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# A new species of *Centrouropoda* (Acari: Uropodidae: Uropodina), with a key to the world species of the genus

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# Abstract

The present work provides descriptions of a new species of mite, *Centrouropoda bahariyaensis* **n. sp.** (Uropodidae), based on the adult female and male collected from the red palm weevil, *Rhynchophorus ferrugineus* (Oliver) (Coleoptera: Curculionidae) and its habitat at El-Bawiti, Bahariya Oasis, Egypt. Complete descriptions of the immature stages are included. Keys to the known species of genus *Centrouropoda* Berlese based on adult females, adult males and deutonymphs are provided.

Key words: Mesostigmata, Uropodina, morphology, taxonomy, Rhynchophorus ferrugineus, Egypt

## Introduction

The Red Palm Weevil (RPW), *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) is one of the most important pests of palms in the Mediterranean and Subtropical regions. It is distributed in North Africa, southern Europe, the Middle East, and South and Southeast Asia (Fiaboe *et al.*, 2012; Dilipkumar *et al.*, 2015; Farahani *et al.*, 2016). Wiśniewski *et al.* (1992) described several species of mites in the genus *Centrouropoda* Berlese (1916) associated with RPW. Most of the species in this genus were described on the basis of the deutonymphs, and only two species are known as adults (Hirschmann, 1975; Kontschán *et al.*, 2014b). The described deutonymphs were collected on the bodies of beetles of families Brentidae, Cerambycidae and Curculionidae, while the habitats of the adults are completely unknown (Wiśniewski & Hirschmann, 1993). No species of *Centrouropoda* has been described from both the nymphs and adults, and only nine species have been reported from the tropics (Wiśniewski & Hirschmann, 1993).

Only a few records of Uropodina have been published from Egypt so far (Zaher, 1986). El-Bishlawy & Allam (2007) described the new genus *Aegyptus* EL-Bishlawy & Allam (2007), and placed it into family Trachyuropodidae. Allam & El-Bishlawy (2010) then added several contributions to the morphology of immature stages of *Aegyptus rhynchophorus*. Three species of this genus were subsequently described from Egypt and Saudi Arabia (El-Bishlawy & Allam, 2007; Abd El-Ghani, 2009; Al-Dhafar & Al-Qahtani, 2012). Al-Dhafar & Al-Qahtani (2012) described the new species, *Aegyptus alhassa* Al-Dhafar & Al Qahtani (2012), without type designation, therefore this name is unavailable. Several other sporadic occurrences of trachyuropodid species were then recorded by several authors, *i.e.*, Hassan *et al.* (2011); Mostafa *et al.* (2013); Taha *et al.* (2014); Dilipkumar *et al.* (2015); Colmenárez *et al.* (2016). Altogether, 13 species have been described in the genus *Centrouropoda* including the three Egyptian species (including the new species herein described) and the unavailable species from Saudi Arabia. In the present study we present a description of a new species of *Centrouropoda*, and provide keys to the known species of the genus based on adult females, males and deutonymphs.

# Materials and methods

All mite specimens were collected by the second author of this paper. Mites were collected from the red palm weevil, *Rhynchophorus ferrugineus* (Oliver) (Coleoptera: Curculionidae) and its habitat at El-Bawiti, Bahariya Oasis, Egypt. Four females, one male, three deutonymphs, four protonymphs and three larvae were used in the analysis. Mites were extracted from the samples in modified Tullgren funnels, and mounted on microscope slides in Hoyer's medium for later examination under a phase contrast (Olympus, BHA). Mites were identified using the world taxonomic literature; taxonomically important structures were illustrated with the use of an eye-piece attached to the phase contrast microscope and measured with a graded ocular. Pores and lyrifissures on the idiosoma are in accordance with Athias-Henriot (1969) and Krantz & Redmond (1987), and generally follow the notation of Johnston & Moraza (1991). Setal nomenclature is based on Lindquist & Evans (1965), with the modifications proposed by Lindquist (1994). Notation of the legs follows Evans (1963, 1972). Measurements for each structure are given in micrometres, with the average for the individuals examined followed by the respective range in parentheses, when the measurement varied. Dorsal shield lengths were taken as midline length from the anterior margin of the shield to the caudal margin, while their widths were taken at the levels indicated as their widest point. Leg lengths were taken from the base of the coxa to the apex of the tarsus, including the pretarsus. Coordinates provided are approximate, as it were not taken at the time the samples were collected.

## Genus Centrouropoda Berlese

*Centrouropoda* Berlese, 1916: 142. *Aegyptus* El-Bishlawy & Allam, 2007: 422. *Aegyptus*.—Halliday, 2015: 104. Type species *Aegyptus rhynchophorus* El-Bishlawy & Allam, 2007: 422, by original designation.

