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Full description of *Rhynchophorus ferrugineus* polymorphism (Olivier,1790) and first recorded Mites Associated, in Basrah Province Iraq.

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Abstract

In several Asian and European nations, the red palm weevil, *Rhynchophorus ferrugineus* (Olivier, 1790), is a pest threat to palm trees. Weevils were collected from infested date palms in Safwan region south Iraq. A morphological study was performed to determine the polymorphism RPW diversity. The results showed that there was no difference in morphological traits for Color polymorphism Blake spots of pronotum founded in male and female**.** Two Genus of mites associated were observed under the Elytra in this study, which are recording for the first time in South of Basrah, Iraq.

Keywords: Diagnostic, polymorphism, *Rhynchophorus ferrugineus*, mite associated, Basrah, Iraq.

Introduction:

The weevils are one of the most diverse groups of organisms. Over 50,000 species have been described worldwide in the family Curculionidae (Sauvard, *et al*. 2010, Oberprieler, *et al*,2019), one of these genus *Rhynchophorus* Red palm weevil(RPW) currently contains nine species, of which six are known to attack palms. species, *R*. *ferrugineus* belonging to the European and Mediterranean Plant Protection Organization listed pests (EPPO,2008).

This species has been found in 54 countries and it has been recorded to attack 32 palm species (Esteban- Duran et al. 1998). The date palm *phoenix dactylifera* L. has been seriously impacted by this insect. The larval stages of this insect feed within the trunks of palm trees, and this behavior frequently kills the trees (Murphy& Briscoe, 1999). First recorded in date palm orchards in the Safwan region of the south of Basrah, Iraq in mid-October 2015(Aletby, 2016).

Species of *Rhynchophorus* Others of these have unknown taxonomic identity, and some may be conspecific with the RPW adult, which is characterized by color polymorphism variation. The presence of melanin in the cuticle causes black spots on the adults' pronotum, while carotenoids in the epidermal cells cause the weevils' rusty appearance (Longo, 2006).

Many organisms, including viruses, bacteria, fungi, nematodes, mites, insects and vertebrates, have been found in association with the RPW (Murphy and Briscoe, 1999), in this study, first time recorded two mite species were under the Elytron RPW. The main objectives of the study were to Diagnostic larva and adult the polymorphism RPW diversity in Basrah –Iraq.

Materials and Methods:

- Samples **C**ollection

The study was conducted for the period from February 2021 to July 2021, *R*. *ferrugineus* larvae and adult samples were collected catch by hand from Palm Tree *Phoenix dactylifera* orchards Safwan region (30.116667°N 47.716667°E) Far south of Basra Province. In total, 15 larvae (Last instar), 35 adult *R*. *ferrugineus* comprising (14 ♂, 21 ♀). Mites were collected from

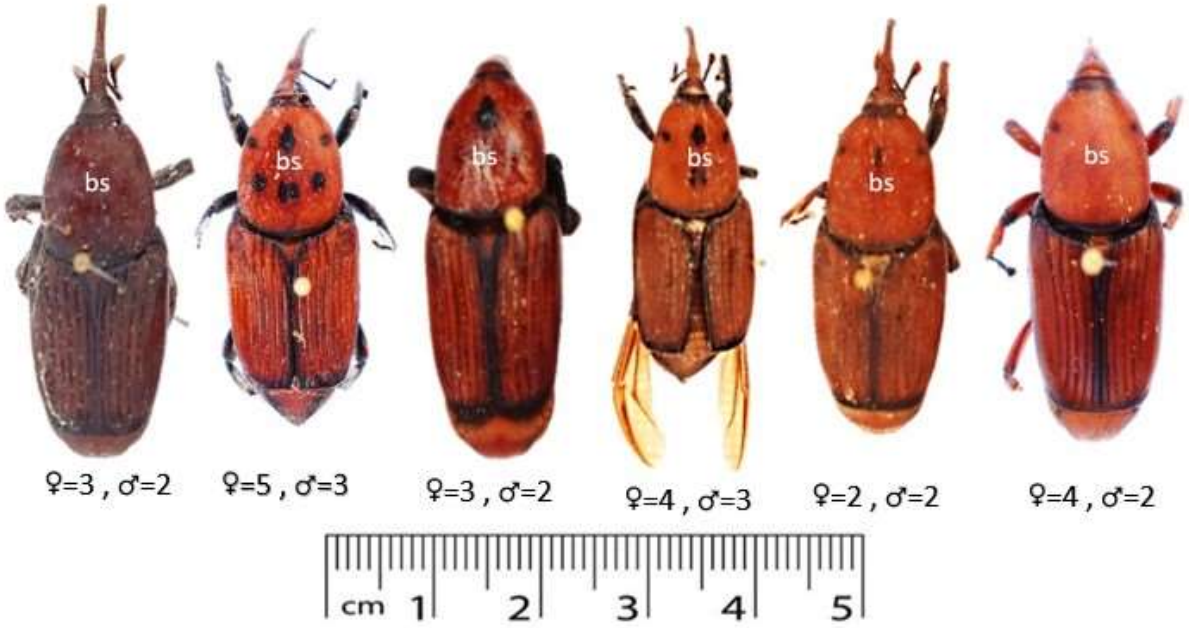

Plate 1: Color polymorphism of *R. ferrugineus* Blake spots(bs) of pronotum founded in male and female.

weevils using a hair brush and stored in 75% ethanol before being cleaned and placed in Hoyer's media on permanent microscopic 40 magnification slides for identification under a microscope and Samples were sent for diagnosis Dr. Ali Ahadiyat Islamic Azad University Science and Research Branch Tehran Iran. This work was carried out at the Lab. Entomology in the Basrah University, Collage agricultural.

