Keys for Identification Arthropods Pests Attacking Date Palm

Tawfiq M. Al-Antary*, Mashhour M. Al- khawaldeh** and Mazen A. Ateyyat***

*Prof of Economic Entomology and Pesticides, Department of Plant Protection, Faculty of Agriculture, the University of Jordan, Amman 11942, Jordan.

E-mail: tawfiqalantary@yahoo.com

**Ph.D. Student.

***Prof of Integrated Pest Management, Department of Plant Production and Protection, the Applied Balkah University, Al- Salt, Jordan.

Abstract

Field trips were carried out weekly in the Jordan Valley, once per two months in Aqaba from April 1999 to August 2000, and one visit every 1-3 months to different parts of Jordan from 2001 to 2014 to collect date palm insect pests. Keys for the species of date palm arthropods are presented for their materials examined. Classification was conducted for order, family, genus and then species. Keys for arthropods attacking date palm in Jordan were for homopterous, lepidopterous, coleopterous and mites' pests were constructed. Some of the specimens were permanently preserved in 70% alcohol. Other specimens were dried and pinned or mounted on microscopic slides when needed, especially for mite materials.

Keywords: Field trips, Taxonomic keys, Homopterous, Lepidopterous, Mite, Jordan.

1. Introduction:

Date Palm tree (*Phoenix dactylifera* L.) is considered one of the fruit trees that belong to Palmaceae. The genus consists of fourteen species distributed in the tropical and sub-tropical regions. In Jordan, there are many locations that have suitable environmental conditions, mainly Jordan Valley and Aqaba. The tree productivity fluctuates from year to another due to the pest's status in the field. The productions also fluctuate and differ from location to another. Of these pests (arthropod pests) which were recorded in Aqaba (Mustafa-Al-Antary and Sharaf, 1994) are: gray date scale: *Parlatoria blanchardi* (Coccidae: Homoptera), almond moth: *Ephestia (Carda) cautella* Walker (Pyralidae:Lepidoptera), old world date mite: *Olygonychus afrasiaticus* (Mc Gregor) (Tetranychidae: Acariformis) and fruit stalk borer: *Oryctes elegans* Perll (Scarabaeidae: Coleoptera). In addition, greater date moth, *Arenipses sabella* (Hampson) (Pyralidae: Lepidoptera) and lesser date moth, *Batrachedra amydraula* Meyric (Cosmopterygidae: Lepidoptera) has been observed attacking date palm in Jordan Valley.

In spite of the economic importance of some insect pests of date palm, which threatens the trees plantation and expansion in Jordan, there is only one published report (Mustafa- Al-Antary and Sharaf, 1994) about recording some insects attacking palm in Aqaba. However, no studies have been conducted yet on the number of pests, number of generations, and the distribution in different localities in Jordan. Mustafa-Al-Antary and Salameh (1999) recorded the destructive red (Indian) palm weevil in Jordan (*Rhynochphorus ferrugineus* F.) which is considered as a key pest in many countries. Four pests were observed in the field. These are greater date moth (*Arenipses sabella*), lesser date moth (*Batrachedra amydraula*), old world date mite (*Olygonychus afrasiaticus*) in Aqaba and gray date scale (*Parlatoria blanchardi*) in Jordan valley. The first two attack the floral parts; the later attack the fruits in the pre and post-harvest phase.

Corbet and Tams (1943) published keys for the identification of lepidopterous insects infesting stored product insects as date fruit moth. Illustrations for the wing venation and the genitalia could be used for species identification. A guide to identify common insect pests of stored food products were made by Hinton (1955), in which *Carpohillus* spp. and *Ephestia* spp. could be identified. Many Nitidulid insects were studied by Jelinek (1967). Al-Azawi (1980) published keys for economic insects of Iraq including the date palm insects. His work relied on some morphological characters, but mainly on the infestation symptoms. Lepsme (1947) published a book about insects attack palm trees; each species distribution, synonymy names and some morphological characters were found. Several workers (AL- Khatri, 2009, Al- Dhaher and Al-Ayeid, 2014) did a survey on date palm insects in Arabic Gulf and Egypt (Abd-Rabou and Abd-El Samea, 2006; Abbas, 2010; Radwan, 2012; Salim & Bakhity, 2013).