**Diagnosis.** Dorsal setae with diverse morphology, smooth, lanceolate or pilose; two pairs of long setae located close to each other in the posterior part of the dorsal shield; tritosternum with a characteristic shape; pygidial shield with four pairs of setae (st1-st4); genitalia without prepygidial border; peritreme curved, with wavy inner margin; epistome with one denticulate tip; chelicerae with sclerotised node; hypostomal setae h1 and h3 long and smooth, h2 short and h4 pilose; legs with pretarsus and claws.

# Centrouropoda bahariyaensis n. sp.

(Figs 1–29) urn:lsid:zoobank.org:act:E466C372-B91F-4A7D-8634-B47A1E25F0FD

**Diagnosis.** Dorsum with 37 pairs of aciculate setae and 14 pairs of pilose setae, vertical setae pilose, setae Z5 and S5 on a small platelet in both sexes; tritosternum with a single basal stalk, which splits into three laciniae, median lacinia pilose and longer than laterals, paralaciniae smooth; anterior margin of pygidial shield narrowly rounded, posterior end trapezoidal; opisthogaster with six pairs of setae (JV5 and ZV4 pilose), with three pairs of pilose submarginal ventral setae and six pairs of simple setae; epistome with a broad dentate base and medial dentate projection; fixed cheliceral digit with a curved distal process; all legs provided with well developed ambulacral apparatus, tarsus I with a characteristic claw.

**Material examined.** Holotype female, one paratype female, one paratype male, three paratype larvae, four paratype protonymphs, one paratype deutonymphal female and two paratype deutonymphal males, collected from the red palm weevil, *R. ferrugineus*, November 20, 2017 at El-Bawiti, Bahariya Oasis (25°47'E, 29°10'N); deposited in the mite reference collection of the Egyptian Society of Acarology Museum (ESAM), Zoology and Agricultural Nematology Department, the Faculty of Agriculture, Cairo University, Giza governorate, Egypt. Two paratype females from the same substrate, locality and date; deposited in the Montpellier SupAgro—INRA Acarology collection, Montpellier, France.

*Female* (n=4). *Dorsal idiosoma* (Fig. 1) Dorsal shield oval, 574 (529–639) µm long and 394 (369–437) µm wide at widest level; with 37 pairs of aciculate setae, 14 pairs of pilose setae, 22 pairs of distinct lyrifissures and

four pairs of distinct pores. Most dorsal shield setae of uniform length and shorter than distance to the subsequent seta, and associated with a pore; setae Z5 and S5 on small platelets. Marginal shield narrow, fused with dorsal shield anterior of z3; with 13 pairs of aciculate setae and a pair of pilose setae, most setae of uniform length and associated with a pore. Lengths of some dorsal setae: *j1* 49 (42–53), *j5* 39 (39–40), *z1* 43 (39–47), *z3* 47 (47–49), *z6* 41 (36–44), *s4* 42 (39–47), *s6* 43 (42–46), *r3* 41 (34–49), *Z2* 40 (38–43), *Z4* 43 (39–48), *Z5* 68 (61–77), *S1*47 (44–52), *S3* 44 (42–49), *S4* 46 (42–49), *S5* 65 (59–76).

*Ventral idiosoma* (Figs 2, 3) All setae aciculate and smooth, except *JV5* and *ZV4* pilose. Tritosternum base 21 (20–23) long and 42 (38–45) wide at mid-level, with three laciniae, laciniae 86 (78–99) long, median lacinia pilose and longer than laterals, free for about 38% of their total length (Fig. 2). Sternal shield with anterior margin well de-lineated, medially convex, with four pairs of simple setae (*st1–st4*), three pairs of lyrifissures and two pairs of pores, *st1* shortest, inserted anterior to pygidial shield, accompanied by a pair of lyrifissures *iv1, st2–st4* lateral to pygidial shield. Endopodal plates between coxae I–II, II–III and III–IV fused to sternal shield. Pygidial shield tongue-shaped, 209 (191–218) long; posterior margin at anterior margin of coxae IV, straight, 70 (60–79) wide at posterior corners; shield located between coxae II–III; pygidial seta *st5* absent. Opisthogaster with six pairs of opisthogastric setae (*JV2, JV3, JV5* and *ZV2–ZV4*) in addition to circumanal setae (*Ad1, Ad2* and *Pa*), five pairs of distinct lyrifissures and six pairs of distinct pores; anal opening small, 32 (27–38) long including frame. With six pairs of submarginal ventral setae, short and aciculate, most of uniform length and associated with a pore, and three pairs of pilose setae, all long. Exopodal plates between coxae II–III and III–IV fused with endopodal plates (Fig. 3). Lengths of setae: *st1* 18 (16–20), *st2* 21 (20–23), *st3* 22 (21–23), *st4* 24 (21–26), *JV2* 29 (27–31), *JV3* 37 (34–40), *JV5* 71 (64–77), *ZV2* 43 (39–49), *ZV3* 52 (44–59), *ZV4* 56 (53–59); *Ad1* 34 (33–36), *Ad2* 30 (27–31) and *Pa* 14 (13–16).

*Peritreme* (Fig. 3) Peritrematic plate broadly fused with exopodal plate between coxae II–III; stigmata located at level between coxae II–III; with two pairs of lyrifissures and a pair of pores behind coxa IV; peritreme straight anteriorly.