-Morphological characters

Separated into color polymorphism based on the black marking(spots) patterns on the pronotum (plate 1). The measurements included the following body parts: whole body length; abdomen length; abdomen width; pronotum length; pronotum width; head size; length from tip of rostrum to antennal cavities, flagellum, scape, mandibles, Maxilla, Pronotum, Protesternum, Scutellum, Elytra, Hymenous, Legs, Pygidium and Genitalia, according to (Wattanapongsiri, 1966; E. P. P. O., 2007).

The body dissection in three parts: head, thorax and abdomen with assistance of Entomology Forceps, Tweezers, Scalpel Handle and Needles Straight, (Al-Mallah, 2016). using Bel Dissecting microscope and camera Nikon D5300. genitalia were hydrated and clarified in10% KOH, Parts are photo by Leica

EZ4Steromicroscopes, which based on keys (Anderson, 2002; EPPO, 2008; Giblin*, et al.* 2013).

Results:

Name: *Rhynchophorus ferrugineus* (Olivier, 1790)

Preferred Common Name: Red Palm Weevil

Synonyms:

Curculio hemipterus Suizer, 1776
Curculio ferrugineus Olivier, 1790
Rhynchophorus ferrugineus Herbst, 1795
Cordyle sexmaculatus Thunberg, 1797
Calandra ferruginea Fabricius, 1801
Rhynchophorus pascha v. *papuanus* Kirsch, 1877
Rhynchophorus indostanus Chevrolat, 1882
Rhynchophorus signaticollis Chevrolat, 1882
Rhynchophorus pascha v. *cinctus* Faust, 1893
Rhynchophorus ferrugineus v. *seminiger* Faust, 1895
Rhynchophorus signaticollis v. *dimidiatus* Faust, 1895. (Hallett, *et al.*2004).

1- larvae Description (Plate 2):

The Last instar (10 specimen): ($\bar{x}$=10) Length 30.11mm, width 16.92 mm, Piriforme, legless, slightly curved body, highly sturdy, extended at mid-abdomen, creamy white to ivory in color, The body is made up of 13 segments, including the thoracic and abdominal regions present sternellum, Their mouthparts are well developed and strongly chitinized.They have powerful

Plate 2: Mature larva; A, B, C= lateral, ventral and dorsal view; he= head, th=thorax, ab=abdomen.

horizontal conical jaws that they use to burrow from the axils of the leaves to the crown, and their cephalic capsule is brown russet-red to dazzling brown-black.

Head (plate3):

Head size, Length 12.2mm, width 09.9mm, distinctively strongly sclerotized and longer than wide, with paler paramedian stripes(ps), Frontal lines distinct(Frs), epicranial suture (ES) distinct, epicranium with one pair of sensilla.

labrum (plate 4): is prominent distinctive characters on the ventral surface of labrum are the shape of epipharynx. Mandible (plate 5); the mandible is stout, with distinct globular condyle and concave fossa, Mandible subtriangular with one blunt apical tooth. Labium and maxilla (plate 6); the shape of the hypopharynx. maxilla is simple, the second segment of the maxillary palpus bears the dorsal sensory spot.

Thorax (plate 2): The pronotum is undivided and dorsally has a paired distinct scierotized plates.

Abdomen (plate 7): The setae on the intersegmental fold and scutum, ninth abdominal segment scierotized, with two or five sensillae at base, anus transverse, shape of the anal opening, preanal, median, and lateral lobes present.

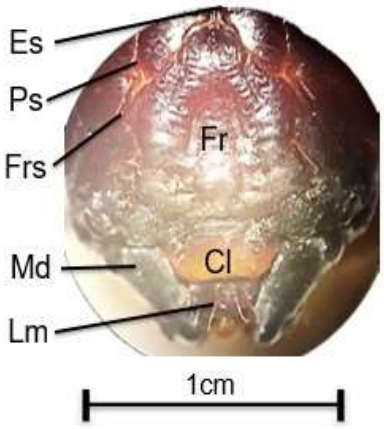

Plate 3 Head larvae; ES= epicranial suture, Ps= paramedian stripes, Fr=Frons, FrS= frontal suture, Md= mandible, Cl =clypeus, Lm= labrum.

