



The Red Palm Weevil (*Rhynchophorus ferrugineus*) in Mansoura City, Daqahliya Governorate, Egypt.

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Abstract

Red Palm weevil (RPW) *Rhynchophorus ferrugineus* was identified and studied morphologically. Stages studied were larva, prepupa, pupa, pupal case, and adult. All studied specimens were collected from the field which was at the backyard of Science Faculty, Mansoura University. Different signs of infection on date palm *Phoenix dactylifera* were recorded and photographed. This article is representing the first record of RPW in Daqahliya Governorate, Egypt.

Introduction

Red palm weevil *Rhynchophorus ferrugineus* (Olivier, 1790) belongs to Order Coleoptera, Subfamily Curculionidae, Family Dryophoridae, Subfamily Rhynchophorinae, Tribe Rhynchophorini, Genus *Rhynchophorus* (Alonso- Zarazaga and Lyal, 1999). It has different common names, for instance, coconut weevil, red stripe weevil (OEPP/EPPO, 2008; Faghieh 1996). It is an indigenous pest in Southern Asia and Melanesia causing serious damage to coconut palms (Falerio, 2006). By 1980s the weevil becomes a serious pest in many countries all over the world. It invades several palm species such as *Phoenix dactylifera*, *P. canariensis*, *P. sylvestris*, *Cocos nucifera* and *Metroxylon sago* (Rahalkar *et al.*, 1985; Murphy and Briscoe, 1999; Ferry and Gomez, 2002 and Falerio, 2006).

It has invaded Kingdom of Saudi Arabia, United Arab Emirates and Sultanate of Oman in 1985 (Abozuhairah *et al.*, 1996). It spread in Iran in 1990 (Faghieh, 1996). The invasion

has extended to Spain in 1994), Israel, Jordan and Palestine in 1999. The weevil expands its invasion to Italy in 2004 (EPPO, 2006), Greece, Cyprus and France in 2006 (OEPP/EPPO, 2008), then Portugal, Syria, Morocco in 2008 (EPPO, 2008) and USA in 2010 (EPPO, 2010).

Egypt has been invaded by the pest since 1992, the first record was in El-Husainia, Sharquiya Governorate (Cox, 1993) and then

the invasion has expanded to Ismaeliya (CABI/EPPO, 2003).

The present article documents the invasion of date palm *P. dactylifera* by *R. ferrugineus* in Mansoura city, Daqahliya Governorate, Egypt.

Materials and methods

Different developmental stages of RPW except eggs were collected from the backyard of Science Faculty, Mansoura University. Larvae were collected from the fallen fronds; they were hidden in tunnels into the petioles. Cocoons obtained from collapsed

trunks where they were among the rotting trunk tissues. Fifty cocoons were collected and gathered in wooden cage. Its size was $100 \times 50 \times 50 \text{ cm}^3$. The sides were lined with wire screen with square meshes 10 mm^2 . The cage was left inside the area of the infected palms to keep cocoons under the natural ecological conditions. (Avg. temperature : 29°C , Avg. humidity: 41%) Emerged adults were collected and transferred to the laboratory for studying. Nikon dissecting microscope was used at magnification 3x.

Results

The adult

The size of adult red palm weevil (RPW), *Rhynchophorus ferrugineus*, varies from 42 to 48 mm in length and from 12 to 14 mm in width (Fig.1).

The weevil has long slightly curved slender snout (Figs.2&3) ending anteriorly with a pair of sharp denticulate mandibles. The snout and head combined are equal to four fifth the length of the pronotum (Figs.1&2). Male snout carries stout erect hairs along the anterior two third of the mid-dorsal line (Fig.3). RPW has shiny reddish brown head finely punctured and has a pair of prominent dark eyes each is lateral in position situated next to the base of the snout (Fig.3).

Snout is shiny reddish-brown in color dorsally while it is shiny dark brown ventrally (Figs.4&5).



Fig.1 : Newly emerged adult of red palm weevil (RPW) from pupal case.
as. anterior spot, e. elytra, Ls. Lateral spots, p. pronotum, py. Pygidium, s. snout

There is a sexual dimorphism in RPW as female snout is bare (does not carry any hairs).