*Gnathosoma* (Figs 4–6) Epistome with a broad dentate base and medial dentate projection (Fig. 4). Fixed cheliceral digit 53 (48–57) long, with six teeth; movable cheliceral digit 44 (40–47) long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct (Fig. 5). Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 29 (25–31) long and 11 (10–11) wide at the base. Hypostomal setae h1 long and smooth, h2 shortest and stout, h3 longest and smooth, h4 short and pilose. Ventral setae on palp trochanter av long, pv short, all smooth (Fig. 6). Lengths of setae: h1 44 (39–47), h2 56 (52–60), h3 11 (10–12) and h4 18 (17–20); palp trochanter setae av 58 (57–60) and pv 11 (10–13).

*Legs* (Figs 7–12) Pretarsi I–IV each with a pair of claws and pulvillus with three rounded lobules (Figs 11, 12). Lengths of legs: I—302 (284–322), II—289 (259–311), III—285 (272–304) and IV—300 (279–320). Leg chaeto-taxy—coxae: 2–2–2–1; trochanters: 4–4–4–4; femora: I—9 (1 2/1 2/2 1); II—9 (2 2/1 2/1 1); III—6 (1 2/1 1/0 1); IV—7 (1 2/1 2/0 1); genua: I—6 (1 2/0 2/0 1); II—6 (1 2/0 2/0 1); III—6 (1 2/0 2/0 1); III—6 (1 2/0 1/0 0); tibiae: I—7 (1 1/1 2/1 1); III—7 (1 1/1 2/1 1);

*Male* (n=1). *Dorsal idiosoma* (Fig. 13) Dorsal shield oval, with longitudinal broken striae in anterior two-thirds, irregular small markings posteriad J2, Z2 and S3, and finely ornamented in region between J4 and J5; 527  $\mu$ m long and 371  $\mu$ m wide at widest level; with 27 pairs of aciculate setae, 38 pairs of pilose setae, two pairs of distinct lyrifissures and no distinct pores. Relative lengths of setae as in adult female, most dorsal shield setae associated with a pore; setae Z5 and S5 on small platelets. Marginal shield narrow, with a few irregular striae and ornamented posteriorly, fused with dorsal shield anterior of z3; with 14 pairs of aciculate setae and a pair of pilose setae, most of uniform length and associated with a pore. Lengths of some dorsal setae: *j1* 69, *j5* 52, *z1* 68, *z2* 74, *z3* 66, *z6* 66, *s4* 65, *s6* 68, *r3* 73, *J2* 44, *J3* 57, *J4* 65, *J5* 59, *Z2* 62, *Z3* 69, *Z4* 66, *Z5* 177, *S1* 81, *S3* 49, *S4* 60, *S5* 151.

*Ventral idiosoma* (Figs 14, 15) All setae aciculate and smooth, except *JV5* and *ZV4* pilose. Tritosternum base 39 long and 56 wide at mid-level, laciniae 68 long, with three laciniae, median lacinia pilose and longer than laterals, free for about 32% of their total length (Fig. 14). Sternal region with anterior margin well delineated and dentate, medially convex, fused with whole endopodal plates, mostly smooth with a few broken longitudinal striae; with four pairs of simple setae (*st1–st4*) and four pairs of lyrifissures, *st1* and *st2* anteriad pygidial opening, *st3* laterad pygidial opening, *st4* posterolaterad pygidial opening. Pygidial opening oval, 69 long and 48 wide, displaced at level of coxae III; pygidial seta *st5* behind pygidial opening; distance between pygidial setae 33; parapygidial lyrifissures (*iv5*) on unsclerotised cuticle posterolaterad *st5*. Opisthogaster with broken transverse striae, with six pairs

of opisthogastric setae (*JV2*, *JV3*, *JV5* and *ZV2–ZV4*) in addition to circumanal setae (*Ad1*, *Ad2* and *Pa*), a pairs of distinct lyrifissures and three pairs of distinct pores; anal opening small, 23 long including frame; intercoxal region 450 long and 335 wide at widest level. With five pairs of submarginal ventral setae, short and aciculate, most of uniform length and associated with a pore, and three pairs of pilose setae, all long. Exopodoal plates between coxae II–III and III–IV fused with endopodal plates (Fig. 15). Lengths of setae: *st1* 26, *st2* 22, *st3* 16, *st4* 21, *st5* 18, *JV2* 23, *JV3* 36, *JV5* 98, *ZV2* 33, *ZV3* 34, *ZV4* 53; *Ad1* 31, *Ad2* 30 and *Pa* 16.

*Peritreme* (Fig. 15) Peritrematic plate broadly fused with exopodal plate between coxae II–III; stigmata located at level between coxae II–III; with two pairs of lyrifissures and a pair of pores behind coxa IV; peritreme curved down anteriorly.