This study objectives were to survey the insect pests attacking all parts of date palm including the flowers, fruits, stem, trunk and roots, in different regions of Jordan particularly Jordan Valley cultivating this mentioned economic tree and constructing a taxonomy key of date palm arthropods to facilitate the identifying of any pest attacking this tree in Jordan and surrounding countries.

2. Materials and Methods:

2.1. Survey of Insects and Pests Attacking Date Palm Trees

2.1.1. Field Work

2.1.1.1. Collecting sites: The survey mainly focused on the Jordan valley in the main date palm groves. Some materials were also collected from Aqaba. These localities had several unidentified date palm cultivars.

2.1.1.2. Collecting methods:

Once monthly, for two years (1999-2000) and 1-3 months to different regions in Jordan from 2001 to 2014, date palm trees were examined for any mite or insect infestation. Random samples were collected by the following methods:

a. The base of the stem, stem trunk, leaves, bunches and the top of the tree were checked for any pest infestation. Insects found were collected and killed by using the killing jar. Soft body-small insects were preserved in 70% alcohol. Some infested parts of the trees were brought to the laboratory as well for further examination.
b. Six light traps (20W Bio-lab design-USA, manufactured in Jordan) were used. Three light traps were placed in each of the two farms (Southern Shouneh farm and Baqura farm). The distance between each two traps was more than 50 m and about one kilometer from the electricity source. These traps were used to capture moths and other insects. Insects collected were examined in the laboratory weekly, sorted out and identified. The insect collection continued for two years, from April, 1999 to November, 2000.
c. Occasionally, the farmers or government staff of Ministry of Agriculture collected insects. These materials were considered as part of the survey; collector name was written on each sample.

2.1.1.3. **Labelling:**Collected samples were labelled with the following data: the name of the locality, date of collecting, part of the tree in which the material was collected and other field notes.

2.1.2. Specimens preparation

2.1.2.1. **Sorting:** Adults of each collected arthropod were sorted preliminary into different morphs that were suspected to be a different species.

2.1.2.2. **Preservation and pinning:** Some of the specimens were permanently preserved in 70% alcohol. Other specimens were pinned or prepared on microscopic slides when needed especially for mite materials.

2.1.3. Identification of Species

2.1.3.1. Training in Iraq Natural History Museum:

A visit to Iraq Natural History Museum was done by the second author in the period from March, 2 to April 3, 2000. During the visit, a training was received under supervision of Prof. Dr. Mohammed Saleh Abdul Al-Rassoul , and Prof. Dr. Hussain Abbas Al-Ali of the museum in Baghdad for identification of the insects of date palm, confirming and identifying Jordanian materials, bringing identified specimens for certain species not collected during this study. Literatures were gathered from the museum library, the Agricultural Faculty library in University of Baghdad, the library of the Faculty of Agricultural Research (Ministry of Agriculture), in addition to many personal libraries of those institutions staff. Dr. Ibraheem Al-Jouburi, of Faculty of Agriculture, University of Baghdad, had identified mite specimens.

2.1.3.2. Identification keys:

Due to the lack of any key for the identification of the insects of date palm of Jordan, keys for the identification of species were formulated depending on the characters of the collected specimens and key specimens brought from Iraq. For the unavailable specimens, characters used in the keys were obtained from various sources in the literature.

Formulated keys were reviewed by both Dr. M. S. Abdul Al-Rassoul, and Dr. H. A. Al-Ali during their visit to Jordan to participate in the Seventh Arab Congress of Plant Protection hold on 22-26, October, 2000 in Faculty of Agriculture, University of Jordan, Amman, Jordan.

3. Results

Keys for the species of date palm insects are presented. Higher classification (order and family) was followed according to Borror *et al* (1981).

3.1. Keys for identification

3.1.1. Key for Homopterous insects that attack date palm:

Homopterous insects that attack date palm belong to two families, Tropiduchidae and Coccidae (scale insects). These two families belong to different Sub orders, the first belongs to Auchenorrhncha and the later belongs to Sternorrhynch. Borror *et al* (1981) separated the two sub orders.