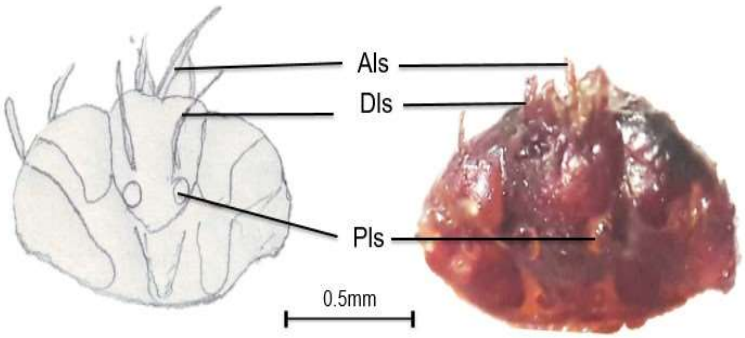

Plate 4: larvae Labrum; Als= anterior labral seta, Dls= dorsal seta of labrum, Pls=posterior labral sensillum.

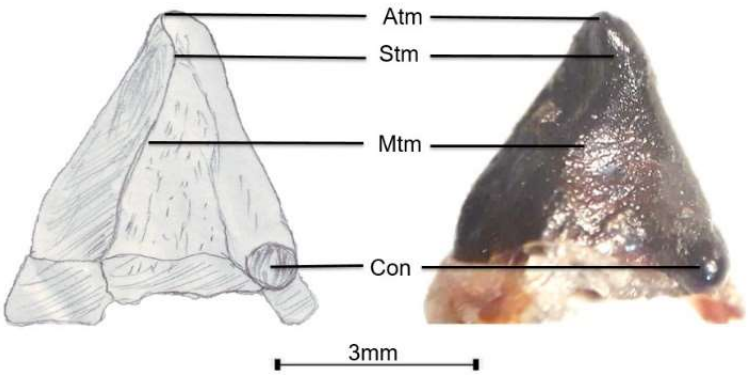

Plate 5: larvae mandible; Atm= apical tooth of mandible, Stm= subapical tooth of mandible, Mtm=median tooth of mandible, Con=condyl.

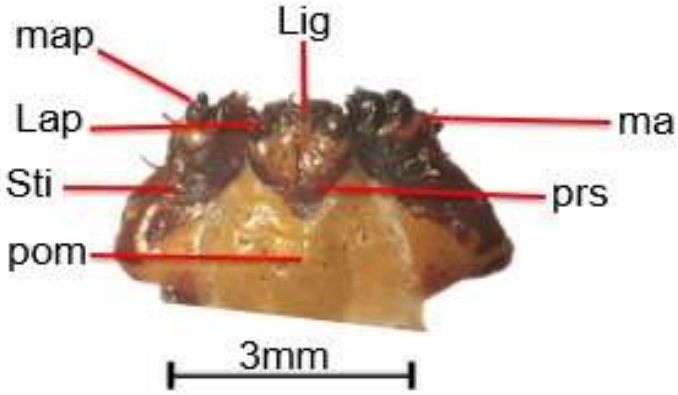

Plate 6: larvae labium and maxilla ventral view; Lig=ligula, ma=mala, prs=premental sclerite, map=maxillary palp, lap=labial palp, sti=stipes, pom=postmentum.

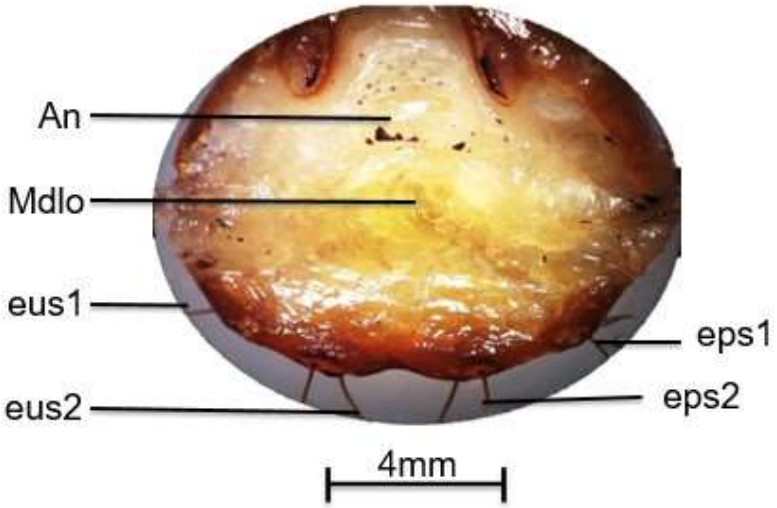

Plate 7: larvae abdominal ninth segment, dorsal view; An=anus, Mdlo=median lobe of anus, eus1=eusternal 1seta, eus2=eusternal 2 seta, eps1=epipleural 1seta, eps2=epipleural 2seta.

2- Adult Description (Plate 8):

The adult weevil is relatively large, ($\bar{x} = 21$) Length♀ 34.0 mm, width 12.9 mm, ($\bar{x} = 14$)Length♂ 31.2 mm, width 11.6 mm, body elongate-oval, the color ranges from reddish-brown and to deep black, black spots on pronotum extremely variable, male rostrum shorter than pronotum, pronotum usually rounded, rostral setae present, setae on front femur.