*Gnathosoma* (Fig. 16) Fixed cheliceral digit 64 long, with six teeth; movable cheliceral digit 48 long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct (Fig. 16). Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 30 long and 14 wide at the base. Epistome and hypostomal setae as in adult female. Lengths of setae: h1 44, h2 12, h3 60 and h4 25; palp trochanter setae av 57 and pv 10.

*Legs* (Figs 17–23) Pretarsi I and IV each with a pair of claws and pulvillus with three rounded lobules (Figs 21, 23), pretarsi II–III each with a short claw and pulvillus with three lobules (Fig. 22). Lengths of legs: I—324, II—339, III—320 and IV—369. Leg chaetotaxy—coxae: 2–2–2–1; trochanters: 4–4–4–4; femora: I—9 (1 2/1 2/2 1); II—9 (2 2/1 2/1 1); III—6 (1 2/1 1/0 1); IV—7 (1 2/1 2/0 1); genua: I—8 (1 2/1 2/1 1); III—6 (1 2/0 2/0 1); III—6 (1 2/0 1/0 0); tibiae: I—7 (1 1/1 2/1 1); III—7 (1 1/1 2/1 1); III—7 (1 1/1 2/1 1); IV—7 (1 1/1 2/1 1). Most leg setae thick and spine-like.

Deutonymph female (n=1). Dorsal idiosoma (Fig. 24) Oval, smooth; 484  $\mu$ m long and 333  $\mu$ m wide at widest level; with 38 pairs of aciculate setae, eight pairs of pilose setae, 16 pairs of distinct lyrifissures and no distinct pores. Most dorsal shield setae of uniform length and shorter than distance to the subsequent seta. Marginal shield narrow, fused with dorsal shield anteriorly at level of *z1*; with ten pairs of aciculate setae and a pair of pilose setae, most of uniform length. Lengths of some dorsal setae: *j1* 16, *j5* 27, *z1* 29, *z3* 26, *z6* 29, *s4* 26, *s6* 29, *r3* 26, *J5* 22, *Z2* 35, *Z4* 29, *Z5* 31, *S1* 33, *S3* 27, *S5* 23.

*Ventral idiosoma* (Fig. 25) All setae aciculate and smooth, except *JV5* pilose. Tritosternum with three laciniae, base 12 long and 40 wide at mid-level, laciniae 72 long, median lacinia longer than laterals, free for about 34% of their total length. Sternal shield with anterior margin delineated, medially convex, with five pairs of simple setae (*st1–st5*) and three pairs of lyrifissures, distance between pygidial setae 35. Endopodal plates between coxae I–II, II–III and III–IV fused to sternal shield. Opisthogaster with a triangular punctate plate, having three pairs of opisthogastric setae (*JV2, JV3* and *ZV4*) in addition to circumanal setae (*Ad1, Ad2* and *Pa*), a pair of distinct lyrifissures and three pairs of distinct pores; anal opening small, 27 long including frame. Unsclerotised cuticle of opisthogaster with a pair of setae (*JV5*). With three pairs of submarginal ventral setae, short and aciculate, most of uniform length and a pair of pilose setae, long. Exopodal plates between coxae II–III and III–IV fused with endopodal plates (Fig. 25). Lengths of setae: *st1* 16, *st2* 16, *st3* 16, *st4* 16, *st5* 12, *JV2* 26, *JV3* 12, *JV5* 34, *ZV4* 31; *Ad1* 11, *Ad2* 22 and *Pa* 7.

*Peritreme* (Fig. 25) Peritrematic plate broadly fused with exopodal plate between coxae II–III; stigmata located at level between coxae II–III; with two pairs of lyrifissures and a pair of pores behind coxa IV; peritreme straight forward anteriorly.

*Gnathosoma* Epistome with a broad dentate base and medial dentate projection. Fixed cheliceral digit 46 long, with six teeth; movable cheliceral digit 35 long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct. Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 22 long and 8 wide at the base. Hypostomal setae h1 long and smooth, h2 shortest and stout, h3 longest and smooth, h4 short and pilose. Ventral setae on palp trochanter av long, pv short, all smooth. Lengths of setae: h1 21, h2 8, h3 29 and h4 14; palp trochanter setae av 26 and pv 8.

*Legs*. Pretarsi I–IV each with a pair of claws and pulvillus with three rounded lobules. Lengths of legs: I—250, II—253, III—261 and IV—250.

Deutonymph male (n=2). Dorsal idiosoma (Fig. 26) Oval, with longitudinal broken striae over most its surface and a small wavy markings posteriad Z4 and S3 setae; 443–448  $\mu$ m long and 331–333  $\mu$ m wide at widest level; with 43 pairs of aciculate setae, eight pairs of pilose setae (base of *j1* and *z2* setae present), 14 pairs of distinct lyrifissures and 13 pairs of distinct pores. Most dorsal shield setae of uniform length and shorter than distance to the subsequent seta. Marginal shield narrow; with 12 pairs of aciculate seate. Lengths of some dorsal setae: *j2* 16–17, *j3*  26–29, *j*5 27–29, *z*3 27–28, *z*6 29, *s*4 26, *s*6 29–31, *r*3 16–18, *Z*2 27–29, *Z*4 33–36, *Z*5 21–22, *S*1 30–31, *S*3 27–31, *S*5 18–20.