1. Insect less than 3 mm long, scale insect, nymph without long white caudal filament in the end of the abdomen **(Coccidea)** ……..2
- Insect 3-6 mm long, leaf hopper, nymph with 16 waxy caudal filaments in the abdomen **(Tropiduchiae)** ……***Ommatissus binotatus***

2. Insect covered with scale ……3
- Insect with waxy material around the insect instead of the scale, rosy to red insect 1-1.25 mm long ……..……***Phoenicoccus marlatii***

3. Oval yellowish green scale, insect under scale is yellowish green, 1-1.25 mm long, 0.7 wide, convex ……..….***Asterolecanium phoenicis***
- Oval white scale with dark spot on dorsum yellowish pink to red 0.8 mm long, 1.2-1.6 mm long, flat ……....***Parlatoria blanchardii***

3.1.2. Key to the moths (Lepidoptera) that attack date palm trees:

The moths belong to two families; Pyralidae and Coleophoridae (Sub-order: Ditrysia) according to key from Borror *et al* (1981) and confirmed from Corpet (1943).

1. Hindwing with vein Sc and Rs fused for a varying distance beyond discal cell or separated ,but closely parallel (Plates 1 and 2), Sc and R in hindwing separated along front of discal cell, or base of R trophoid **(Pyralidae)** ……..2
- Hindwing with vein Sc and Rs widely separated beyond discal cell, base of R usually well developed (Plate 3) (**Coleophoridae**: Batrachedrinae).....***Batrachededra amydraula***

2. Forewing with R5 absent (plate 1) (Phyctinae), R3 absent ……..……***Ephestia* spp.**
- Forewing with R5 present (plate 2) (**Galleriinae**, labial palpi short, forewing vein A1+2 furcated at the base and vein R3 and R4 arising out of vein R5) …….***Arenipses sabella***

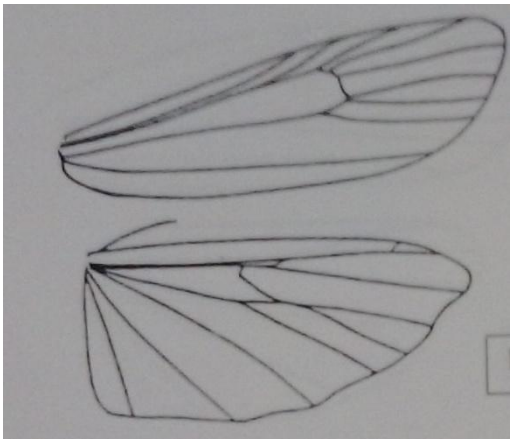

Plate 1: Wing venation of *Ephestia* spp. (After Al-Antary *et al*, 2014)

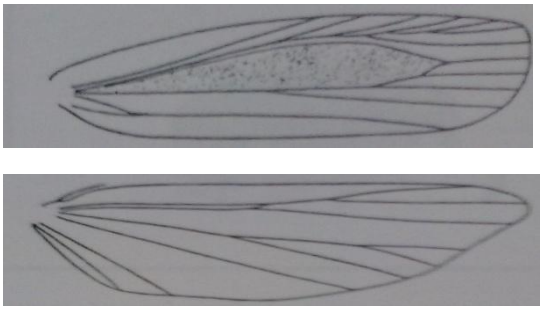

Plate 2: Wing venation of *Arenipses sabella.* (After Al-Antary *et al*, 2014)

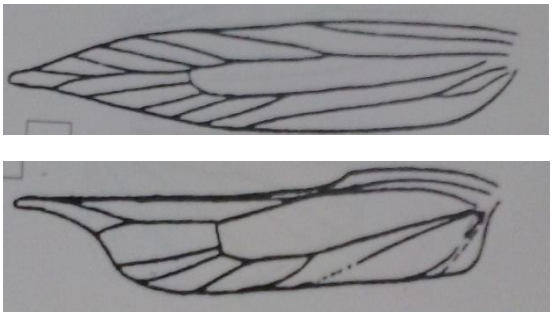

Plate 3: Wing venation of *Batrachededra amydraula.* (After Al-Antary *et al*, 2014)

3.1.3. Key for Coleopterous insects that attack date palm:

1. Head strongly produced in front of eyes to form a distinct peak or snout, weevil **(Curculionidae)** (adult more than 25 mm long, dark red with black spots on thorax)……***Rhynchphorus ferrugineus***
- Head broad and short beyond eyes without a distinct snout, beetle…….2