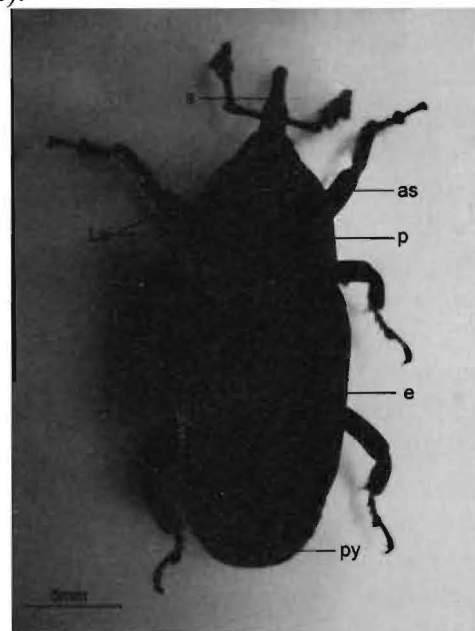


Fig.2: Dorsal side of RPW

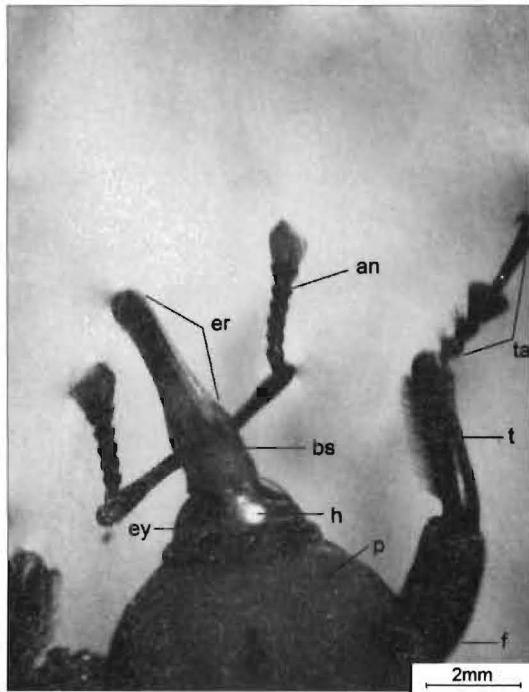


Fig.3 The snout of male RPW
 an. antenna, bs. basal part of the snout, er. erected hairs, ey. eye, f. femur, h. head, p. pronotum, t. tibia, ta. tarsus

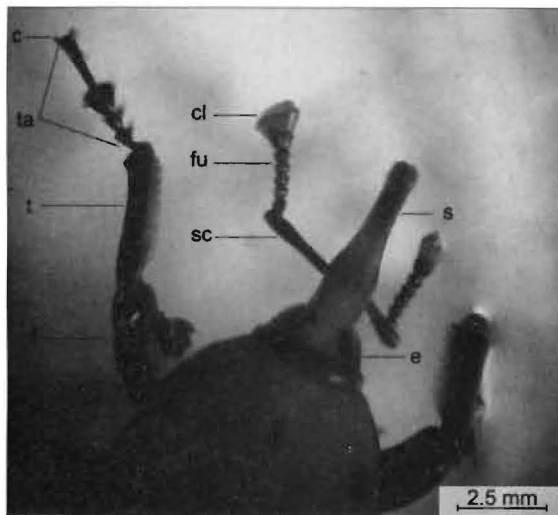


Fig.4: Geniculate antennae of RPW
 c. claw, cl. club, cm. cluster of mites, e. eye, f. femur, fu. funicle, s. snout, sc. scape, t. tibia, ta. tarsus

Antennae of the weevil are geniculate. They are formed of brown scape, reddish brown funicle and reddish club (Fig.4). The length of the scape is equal to the length of funicle and club combined. Funicle consists of 6 segments, the basal and apical segments are differ in size and shape while the 4 segments

in between are identical. The club is large, triangular in shape with several setae distributed all over the dorsal, ventral and inner side. Antennae are situated laterally near to the base of the snout.