*Ventral idiosoma* (Fig. 27) All setae aciculate and smooth. Tritosternum with three laciniae, base 20–22 long and 22–38 wide at mid-level, laciniae 73–75 long, median lacinia longer than laterals, free for about 34–35% of their total length. Sternal shield with anterior margin delineated, medially convex, with five pairs of simple setae (*st1–st5*) and three pairs of lyrifissures. Pygidial opening oval, 64–66 long and 43–46 wide, displaced at level of coxae III; distance between pygidial setae 36–40. Endopodal plates between coxae I–II, II–III and III–IV fused to sternal shield. Opisthogaster with a triangular punctate plate, having five pairs of opisthogastric setae (*JV2*, *JV3*, *JV5* and *ZV3*, *ZV4*) in addition to circumanal setae (*Ad1*, *Ad2* and *Pa*), a pair of distinct lyrifissures and two pairs of distinct pores; anal opening small, 20–22 long including frame. With a pair of submarginal ventral setae, long and aciculate. Exopodal plates between coxae II–III and III–IV fused with endopodal plates (Fig. 27). Lengths of setae: *st1* 11–12, *st2* 16, *st3* 15–16, *st4* 15–16, *st5* 14–16, *JV2* 23–26, *JV3* 10–13, *JV5* 17–21, *ZV3* 8–10, *ZV4* 28–30; *Ad1* 10–13, *Ad2* 21–22 and *Pa* 8–10.

*Peritreme* (Fig. 27) Peritrematic plate broadly fused with exopodal plate between coxae II–III; stigmata located at level between coxae II–III; with two pairs of lyrifissures and a pair of pores behind coxa IV; peritreme straight anteriorly.

*Gnathosoma* Fixed cheliceral digit 40–42 long, with six teeth; movable cheliceral digit 29–30 long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct. Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 22–23 long and 7 wide at the base. Epistome and hypostomal setae as in deutonymph female. Ventral setae on palp trochanter  $av \log_{10} pv$  short, all smooth. Lengths of setae: h1 22–25, h2 5–7, h3 30–31 and h4 12–16; palp trochanter setae av 31–34 and pv 10.

*Legs* Pretarsi I–IV each with a pair of claws and pulvillus with three rounded lobules. Lengths of legs: I—225–230, II—254–257, III—242–248 and IV—248.

*Protonymph* (n=4). *Dorsal idiosoma* (Fig. 28) Oval, with anteromedian punctate oval plate over most its surface, two pairs of oval punctate plates laterally and a transverse punctate plate near posterior margin; 371 (331–416)  $\mu$ m long and 237 (209–266)  $\mu$ m wide at widest level; with 26 pairs of aciculate setae, six pairs of pilose setae, six pairs of distinct lyrifissures and a pair of distinct pores. Most dorsal shield setae of uniform length and shorter than distance to the subsequent seta. Marginal shield narrow, fused with dorsal shield anteriorly at level of *j1*; with seven pairs of aciculate seate. Lengths of some dorsal setae: *j1* 20 (18–21), *j2* 21 (21–22), *z3* 35 (31–39), *z6* 31, *s4* 24 (22–26), *s6* 37 (34–39), *Z2* 38 (34–43), *Z3* 10 (9–12), *Z4* 12 (10–14), *Z5* 38 (36–42), *S3* 28 (25–30), *S4* 18 (16–19), *S5* 15 (13–17).

*Ventral idiosoma* (Fig. 29) All setae aciculate and smooth. Tritosternum with three laciniae, base 18 (13–25) long and 27 (23–29) wide at mid-level, laciniae 49 (40–53) long, median lacinia longer than laterals, free for about 36% of their total length. Sternal shield with anterior margin delineated, medially convex, with four pairs of simple setae (*st1–st4*) and three pairs of lyrifissures. Pygidial seta *st5* behind coxae IV; distance between pygidial setae 39 (33–43). Endopodal plates between coxae I–II, II–III and III–IV fused to sternal shield. Opisthogaster with a transverse oval punctate plate near posterior margin having a pair of adanal setae (*Ad2*) and post-anal seta (*Pa*), two pairs of distinct lyrifissures and no distinct pores; anal opening small, 20 (18–21) long including frame. Unsclerotised cuticle of opisthogaster with a pair of opisthogastric setae (*ZV4*), a pair of adanal setae (*Ad1*) and a pair of distinct lyrifissures. With no submarginal ventral setae. Exopodal plates between coxae II–III and III–IV fused with endopodal plates (Fig. 29). Lengths of setae: *st1* 14, *st2* 12 (10–14), *st3* 19 (18–21), *st4* 18 (17–20), *st5* 20 (19–22), *ZV4* 14 (13–16); *Ad1* 5, *Ad2* 18 (16–20) and *Pa* 10 (9–10).