2. Head not visible from above, pronotum tuberculate with blunt horn like process (species belong to **Bostrichidae**)……..3
- Head easily visible from above, pronotum not as above ……..……..4

3. Small, 2-3.5 mm long, head and abdomen brownish, pronotum and elyrta base reddish……***Enneadesmus trispinosus***
- Big, 11-12 mm long, dark brown to black …….... ***Phonapathe frontalis***

4. Antennae lamellate, 3 or 4 terminal antennal segment expended laterally (side way) into elongate lamellate capable of being united into a compact club (rhinoceros beelte, more than 25 mm, belong to family **Scarabidae, *Oryctes* spp.**)……6
- Antennae not lamellate (not club), antennae with 11-12 segments …….5

5. Antennae 11 segments, less than body long, (body length less than 1.5 mm, elytra sometimes short and exposing tip of abdomen (**Nitidulidae**)…….…… 9
- Antennae 12 segmented, as long as the body (elytra not exposing tip of the body, long horn beetle, **Cermbicidae**)……. ***Jebusaea hammershmidti***

6. Longitudinal carina on ventral of protibia with strong apical vertical and acute teeth, elytra strongly punctuated……....***Oryctes rhinoceros***
- Longitudinal carina on ventral of protibia without teeth, elytra smooth without punctuation…… …7

7. Apical trucanter for posterior tibia with two tooth……...***Oryctes elegans***
- Apical trucanter for posterior tibia with three tooth……...***Oryctes boas***

8. Body length more than 6 mm, nearly rounded, black in color ……..***Urophorus humeralis***
- Body length less than 6 mm, nearly elongate ……9

9. Each elytron dark brown with large and distinct pale (usually yellow) spot at apex (M-shaped), smaller spot at base, 2 mm long ……..***Carpophilus hemipterus***
- Elytra unicolorous or with sutural region slightly darker than the rest of elytra……..10

10. The body nearly oval, sutural region dark brown in color, side parts of male genitalia with moderately dense hairs, 2-3.5 mm…….***Carpophilus dimidiatus***
- The body nearly compact in the middle, sutural region red in color, side parts of male genitalia with little dense hairs…….***Carpophilus mutilates***

3.1.4. Key to the mite pests that attack date palm trees:

Keys for mite pests' families, genera and species of date palm mite pests are presented after modification after Abul-Hab (1986).

1. Mite 8-legged with fate body (**Tetranychoidea**)……2
- 4-legged mite with wormlike shape (**Eriophoidea**)……..……..8

2. Mite with palpal thumb-like and long needle-like chelicerae (**Tetranychidae**)……..…3
- Mite lacking thumb-claw (**Tenuipalpidae**)……...6

3. Tarsus I without closely associated duplex setae, or duplex setae absent, empodial clawlike and small (**Eutetranychus**)…….…….4
- Tarsus I with 2 pairs of duplex setae, empodium claw like or split distally……...5

4. Hysterosomal setae D3 and D4 form a rectangular. The striae are longitudinal between the hysterosomal setae ……...…..…3
E. orientalis
- Hysterosomal setae D3 and D4 did not form a rectangular. The striae on the hysterosoma are transverse except for the V-pattern between setae D2 and D3 ……...***E. bankasi***

5. Empodium clawlike with proximoventral hairs; duplex setae of tarsus I distal and approximate (**Oligonuchus**)……..…
O. sfrasiticus
- Empodium split distally, usually into three pairs of hairs; duplex setae of tarsus I well separated (**Tetranychus**)…….……..
T. urticae

6. Dorsosublateral setae present……7
- Dorsosublateral setae absent (gnathosoma not covered by propodosoma; a pair of caudal setae flagellate, **Colopalpus** Pritchard and Baker) ……..……....
C. eriophoides

7. Hysterosome with 4 pairs dorsosublateral setae; rostral shield absent (**Raoiella** Hirst)……..*R. indica*
- Hysterosome with 3 pairs dorsosublateral setae; rostral shield present in female (**Phyllotetranychus** Sayed)……..…….***P. aegyptiacus***

8. Cephalothoracic shield with 3 or 4 shield setae, legs with all standard setae, including foretibial setae, usually with lateral foretibial spur. (**Nalepllidae**)…***Mackiella phoenicis***
- Shield with 2 rear (dorsal) setae, or none, legs setae variable, most forms with standard setae, never with foretibial lateral spur. (**Eriophidae**)……..***Tumescoptes trachycarpi***

4. Discussion

The actual number of species that occurs in Jordan could be closely estimated only by conducting a survey for long time, collecting materials from all date palm planted areas in Jordan. Also it should be taken in consideration that new species might be introduced into the country with the introduction of plant materials from any area that could be infested with pests.