Head (Plate 9):

Head size 11.48mm, the eyes are large, elongate oval (Pla.9A), rostrum ♀ length 7.11mm, curved, smooth, slightly longer and shiny, slender, more cylindrical, Sculpturing of rostrum smooth(Pla.9B). rostrum ♂ length 6.41 mm, straight, stout with pad of small hairs on dorsal apical region, Sculpturing of rostrum rugose (Pla.9C).

Antennae Plate(9D): capitate or clubbate, large usually ferruginous or reddish-brown, thick, arising laterally from scrobe at base of rostrum; scrobe deep, Antennal scape of one-half the length of rostrum, pregular suture elongates over shape.

Mouthparts Plate(9E): brown mandible nearly twice the breadth of the rostrum at the base,

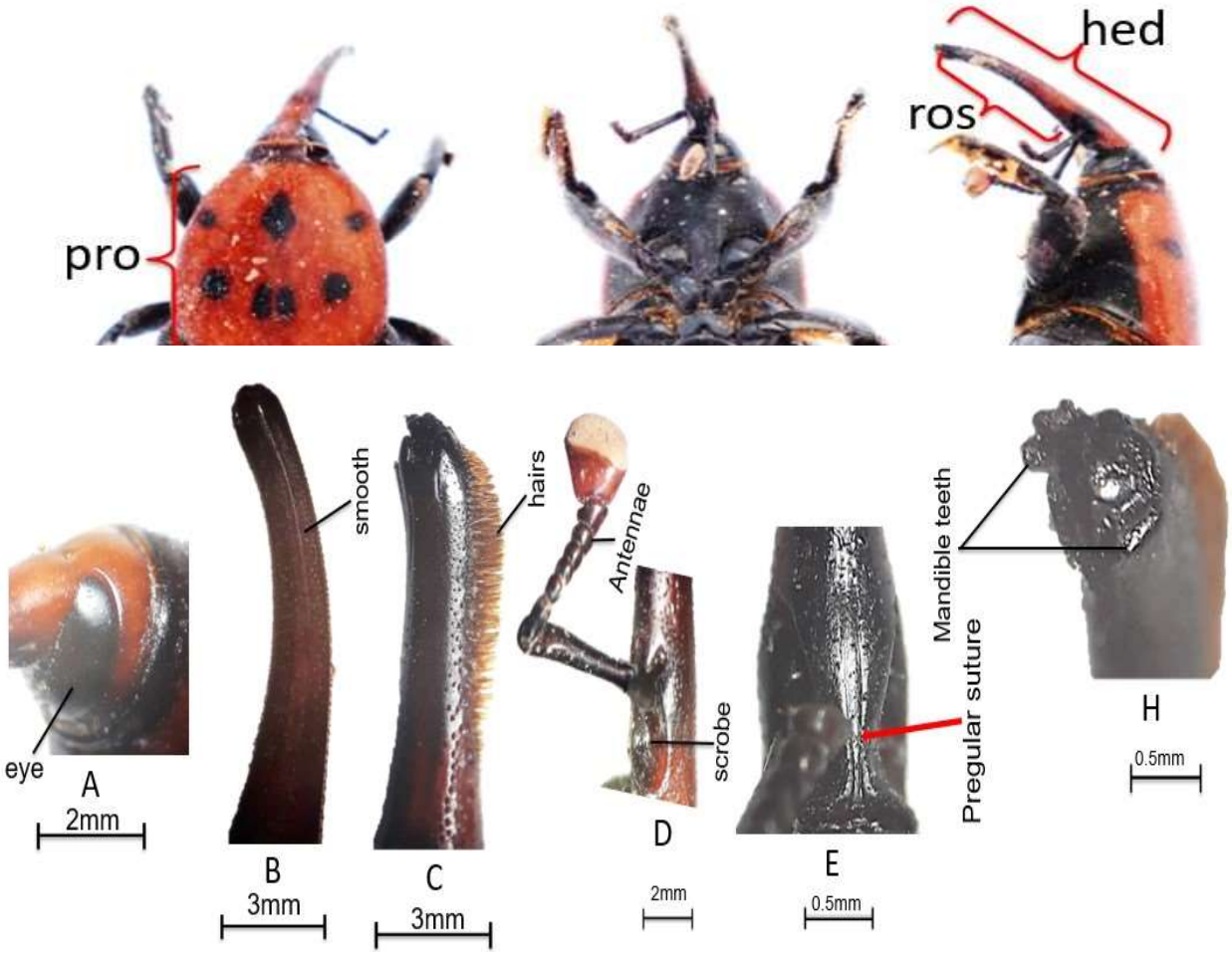

Plate 8: Adult weevil dorsal(A), Ventral(B), lateral(C)view; ros=rostrum, hed=head size, pro=pronotum, elt=Elytra, pyg=pygidium, abd=Abdpmen.

Plate 9: Head parts; A=eyes, B=rostrum ♀, C= rostrum ♂, D=antenna and scrobe, E= Pregular suture H=Mandible teeth.

tridentate distally with all teeth strongly pointed, apical and subapical teeth widely separated

Thorax (Plate 10):

Pronotum (Plate 10A): usually oval or slightly produced posteriorly, length 12.75mm, width 11.38mm, posterior margin nearly rounded, colour mostly ferruginous and varying to dark brown and black, black marking(spots) patterns on the pronotum, which varied from 1 to 6 Variations.