*Peritreme* (Fig. 29) Peritrematic plate narrow, restricted to region along peritreme, separate from exopodal plate; extending posteriorly to region laterad margin of coxae III; with two pairs of lyrifissures and a pair of pores posterior to stigmata; stigmata located at level between coxae II–III, peritreme straight forward anteriorly.

*Gnathosoma* Epistome with a broad dentate base and medial dentate projection. Fixed cheliceral digit 37 (35–38) long, with six teeth; movable cheliceral digit 26 (25–27) long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct. Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 17 (16–18) long and 7 (6–8) wide at the base. Hypostomal setae h1 long and smooth, h2 shortest and stout, h3 longest and smooth, h4 short and pilose. Ventral setae on palp trochanter av long, pv short, all smooth. Lengths of setae: h1 28 (26–31), h2 6 (5–7), h3 31 (29–34) and h4 15 (12–17); palp trochanter setae av 20 (18–21) and pv 11 (10–11).



FIGURES 1–6. *Centrouropoda bahariyaensis* n. sp., holotype female: 1. Dorsal idiosoma; 2. Tritosternum; 3. Ventral idiosoma; 4. Epistome; 5. Chelicera; 6. Hypostome.



**FIGURES 7–12.** *Centrouropoda bahariyaensis* **n. sp.**, holotype female: 7. Coxa-tibia of leg I; 8. Coxa-tarsus of leg II; 9. Coxa-tarsus of leg II; 10. Coxa-tarsus of leg IV; 11. Pretarsus of leg I; 12. Pretarsus of legs II–IV.



FIGURES 13–16. *Centrouropoda bahariyaensis* n. sp., paratype male: 13. Dorsal idiosoma; 14. Tritosternum; 15. Ventral idiosoma; 16. Chelicera.



**FIGURES 17–23**. *Centrouropoda bahariyaensis* **n. sp.**, paratype male: 17. Coxa-tibia of leg I; 18. a. Coxa-tarsus of leg II, b. Ventral view of tarsus of leg II; 19. Coxa-tarsus of leg III; 20. Coxa-tarsus of leg IV; 21. Pretarsus of leg I; 22. Pretarsus of legs II–III; 23. Pretarsus of leg IV.



FIGURES 24–27. FIGURES 24–25. *Centrouropoda bahariyaensis* n. sp., deutonymph female: 24. Dorsal idiosoma; 25. Ventral idiosoma. FIGURES 26–27. *Centrouropoda bahariyaensis* n. sp., deutonymph male: 26 Dorsal idiosoma; 27. Ventral idiosoma.



FIGURES 28–31. FIGURES 28–29. *Centrouropoda bahariyaensis* n. sp., protonymph: 28. Dorsal idiosoma; 29. Ventral idiosoma. FIG-URES 30–31. *Centrouropoda bahariyaensis* n. sp., larva: 30. Dorsal idiosoma; 31. Ventral idiosoma.

Legs Pretarsi I–IV each with a pair of claws and pulvillus with three rounded lobules. Lengths of legs: I—188 (182–198), II—205 (191–214), III—188 (180–198) and IV—199 (189–208).

*Larva* (n=3). *Dorsal idiosoma* (Fig. 30) Oval, with fragmented punctate platelets over most its surface; 249 (243–253)  $\mu$ m long and 167 (155–185)  $\mu$ m wide at widest level; with 15 pairs of aciculate setae, a pair of distinct lyrifissures and no distinct pores. Most dorsal shield setae of uniform length and shorter than distance to the subsequent seta. Lengths of some dorsal setae: *j1* 13 (13–14), *j5* 13 (12–14), *z1* 16 (15–17), *z3* 15 (14–16), *z6* 15 (14–16), *s4* 16 (14–17), *s6* 21, *Z2* 13 (13–14), *Z4* 17 (16–18), *Z5* 21 (20–23), *S1* 18 (16–20), *S3* 29 (26–31), *S4* 32 (29–35), *S5* 28 (27–29).

*Ventral idiosoma* (Fig. 31) All setae aciculate and smooth. Tritosternum with three laciniae, base 13 (10–16) long and 9 (8–10) wide at mid-level, laciniae 41 (39–44) long, median lacinia longer than laterals, free for about 40% of their total length. Body venter with three pairs of sternal setae (*st1–st3*). Opisthogaster with a crescentic punctate plate posteriad anal opening having only post-anal seta (*Pa*). Unsclerotised cuticle of opisthogaster with a pair of setae (*ZV4*) and para-anal setae (*Ad1*, *Ad2*); no distinct lyrifissures or pores; anal opening small, 16 long including frame. With three pairs of submarginal ventral setae, long and aciculate, most of uniform length (Fig. 31). Lengths of setae: *st1* 13 (13–14), *st2* 16 (16–18), *st3* 19 (18–20), *ZV4* 24 (22–26); *Ad1* 21 (20–23), *Ad2* 24 (23–26) and *Pa* 11 (10–12).

Peritreme Not distinguishable.