Three insect species and one mite species were recorded from Jordan. Mustafa-Al-Antary and Sharaf (1994) recorded three insect species and one mite from Aqaba area, namely: *Parlatoria blanchardii* (Targioni-Tozetti) (Grey date scale), *Oryctes elegans* Prell (Fruit stalk borer), *Ephestia cautella* (Walk) (Almond or fig moth) and *Olygonychus (Paratetranychus) afrasiticus* (Mc Gregor) (Old world date mite).

Red (Indian) palm weevil (*Rhynchophorus ferrugineus* Olivier) was added to date palm fauna of Jordan as an introduced pest (Mustafa-Al-Antary and Salameh 1999), to increase the recorded species to five. These species were also collected during this study. However, *Oryctes rhinoceros* L. (Rhinoceros beetle borer) was misrecorded as *Oryctes elegans* Prell (Friut stalk borer). This was found after examination of materials collected at that time, compared with key specimens of *O. elegans* brought from Baghdad and following illustrated keys published by lipsume (1947). The late identification was confirmed by Prof. Abdul Al-Rassoul of Baghdad Insect Museum.

Three other insect pest species and one mite species were newly recorded during this study on date palm namely: *Vespa orientalis* L. (Oriental wasp) and *Drosophila melnogaster* (Vinegar fly) on the fruit. *Blattela germanica* (German cockroach) on the trunk. The mite species was *Tetranychus urticae* (two spotted red mite) on the leaves. These raised the pests' number attacking date palm to eight species.

Eleven insects' species and one mite species were newly recorded attacking date palm trees, namely: *Asterolecanium phoenicis* Ram. Rao (Green scale), *Phoenicoccus marlatii* Cockerell (Red date scale), *Ommatissus binotatus lybicus* De Bergevin (Du9bbas bug), *Adiheteothrips jambudvipae* Ramok (Taleh thrips), *Bartachedra amydraula* Mayer (Lesser date moth or Hummairah), *Arenipses sabella* (Humpsn) Great date moth), *Oryctes rhinoceros* L. (Rhinoceros beetle borer), *Carpophilus dimidiatus* F. (Corn sap beetle), *Carpophilus mutilates*, *Urophorus humeralis* (Pinapple beetle) and the mite species was *Eutetranychus banksi* (Texas citrus mite). These newly recorded species raised the number of species attacking date palm trees (in addition to stored product insects collected from the field) in Jordan to be twenty species. In addition, one termite species and other *Ephastia* species which need identification. Twenty-two insect species were recorded to attack date palm in the field in the Near East and North Africa (El Haidari and Al Hafidah, 1986; Abd Al-Salam, 1993; Murphy and Brisco, 2000). From these, eleven species were recorded in Jordan. Another two pests namely *Viricola livia* and *Schistocera gregaria* (El Haidari and Al Hafidah, 1986) were found in Jordan but not recorded to attack date palm during this study. Sixteen species were recorded in Iraq, fifteen in Egypt, fourteen in Saudi Arabia (El Haidari and Al Hafidah, 1986), nine in Libya (Bitaw and Ben Saad, 1990), eight species in Palestine (Avidov and Harpaz, 1969; El Haidari and Al Hafidah, 1986).

In conclusion, keys with illustrations were made as follows:

- The current study is the first reported attempt for doing taxonomical keys for insect attacking date palm trees in Jordan and the surrounding countries.
- This investigation was conducted in order to be used for identifying the existent species and to be used to identify foreign species when examining imported plant material in quarantine stations, particularly those not recorded species in Jordan, but recorded in the surrounding countries, also when transferring plant material from an area to another in Jordan. For example red palm weevil was recorded in Jordan valley, but not in Aqaba and Rhinoceros borer beetle found in Aqaba but not in Jordan valley.

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