The pronotum is finely punctured, reddish in color dorsally and dark brownish ventrally. It is more or less conical in shape with slope sides rounded at anterior and posterior margins.

There are 5 black spots differ in size and shape but with fixed position, two on each lateral side and one situated anteriorly anteriorly at the mid dorsal line (Figs. 1&2).

The scutellum is one fourth the length of the elytron, reddish brown in color, triangular in shape with pointed end (Fig.6).

Prosternum is conical in shape, mesosternum is barrel, while metasternum is greatly reduced representing only by narrow sclerite surrounding the coxae of the hind legs. Sternum is shiny dark brown in color (Fig.5).

First and third pairs of legs are more or less similar in size, while the second pair is noticeably shorter. Legs are shiny dark brown in color (Fig.5).

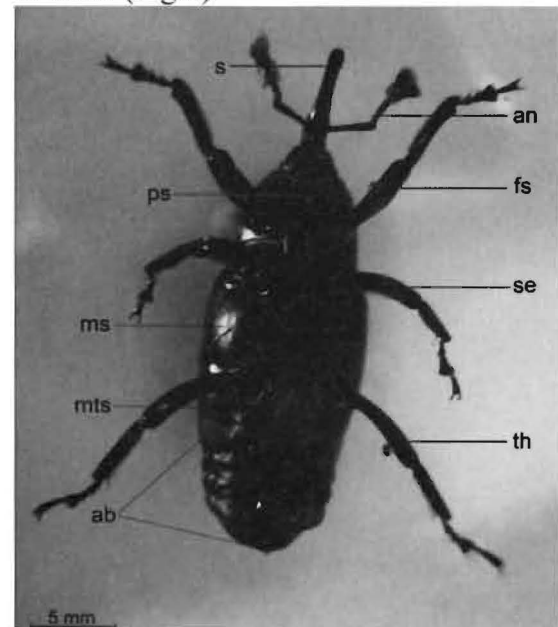


Fig.5: Ventral side of RPW
 ab. abdominal segments, an. antenna, fs. first leg, ms. mesosternum, mts. metasternum, ps. prosternum, se. second leg, th. Third leg

Elytra are reddish brown in color cover about four fifth the length of the abdomen. They are

rectangular in shape with predominant 5 ribs (Fig.6).

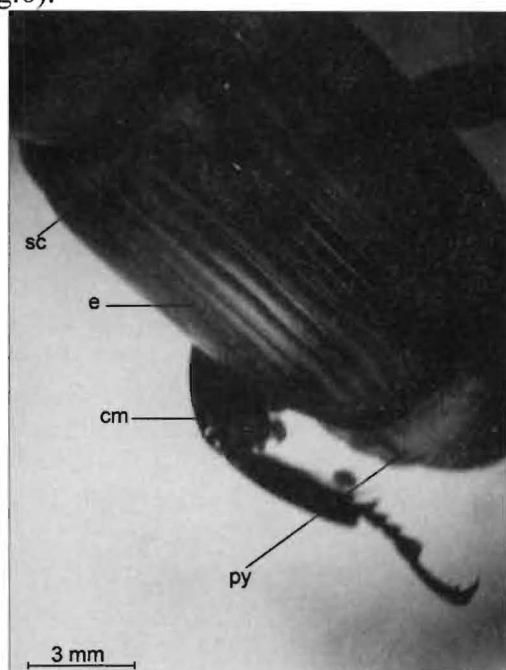


Fig.6: Scutellum, elytra and pygidium
cm. cluster of mites, e. elytron, py pygidium, sc. scutellum.

Pygidium is lighter in color than the elytra with round posterior end (Figs. 2&6). The most posterior abdominal sternite carries elongated sclerite runs longitudinally with numerous setae on its free upper end (Fig.7).