Gnathosoma Epistome with a broad dentate base and medial dentate projection. Fixed cheliceral digit 27 (26–27) long, with five teeth; movable cheliceral digit 28 (27–29) long, with three teeth. Cheliceral antiaxial and dorsal lyrifissures and dorsal seta and nodulus distinct. Deutosternal groove narrow and smooth. Corniculi parallel to each other, about 15 (14–16) long and 5 (4–5) wide at the base. Hypostomal setae h1 long and smooth, h2 shortest and stout, h3 longest and smooth, h4 short and pilose. Ventral setae on palp trochanter av long, pv short, all smooth. Lengths of setae: h1 27 (26–29), h2 5, h3 44 (40–47) and h4 21 (20–21); palp trochanter setae av 20 (18–22) and pv 9.

*Legs* Pretarsi I–III each with a pair of claws and pulvillus with three rounded lobules. Lengths of legs: I—175 (169–180), II—186 (180–194) and III—179 (173–182).

**Etymology.** The name *bahariyaensis* refers to "from Bahariya Oasis", locality where the type specimens were collected.

**Remarks.** This new species is most similar to *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992, *C. rackae* Hirschmann, 1975, *C. rhynchophorus* (El-Bishlawy & Allam, 2007) and *C. zaheri* (Abd El-Ghani, 2009). The main differences between the new species and the other closest species were in Table 1.

The species has sexual dimorphism as the dorsal chaetotaxy of females differ from that of males. Also there are sexual differences in this mite species, such as coxal setae on leg IV are needle-like in females and short and robust in males. Differences of leg setaion such as setae (av1 and pv2) on genu I (1 2/1 2/1 1) are present in male and absent in female (1 2/0 2/0 1).

#### Key to known Centrouropoda species based on adult females and males

*Centrouropoda (Aegyptus) alhassa* (Al-Dhafar & Al-Qahtani, 2012) was not included in the present key because we unable to examine the type specimen of this species, and the original description was brief, without illustrations or measurements. Also *Centrouropoda rhombogyna* (Berlese, 1916) was not included because the original description was very brief:

1.	Posterior end pointed (V-shaped)
-	Posterior end rounded (C-shaped)
2.	Ventrum with two pairs of long pilose submarginal setae in female, and four pairs in male.
-	Ventrum with four pairs of long pilose submarginal setae in female, and five pairs in male
	Centrouropoda rhynchophorus (El-Bishlawy & Allam, 2007)
3.	Seta <i>h4</i> smooth, dorsal chaetotaxy and gnathosoma of male similar to female
-	Seta h4 pilose, dorsal chaetotaxy and gnathosoma of male different from that of female
4.	Setae h2 and h4 of equal length, ventrum with eight pairs of short aciculate submarginal setae in female
-	Seta <i>h4</i> about 1.6 times as <i>h2</i> , ventrum with three pairs of long pilose submarginal setae in female

# Key to known Centrouropoda species based on deutonymphs

*Centrouropoda (Aegyptus) zaheri* (Abd El-Ghani, 2009) was not included in the present key because we were unable to check the deutonymphs of this species, the original description was based only on the adult female. Also *Centrouropoda rackae* Hirschmann, 1975 was not included because there is no available descriptions of deutonymphs of this species:

1.	Submarginal ventral surface ornamented with a row of irregular structures, stigmata enlarged
-	Submarginal ventral surface smooth, stigmata in normal size
2.	Sternum with 21–24 small roundish reticulations
	Centrouropoda securiformis Wiśniewski & Hirschmann, 1992 in Wiśniewski, Hirschmann & Hiramatsu, 1992
-	Sternum with 13–16 small roundish reticulations
	Centrouropoda pelekymorpha Hirschmann & Wiśniewski, 1992 in Wiśniewski, Hirschmann & Hiramatsu, 1992
3.	All dorsal shield setae of equal length
-	Some dorsal shield setae longer than other setae
4.	Seta <i>h2</i> short, stout and smooth
-	Seta <i>h2</i> long, acicular and smooth
5.	With three pairs of short and aciculate submarginal ventral setae and a pair of long pilose setae
-	With 11 pairs of short and aciculate submarginal ventral setae
6.	Dorsal shield smooth, setae <i>h4</i> and <i>h2</i> of equal length or not
-	Dorsal shield punctate, setae <i>h4</i> and <i>h2</i> of equal length
7.	Seta <i>h4</i> and <i>h2</i> of equal length
-	Seta h4 shorter than h2
8.	Dorsal marginal shield punctate
-	Dorsal marginal shield smooth.

## Discussion

Kontschán *et al.*, 2014a (page 68) mentioned that *Aegyptus rhynchophorus* El-Bishlawy & Allam (2007) could be a junior synonym of *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992 based on the figures of El-Bishlawy & Allam (2007) and Allam & El-Bishlawy (2010), after the description of *C. almerodai* deutonymph given by Wiśniewski *et al.*, 1992. However, a new synonymy should be assigned after type examination not only descriptions or figures, especially because the figures of El-Bishlawy & Allam (2007) and Allam & El-Bishlawy (2010) lack some important details.