Scutellum (Plate 10B): large, long, one-fourth to one-fifth the length of elytron, varying from reddish-brown to black, somewhat pointed posteriorly.

Legs(Plate11): Femur, Setae on the female absent but present on the male, not strongly curved, usually punctured on outer edges, front coxa strongly globose. The tibia is fairly constant in size

Plate 10: Thorax; A= marking patterns of Pronotum, B= Scutellum.

and form. first tarsal segment twice as long as second and or slightly shorter than third, 4 segments with and cover seta.

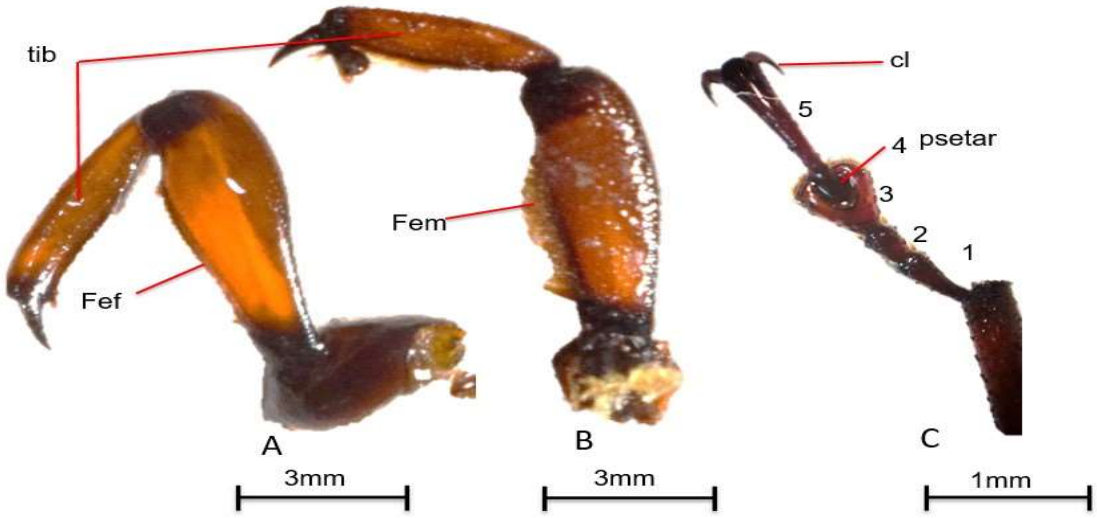

Plate 11: Legs; A(Fef)= Femur female, (tib)=tibia, B= Femur male, C= tarsus (4) = pseudotetramerous, cl= claw.

Elytra(Plate12A): Elytra wider, length 17.18mm, width 6.07mm, smooth, nearly rectangular, feebly convex at base and more convex dorsoposterior.

Hymenous(wing) (Plate12B): length 29.2mm, width 07.4mm, brown, almost hyaline from lower part of median area to anal area, all veins dark brown, heavily scierotized and thick, costa thick and brown, subcosta uniting with basal stem of radius, radius 1 separated from basal stem, broad, thick at base, radius 3+4+5 joining with radius2, media 3+4+Cu very narrow.

Abdomen(Plate13A): length 19.56mm, width 12.94 mm, usually ferruginous, first abdominal sternite as long as third and fourth combined but much shorter than second.

Pygidium(Plate13B): mostly ferruginous or dark brown, sparsely and minutely punctured posteriorly and dorsolaterally.