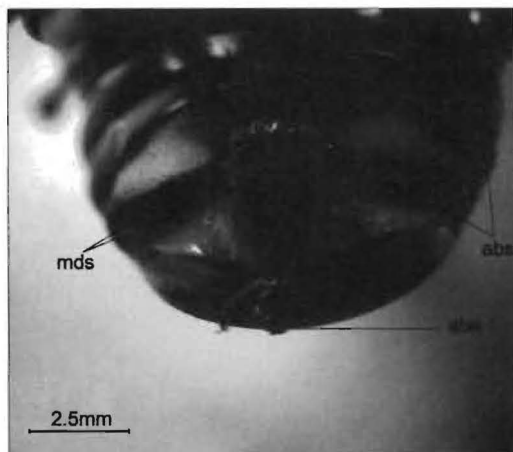


Fig.7: Reduced abdominal sternite of RPW
abe. abdominal end, abs. abdominal sternite, mds. Longitudinal reduced sternite

The larva

The larva is fleshy apodous with segmented body, 13 segments identical in shape except the width (Figs. 8-10). The last abdominal segment has a posterior cleft. Most

of the abdominal segments carry 2 rounds obvious Spiracles, each is lateral in position (Figs.9, 10)

The color of the body varies from ivory to dark yellow according to the larval age. The body has narrow ends, the width of the segments increases gradually towards the middle part of the body then reduced also gradually towards the end (Figs. 8,9). The size of fully grown larva varies from 38 to 50 mm in length and 18 – 22 mm in the widest width.

The cuticle of the body is semi-transparent, in fully grown larva, reserved fat tissue batches can be observed through it (Fig. 11).

The head of larva is brilliant dark brown, bent downwards (Fig. 9) with large brown eyes. Mouth parts are highly chitinized of chewing type. Labrum, mandibles, maxillae and labium are obvious with naked eyes. (Fig. 12)

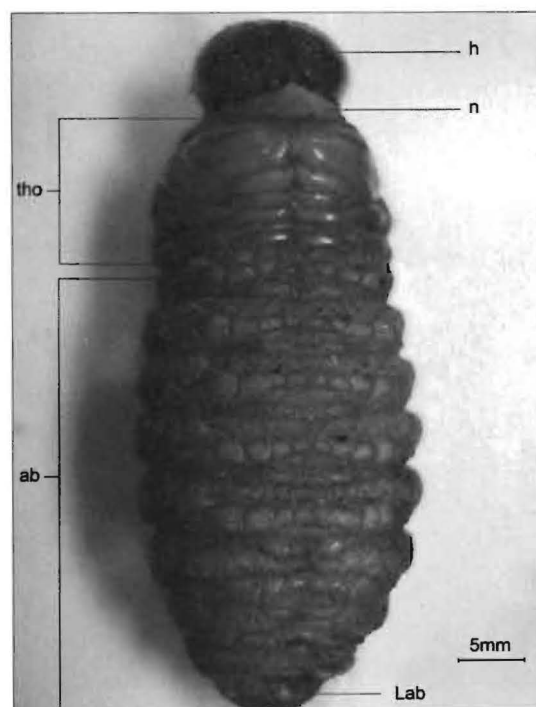


Fig.8: Dorsal view of fully grown larva of RPW
ab. abdomen, h. head, Lab. Last abdominal segment, n. neck

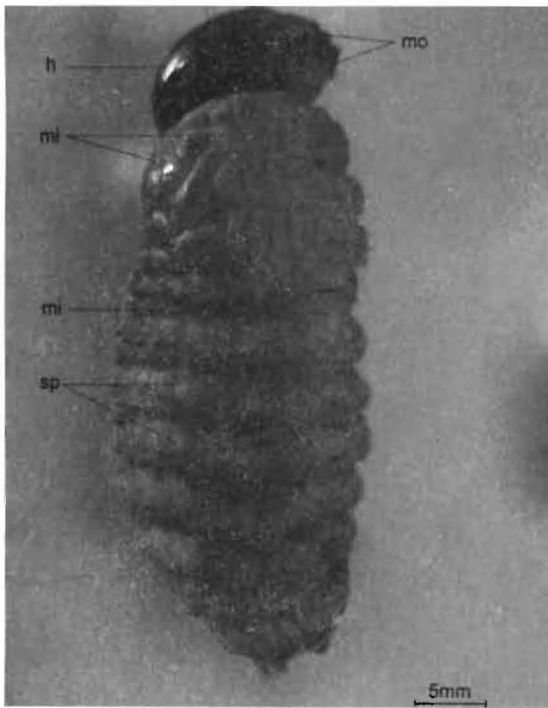


Fig.9: Lateral view of fully grown larva of RPW. h. head, mi. mites, mo. Mouth parts, sp. Spiracles