Based on the examination of the type materials (females, males and several immature stages) of *A. rhynchophorus* El-Bishlawy & Allam, 2007 and *A. zaheri* Abd El-Ghani, 2009, the genus *Aegyptus* El-Bishlawy & Allam, 2007 is a junior synonym of *Centrouropoda* Berlese, 1916. Kontschán *et al.*, 2014b (page 83) mentioned *Aegyptus rhynchophorus* is a junior synonym of *Centrouropoda* almerodai after describing the adult female, male and all immature stages of this species. However, after examining several specimens of the type species of *A. rhynchophorus*, we found that these species are completely different from each other in the following characters: *C. almerodai* have dorsal chaetotaxy and gnathosoma of male similar to female (male completely different from female in *A. rhynchophorus*), dorsal shield of female with 25 pairs of aciculate setae (37 pairs in *A. rhynchophorus*), ventrum with two pairs of long pilose submarginal setae in female (four pairs in *A. rhynchophorus*), seta *h4* smooth (pilose in *A. rhynchophorus*), leg I without claw (with claw in *A. rhynchophorus*), addition to the description of all immature stages are different from that of *A. rhynchophorus*. Unfortunately, the description given by Kontschán *et al.* (2014b) for *C. almerodai* is rather brief with few measurements and without information about leg chaetotaxy. This means that the genus *Aegyptus* is a junior synonym of genus *Centrouropoda*, but *A. rhynchophorus* not a junior synonym of *C. almerodai*, and these are different two species belonging to the same genus.

This study continues work on possible biological control agents for the red palm weevil (RPW). Allam & El-Badawy (2017) found that *Centrouropoda* spp. (=*Aegyptus* spp.) significantly affected some biological activities of RPW when the uropodid (parasitoid) mite was released on its pupal stage, as it induced malformation in the pupae as

<b>TABLE 1.</b> Differences between	1 С. bahariyaensis <b>n. sp.</b> аг	id related species.			
Character	C. bahariyaensis	C. almerodai	C. rackae	C. rhynchophorus	C. zaheri
Dorsal chaetotaxy of females & males	Both completely different	Male similar to female	Both completely different	Both completely different	Both completely differ- ent
Gnathosoma of females & males	Male similar to female	Male similar to female	Both completely different	Male similar to female	Male similar to female
Lacinia	Laciniae base and para- laciniae smooth, median lacinia pilose	Laciniae base, median lacinia and paralaciniae smooth	Laciniae base more dentate, median lacinia and parala- ciniae pilose	Laciniae base smooth, median lacinia and parala- ciniae pilose	Laciniae base, median lacinia and paralaciniae smooth
No. of submarginal long pilose setae on ventrum in female	Three pairs	Two pairs	One pair	Four pairs	Two pairs
No. of submarginal long pi- lose setae on ventrum in male	Three pairs	Two pairs	Three pairs	Five pairs	Four pairs
Seta h2 in female	Stout	Simple	Stout	Stout	Simple
Seta <i>h2</i> in male	Stout	Simple	Simple	Stout	Simple
Seta h4 in both sexes	Pilose	Smooth	Pilose	Pilose	Pilose
Setae h2 & h4 in female	h4 = 1.6 h2	h2 = h4	h2 = h4	h4 = 2.9 h2	h4 = 1.5 h2
Setae <i>h2 &amp; h4</i> in male	h4 = 2.1 h2	h2 = h4	h2 > h4	h4 = 2.5 h2	h2 = h4
Body posterior end	C-shaped	C-shaped	C-shaped	V-shaped	V-shaped
Leg I	With claw	Without claw	With claw	With claw	With claw
References	Present Study	Wiśniewski <i>et al.</i> , 1992 Kontschán <i>et al.</i> , 2014b	Hirschmann, 1975	El-Bishlawy & Allam, 2007	Abd El-Ghani, 2009

well as increasing adults malformation up to 50% compared to 3.3% in controls. Also El-Bishlawy & Allam (2007) found that when *C. rhynchophorus* was put with RPW pupae, it causes deformation in wings, and death when present in great numbers (500–1000 mites/insect stage). Thus, *C. rhynchophorus* is a facultative parasite that may be propagated on other media except pupae of RPW. This feeding behaviour leads to easy mass production and application on date palm. The feeding behaviour, biotic and abiotic factors on the mass production of *C. rhynchophorus* suggests its potential as a bio-control agent against RPW on date palm, especially in Arab countries.

The majority of *Centrouropoda* species are associated with palm weevils in deutonymphal stages. The deutonymphs attach themselves underneath the elytra of RPW adults through their anal pedicel in a phoretic relationship. That is why when checking the adults of RPW, the only stage can be found is deutonymphs, and females or males of Uropodina are very rarely found. The females and males have strong avoidance behaviour and they usually escape capture. The adults are usually found associated with the pupae as a facultative parasite, as they search for protein, moisture and darkness.

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