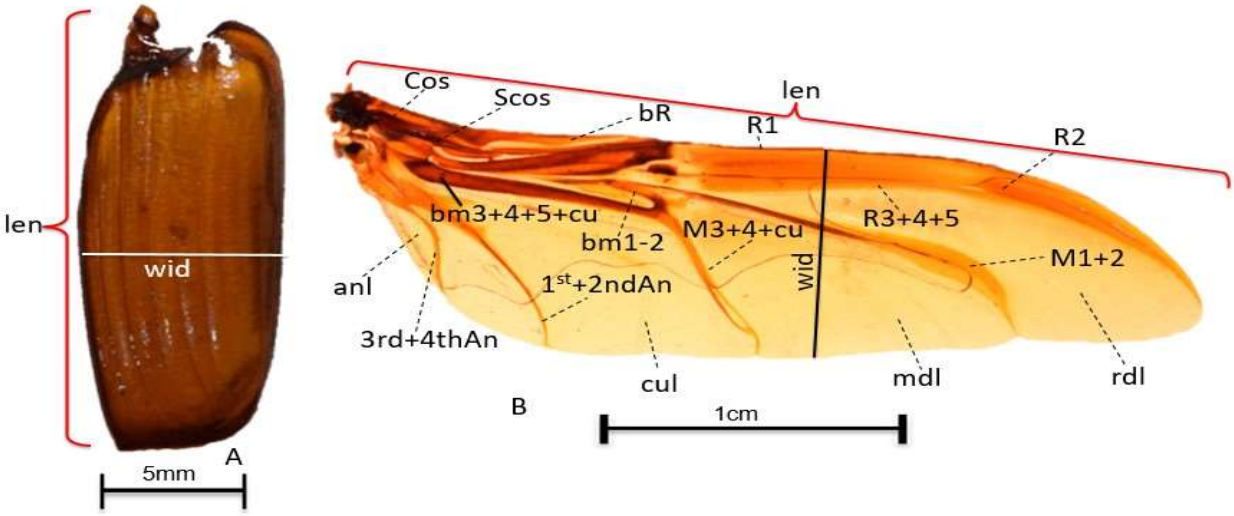

Plate 12: Wings *R. ferrugineus*; A= Elytra length and width; B= Hymenous; Cos=coeta; Scos= subcosta; bR= basal stem of radius; $R_{1,2,3,4,5}$= radial veins; rdl=radial lobe; $M_{1,2,3,4+cu}$ = median veins; mdl=median lobe; $bm_{1,2,3,4+cu}$=basal stem of median veins; cul=cubital lobe; $1^{st}+2^{nd}$ $^{3rd+4th}$ An=anal venis; anl=anal lobe; len= wing length; wid=wing width

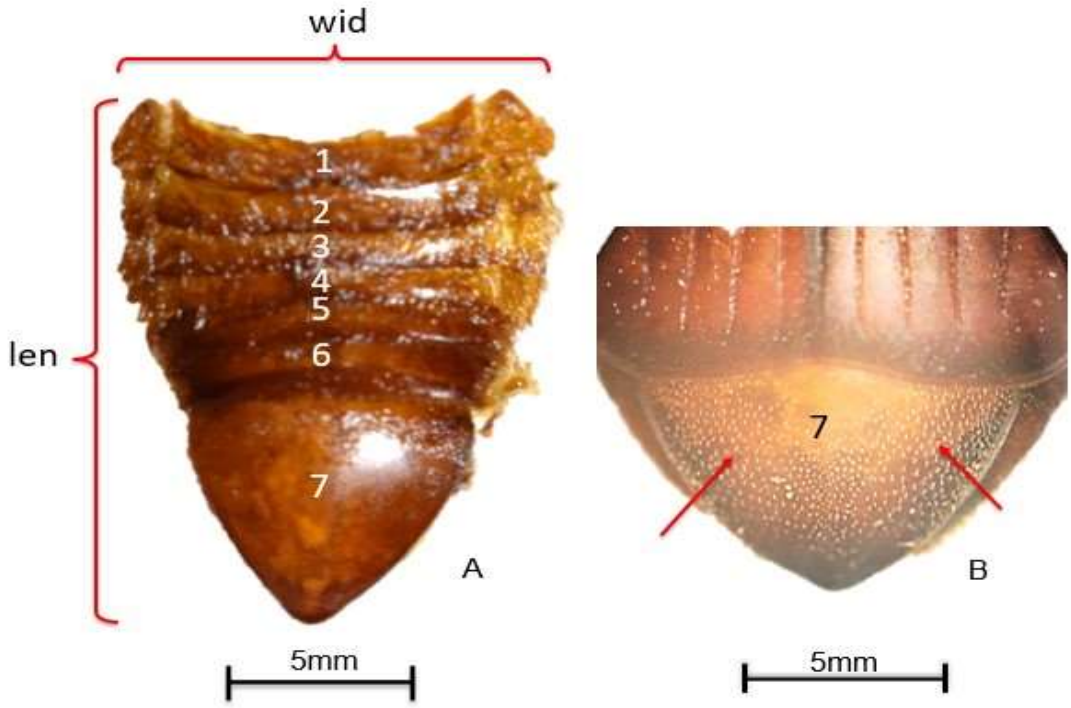

Plate 13: Abdomen *R. ferrugineus* dorsal view; A= abdomen length(leg), width(wid) and abdominal sternite; B= pygidium punctuation.

Male genitalia (Plate14): The phallus is dark brown and consists of a phallobase, endophallus, tegmen, and aedeagus. The phallobase is broad posteriorly, narrow anteriorly, flat, concave ventrally, and convex dorsally, endophallus is tubular, strongly concave, curved ventrally and heavily sclerotized. Tegminal apodeme is large, and broad posteriorly, the posterior part of the tegminal apodeme triangular with straight or gradually curved edges called"tegminal plate". The aedeagus is strongly curved ventrally, connected to the endophalius at the apex with "endophallic membrane", it's a long, flat, structure, heavily sclerotized with split at the apex.

female genitalia (Plate15): The female genitalia are simple, consists of a vaginal, spiculum ventrale, genital styli, vaginal base is triangular in shape base, dark brown, scierotized, it is convex