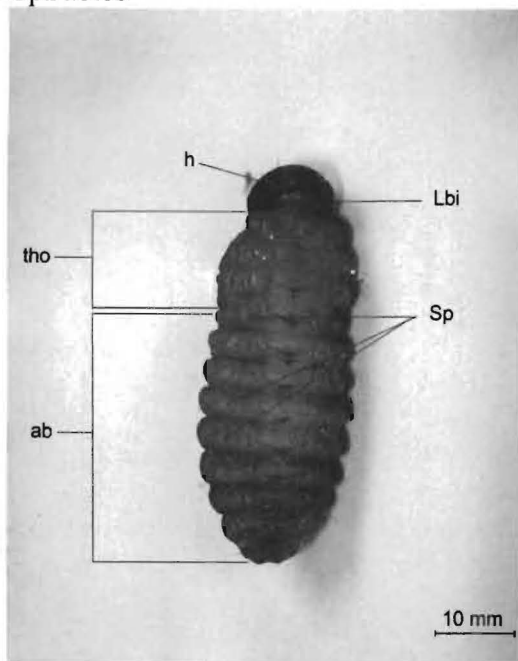


Fig.10: Ventral view of fully grown larva of RPW.

ab. abdomen, h. head, Lbi. Labium, sp. number of abdominal spiracles.



Fig.11: Enlarged thoracic, first and second abdominal segments of fully grown larva of RPW. ab. abdominal segment, Ft. fat tissue, Lbi. Labium, tho. thorax

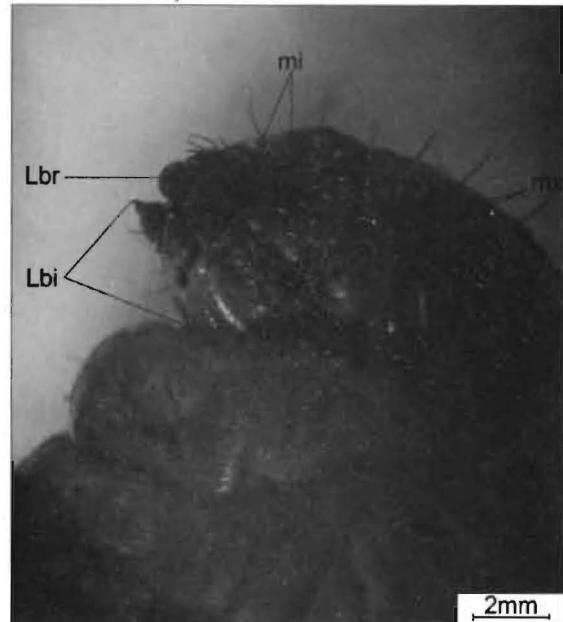


Fig.12: Well chitinized mouth parts of larva of RPW. Lbi. Labium, Lbr. Labrum, mi. mites, mx. maxilla.

