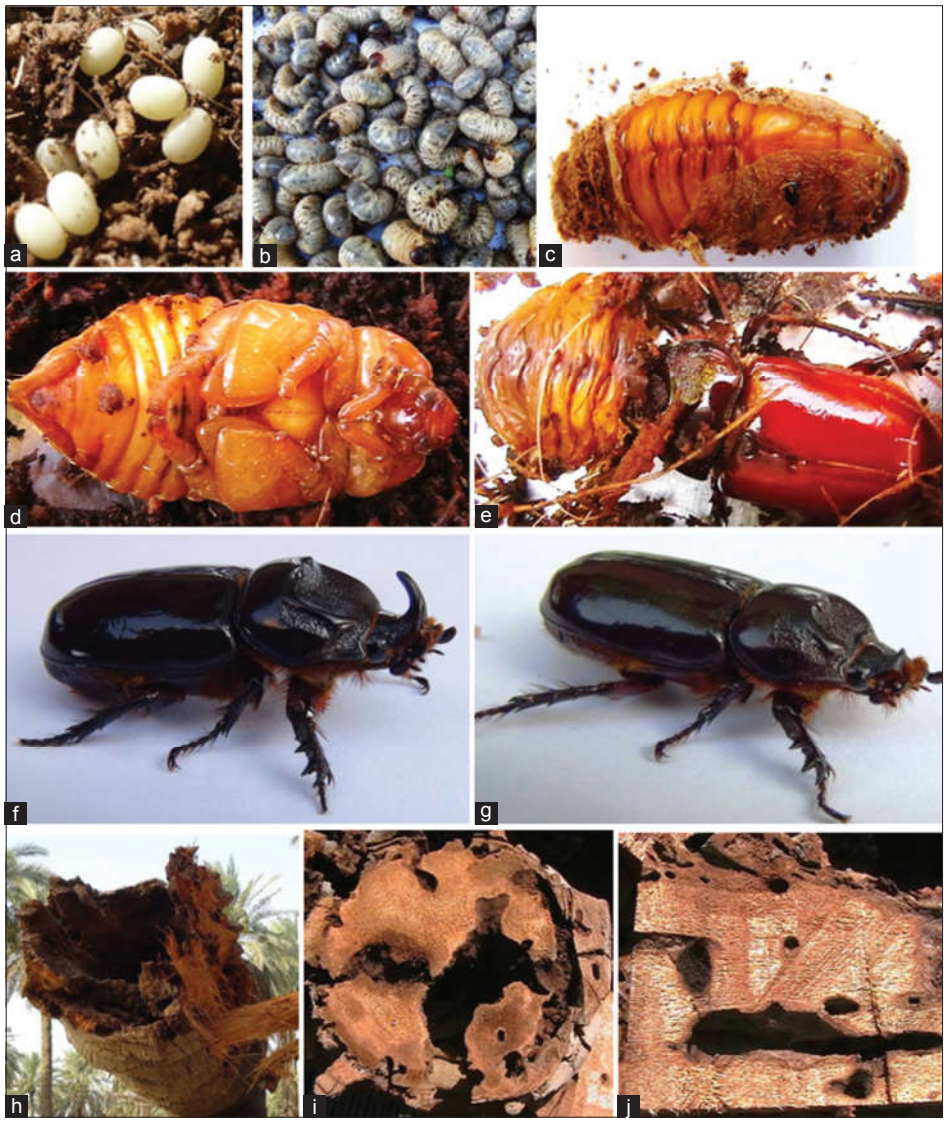

Fig 6. *Oryctes* spp., (a) eggs, (b) larvae, (c, d) pupae, (e) emerging adult, (f)-adult male (*Oryctes agamemnon arabicus*), (g)-adult female (*Oryctes agamemnon arabicus*), (h, i, j) damages caused by different *Oryctes* spp.

Table 1: Present and distribution of palm borers species in some regions of Iraq in 2012-2013

Borer species	Regions			
	Baghdad/Almadain	Wast/Alnoaamanya	Karbala/Aldywania	Basrah/Abu Alkhasib and Shatt Alarab
Phonapate frontalis	+	+	+	+
Jebusaea hammerschmidtii	-	+	+	+
Oryctes elegans	-	-	-	+
O. agamemnon	-	-	-	+
O. agamemnon arabicus	+	+	+	+
O. agamemnon matthiesseni	-	-	-	+

Present (+), Not present (-)