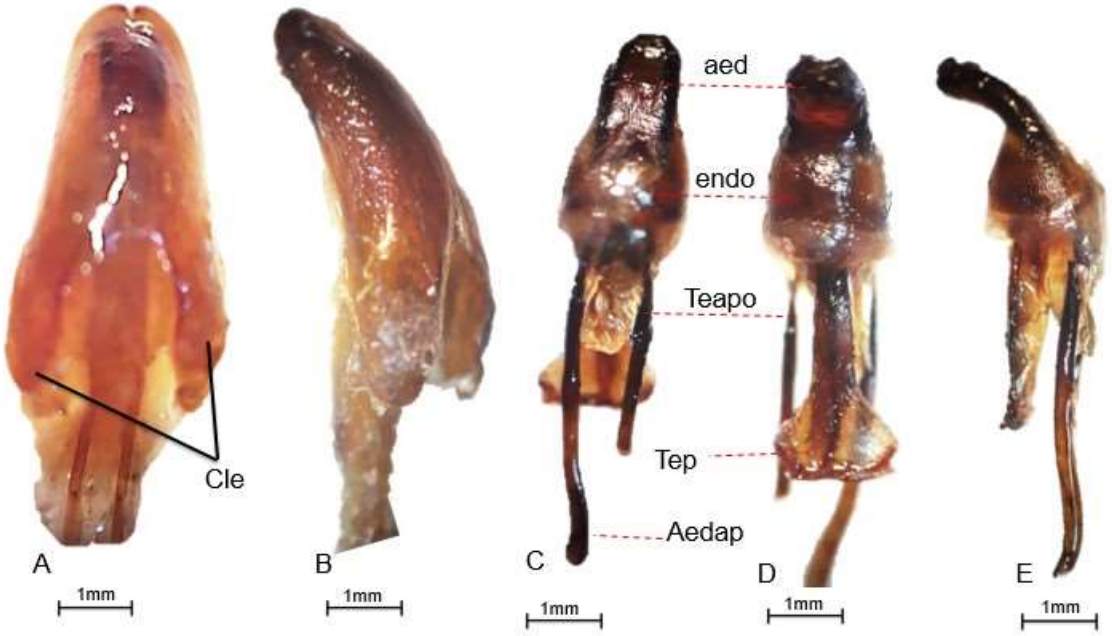

Plate 14: Male genitalia, A= ventral view phallus, cl=claspers; B= dorsal view phallus; C, D, E= dorsal, ventral, lateral view aedeagus; aed=aedeagus, endo=endophallus, Teapo= tegminal abodeme, Tep=tegminal plate, Aedap=Aedeagal abodeme.

dorsally. The spiculum ventrale is elongated and flat, measuring two-thirds to four-fifths the length of the vaginal base. Two genital styli are inserted beneath and attached to the spiculum ventrale by membrane at the anterior end, which is truncate and fringed with little brown setae.

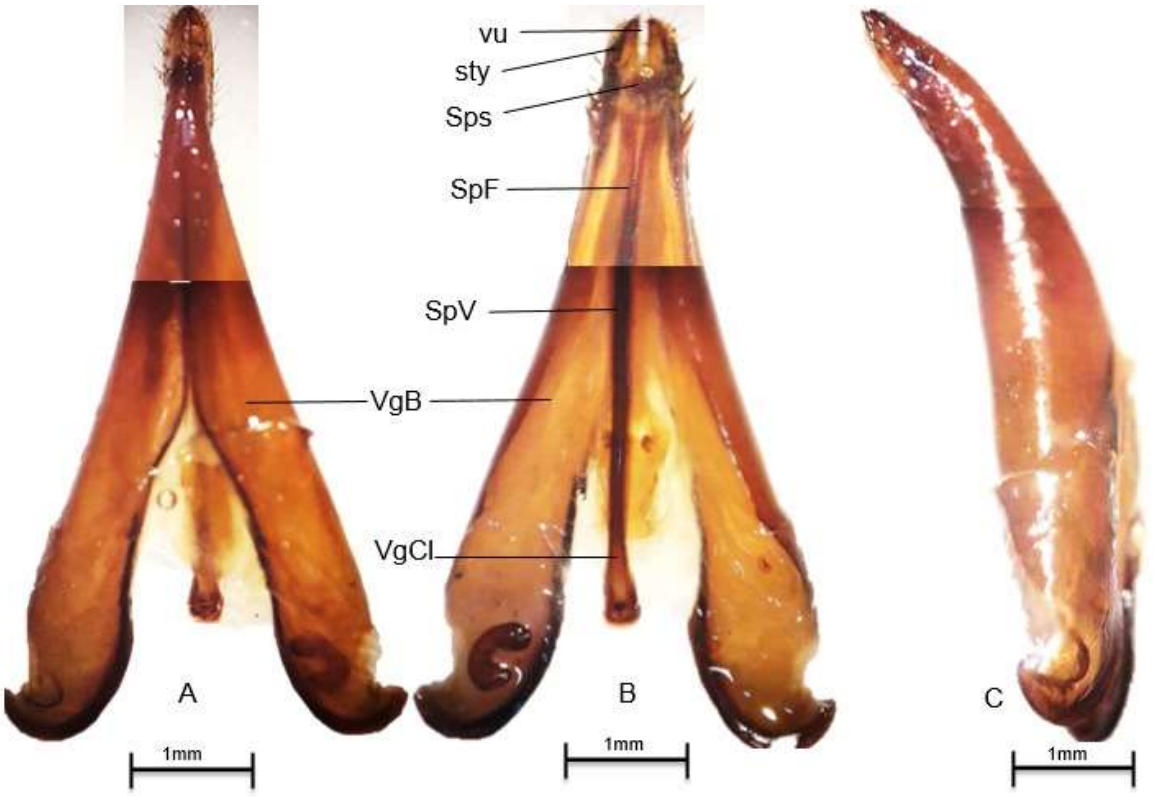

Plate 15: female genitalia, A= dorsal view, B= ventral view, C = lateral, view; vu=vulva, sty=stylus, Sps= spiculum seta, SpF=Spiculum fenestra, spv=spiculum ventrale, VgB=vaginal base, VgCl=vaginal cleft.