Cocoons

Fully grown larvae are hidden deeply either in petioles or inside extended tunnels into palm trunk. Larvae chewed coarse brown palm fibers to construct its cocoons (Fig. 13)

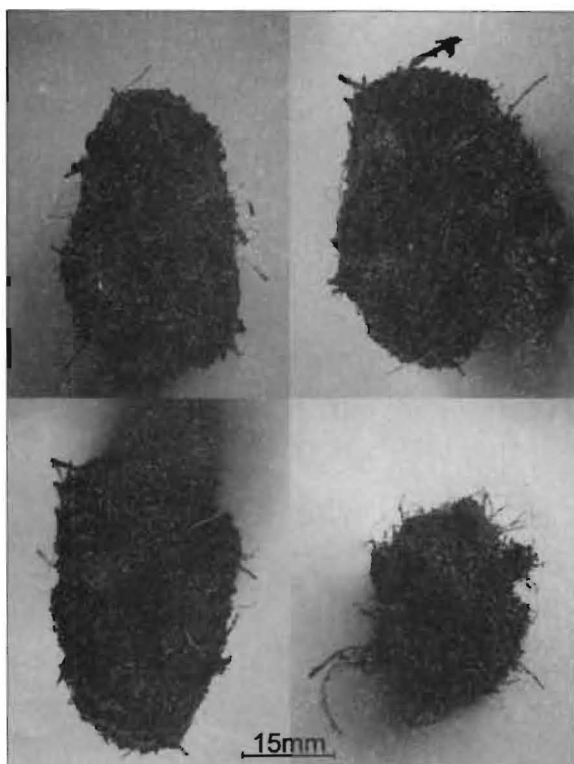


Fig.13: Cocoons constructed by pupae of RPW

Cocoons are oval in shape with size range from 60 mm in length to 30 mm in width (Fig. 13).

Pupa

Newly formed pupae are yellowish in color (Fig. 14), the color darkens as pupae develop. Fully mature pupae are dark brown with shiny appearance (Figs 15-17).



Fig.14: Newly formed pupa of RPW removed from its cocoon.

Pupae are of exarate type (Fig. 15). Heads bent ventrally having one pair of prominent eyes (Figs 15, 16). Fully formed rostrum

extended backwards to the coxae of second pair of legs (Fig. 16).

Antennae emerged from the two sides of rostrum next to its base then extended backwards resting to the femurs of the first pair of legs. Tibiae of the three pairs of legs are bent down its belonging femurs while its tarsi are directed freely backwards (Fig. 16).

Tarsi of hind legs extended behind the thorax underneath the hind wings (Fig. 17). In the pupal stage usually hind wings exceed the length of fore wings (Figs. 15, 17). Spiracles of future adults laterally occurred on the dorsal side of the first five abdominal segments (Fig. 18). Emerged adults stay in their pupal cases for couple of days before leaving cocoons (Fig. 19).

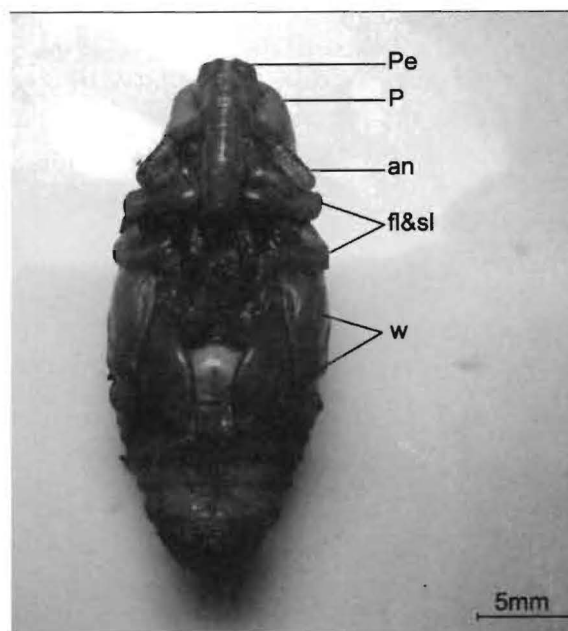


Fig.15: Ventral view of pupa of RPW.
an. antenna, Fl. First leg, Sl. Second leg, P. Pronotum, Pe. Prominent eye, w. wings.