Flight activity of borers

Table 3 indicated that date palm orchards in Baghdad attack by *P. frontalis* and *O. a. arabicus*, with trap catch of 5 and 16 adults/trap/week respectively during June. In Waset orchards, three different species were recorded: *P. frontalis, J. hammerschmidtii and O. a. arabicus*, with highest trap catch of 31 adult/trap/week for *J. hammerschmidtii*. The same three species were found in Karbala and Aldywania orchards, and *J. hammerschmidtii* was also the dominant species. In Basrah, all six different borers species

Table 2: Parts of date palm tree attack by palm borer species

Borer species	Part of date palm attack by borers						
	Root	Lower trunk	Mid trunk	Upper trunk	Tree crown	Fronds	Bunches
Phonapate frontalis	-	-	-	-	-	+	+
Jebusaea hammerschmidtii	-	+	+	+	+*	-	-
Oryctes elegans	-	+	+	+	-	-	+
O. agamemnon	+	+	+	+	-	-	-
O. agamemnon arabicus	-	+	+	+	+*	-	-
O. agamemnon matthiesseni	-	+	+	+	-	-	-

Infested (+), Not infested (-), Infested only in heavy infestation levels (+*)

Table 3: Population density of adult date palm borers s caught by light trap

Region	Number of borer adults caught by light trap per week					
	Phonapate frontalis	*Jebusaea hammerschmidtii*	*Oryctes elegans*	*O. agamemnon*	*O. agamemnon arabicus*	*O. agamemnon matthiesseni*
Baghdad/Almadain	5	0	0	0	19	0
Wast/Alnoaamanya	4	31	0	0	25	0
Karbala, Aldywania	3	24	0	0	16	0
Basrah/Abu Alkhasib and Shatt Alarab	1	42	9	22	27	11

mentioned in this study were found to be presence in date palm orchards, with the dominancy of *J. hammerschmidtii* and *O. a. arabicus* (42 and 27 adults/trap/week respectively) during June.

The overall results were in harmony with that mentioned by Atia et al. (2009) and Hussain (1963) about damages caused by *P. frontalis* in Lybia and Iraq respectively. The present results confirm that of Hussain (1963), Al-Baker (1972) and Swayer *et al* (1979) in that borers of *Oryctes* spp. caused high damages in date palm trees by making galleries inside trunks and the basal part of cut leaf. Al-Sayed and al-Tamiemi (1999) recorded that borers of *Oryctes* species attacks date palm trees and occasionally caused bunches to be broken. In addition, Hinkley (1979) found that *Oryctes* borers caused damages to date palm trees by attack sites underneath the basal part of cut leaf. Soltani (2009) found *O.a. arabicus* attacks all parts of tree trunk, hairy roots and lower part of the crown, in Tunis. Galleries done by different borer's species also might attract by other insect pest, or act as sit for other borers species attack and as entrance for some pathogens.

CONCLUSION

The results depicted in the present investigation showed that six different species of borers, with *Oryctes agamemnon arabicus* recorded for the first time in Iraq infests date palm trees in Iraqi agro-ecosystem with different geographical distribution and flight activity. These endemic borers especially *O. a. arabicus* inflict increasing damages in date palm trees, especially during last 2 – 3 decades due to negligence and bad management of date palm orchards.

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Author contributions

M. Z. K. and H. F. A. made equal contribution in planning and conducting the study, data collection, and manuscript preparation.

REFERENCES

Abass, A. H. 2000. Laboratory and field observation on palm stem borer *Oryctes elegans* (*Coleoptera: Scarabaeidae*). In: 7th Arab Congress of Plant Protection, Oct. 22-26. Amman, Jordan, p42.

Al-Bahely, A. Z. A. 2004. Study of biology and chemical control of date palm long horn stem borer *Jebusaea hammerschmiditi* Reich. (*Coleoptera*: *Cerambycidae*) M.Sc. Thesis, College of Agriculture, Basra University, Basra, Iraq. p95.

Al-Bayti, S. A. and S. A. Ba-Angood. 2009. Sensitivity of some date palm varieties to infestation in palm stem borers in Wadi Hadramaut (in Arabic, Section: palm pests). Available from: http://www.iraqi-datepalms.net, last access in 5 Sept. 2014.

Al-Beker, A. J. 1972.The Date Palm, a Review of Its Past Present and Recent Advances in Its Culture Industry and Trade. Al-Watan Public. Co., Iraq, p1085.

Al-Deeb, M. A. 2011. Population dynamics of *Oryctes agamemnon arabicus* and effect of light color on light-trap effectiveness. Global Conference on Entomology, March 5-9, 2011 Chaing Mai, Thailand. p25.

Al-Sayed, A. E. and S. S. Al-Tamiemi. 1999. Seasonal activating of the fruit stalk borer *Oryctes agamemnon* (*Coleoptera:*