3- The mite associated with the Red Palm Weevil.

During a dissecting specimens observed phoretic mite associates under the elytron (Plate 16). Two genus Mites were recorded, genus *Uroobovella sp.* (Uropodina, Mesostigmata) and genus *Astigmata* deutonymph (Astigmatina) (Plate 17). Which are recording for the first time in South of Basrah, Iraq.

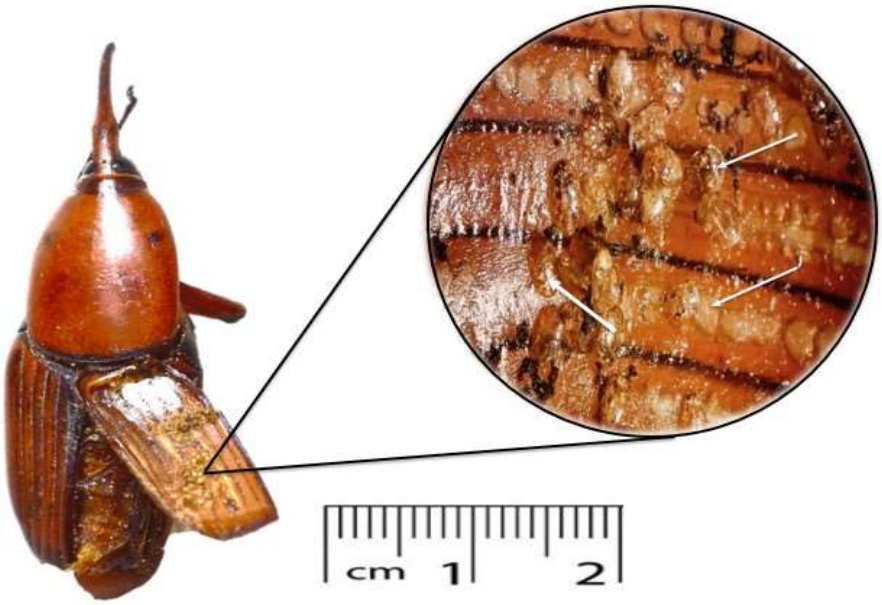

Plate 16: Mites associated with the RPW were observed under the elytron

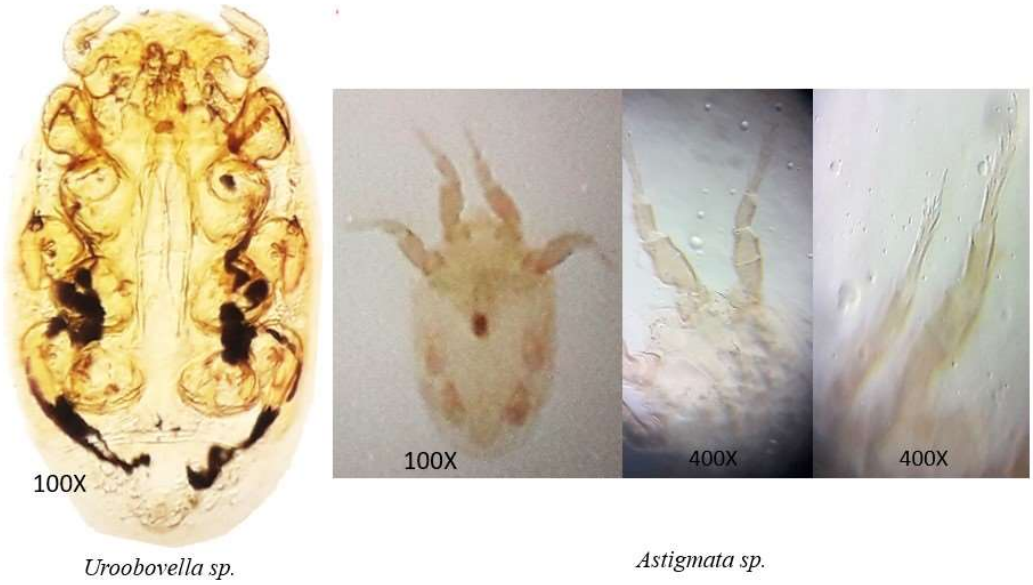

Plate 17: genus *Uroobovella sp.* and genus *Astigmata sp.* deutonymph.

Conclusions

The current study revealed that the body size was larger in females as compared to males. There is no difference in morphological traits for Color polymorphism Blake spots of pronotum founded in male and female.

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