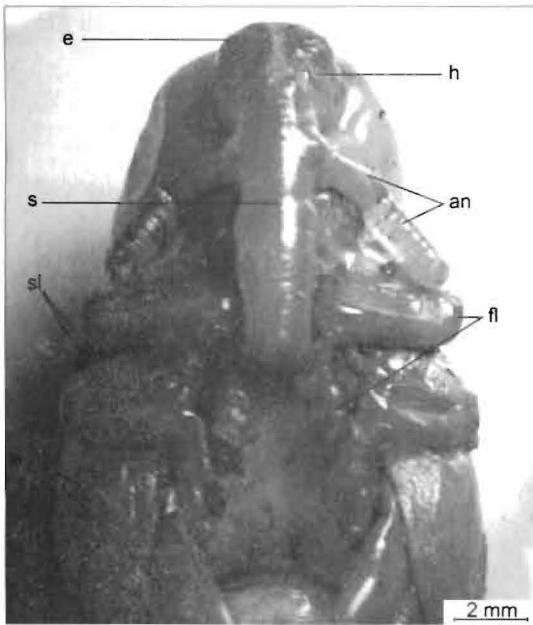


Fig.16: Ventral view of pupal head and thorax with their appendages.
 an. antenna, e. eye, fl. First leg, sl. Second leg, P. Pronotum, w. fore and hind wings.

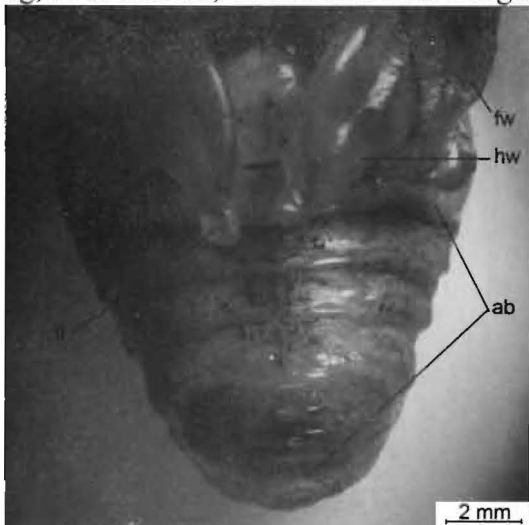


Fig.17: Ventral view of abdominal region of pupa of RPW.
 ab. abdomen, fw. fore wing, hw. hind wing, tl. terminal part of third leg.



Fig.18: Dorsal view of the most anterior abdominal segments.
 sp. abdominal spiracles.



Fig.19: Emerged adult of RPW resting in its cocoon.
 co. opened cocoon, ww. weevil resting in its cocoon.

Signs of infection

Date palms at backyard of Science Faculty, Mansoura University were at different stages of infestation. Some palms were at the beginning of infection as they having yellowish crowns, while others were with completely pulled off crowns (Fig.20). Fronds were also at different stages of infection. Some were with yellowish petioles (Fig.21). At advanced stage of infection petioles changed into dark brown, appear weak, hang down, and pulled off easily. At their bases quite large holes were noticed.

Sometimes mature larvae were hidden at the base of the petioles (Fig. 21). Finally the fronds died and dropped onto the ground next to the trunk (Fig.22). Petioles of the dead fronds were hollow due to the feeding of the grubs on their soft tissues (Fig. 23).



Fig.20: Infected palm without a crown as it is pulled off entirely.
df. Dead fronds, hp. Healthy petiole, st. palm stem



Fig.21: Infected palm with necrotic and rotting petiole
np. necrotic petioles, hp. hole at petiole base, rp rotting petioles.



Fig.22: Fronds with different signs of infection.

df. Dead fronds, g. grub of RPW, np. necrotic petiole



Fig.23: Hollow petiole due to RPW grub feeding df. Dead fronds, Lp. hollow rotting petiole.

Chewed tissues and frass inside the infected petioles were completely fermented (Fig. 24). A lot of chewed tissues were found on ground surface next to severely infected palms (Fig. 25).



Fig.24: fermented chewed tissue of petiole.



Fig.25: Chewed palm tissues on ground surface next to infected palms

Some trunks of infected palms were bent down, others collapsed (falling down) from the very base where the roots emerge. By the time the interior of fallen trunks were completely fermented except the thin outer surface which took longer time (Fig. 26). The fermentation extended to a very base of trunks (Fig. 27).



Fig.26: Part of fallen trunk, completely fermented interiorly with thin semi-intact surface.



Fig.27: Invasion extended to the base of the trunk.

The tunnels inside the palms extended beyond the ground surface even into the upper parts of the roots (Fig. 28). In severely infested trunk with rotting tissues and fermented odor (Fig. 26) an approximately one hundred cocoons were found impeding in the remaining tissues. After complete disintegration of the trunk tissues, cocoons were seen gathering one next to the other (Fig. 29).



Fig.28: Invasion extended beyond the ground surface where roots emerge.



Fig.29: Several cocoons on the ground next to infected palm base

Discussion

The present article revealed the invasion of date palms at Mansoura city, Daqahliya Governorate. The invasion was disclosed in date palms planted at the backyard of Science Faculty, Mansoura University. The date palms were at different stages of infection. The infection was eradicated by burning all the palms at this restricted region.

RPW usually pupate inside the trunk or at the base of petioles (Molet *et al.*, 2011). The infection is hard to be detected except in heavily infested palms where cocoons scattered on the ground next to the base of the palms and underneath the fallen dried fronds. Cocoons were either empty or contained the pest. Pupation never takes place outside the trunk next to its base as mentioned by Ferry and Gomez (2002), otherwise the pest would be easily detected at early stage of infection. All stages described in this article were collected from the field, none of them reared

in laboratory. Eggs were hard to be collected from heavily infected collapsed palms.

The weevil is large insect, its length is up to 48 mm. it is reddish brown in color with long snout, end anteriorly with sharp denticulate mandibles (USDA/APHIS, 2010).

The weevil's pronotum has 5 black patches varies in size but with fixed position.

Larvae are fleshy apodous. Their color varies from ivory to dark yellow as progressed in age. Larvae pupate in cocoons built of coarse chewed date palm fibers.

Females of RPW lay about 250 eggs in holes made by their rostrum during feeding or wounds present on soft tissues of either crowns, base of petioles of upper portion of the trunk of the date palm (Murphy and Briscoe, 1999). Wounds made by the beetle *Oryctes rhinoceros* are favorite sites for the egg laying (EPPO, 2008, Gailce *et al.*, 2008). Eggs of a female are laid next to each other and the hole is cemented with excretion produces by the female (Murphy and Briscoe, 1999).

In the present work tunnels produced by fleshy apodous larvae were seen inside petioles of fronds and interior of trunks of infected date palms. The excavated tunnels were filled with excrement and chewed fibers. Tunnels damaged the vascular system causing death to palms. Fronds of heavily infected palms, wilted, turned yellow, fallen down onto the ground next to the base of its trunk. Most of petioles of the fallen fronds contained either larvae at late stage of development, fully formed cocoons, or hollow tunnels. Some of heavily infected trunks were curved others were completely collapsed exposing their rotting fermented tissues.

In less advanced stages of infections, thick brown fluid oozes from tunnels, sounds of larvae during chewing their way can be heard by persons moving next to heavily infected trunks (Falerio, 2006).

Phoretic mite *Uropoda orbicularis* was seen with great number on larval instars, pre-pupal, pupal, and adult stages.

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سوسة النخيل الحمراء رينكوفورس فيريوجينيس في مدينة المنصورة - محافظة الدقهلية - مصر.

عزيزة درويش، إسلام أحمد الحنفي

قسم علم الحيوان - كلية العلوم - جامعة المنصورة - مصر.

لقد تم التعرف على سوسة النخيل الحمراء رينكوفورس فيريوجينيس و تمت دراستها مورفولوجيا و الأطوار التي تمت دراستها هي اليرقة و ما قبل العذراء و العذراء و الطور اليافع و كل العينات التي استعملت في الدراسة قد تم جمعها من الحقل الذي يقع خلف كلية العلوم - جامعة المنصورة و قد تم تسجيل وتصوير أعراض الإصابة المختلفة في أشجار النخيل و يمثل البحث الحالي أول تسجيل لتواجد سوسة النخيل في محافظة الدقهلية بمصر.

