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## THE TRUE IDENTITY OF THE RED PALM WEEVIL ASSOCIATED UROPODINA MITE, *CENTROUROPODA ALMERODAI* HIRAMATSU & HIRSCHMANN, 1992

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Kontschán J., Mazza G., Nannelli R., Roversi P.F. – The true identity of the Red Palm Weevil associated Uropodina mite, *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992.

Several adults, deutonymphs, protonymphs and larvae of *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992 were collected in Italy on the adults, pupae and cocoons of the Red Palm Weevil, *Rhynchophorus ferrugineus* (Olivier, 1790). New descriptions and illustrations for the female, male, deutonymph, protonymph and larva are presented.

KEY WORDS: Mites, Uropodina, *Centrouropoda almerodai*, Red Palm Weevil, Italy.

### INTRODUCTION

The mite species *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992 was described in WIŚNIEWSKI *et al.* (1992), along with several other species in the genus *Centrouropoda* Berlese, 1916. The majority of these species, including *C. almerodai*, were described on the basis of the deutonymphs, and only two species are known as adults. The described deutonymphs were collected on the bodies of beetles belonging to the families Brentidae, Cerambycidae and Curculionidae (WIŚNIEWSKI & HIRSCHMANN, 1993). In contrast, 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).

*Centrouropoda almerodai* was described on the basis of deutonymphs collected on *Rhynchophorus ferrugineus* (Olivier, 1790) (RPW) in the Philippines (WIŚNIEWSKI *et al.*, 1992). Several years later this species was recorded from the Central America (RODRÍGUEZ-MORELL *et al.*, 2012) and Europe (LONGO & RAGUSA, 2006; PORCELLI *et al.*, 2009; RAGUSA *et al.*, 2009; MORTON & GARCIA-DEL-PINO, 2011; MAZZA *et al.*, 2011, 2014), and it was described again under a different name (see KONTSCHÁN *et al.*, 2014).

In this paper we add new information to the original description of the deutonymph of *C. almerodai* (WIŚNIEWSKI *et al.*, 1992), and we describe the female, male, protonymph and larvae.

### MATERIAL AND METHODS

Specimens were collected on the pupae, adults and cocoons of RPW. Mites were cleared and mounted in Hoyer's medium on slides deposited in CRA ABP - Research Centre for Agrobiological and Pedology, Firenze,

Italy and in the Hungarian Natural History Museum (HNHM). Illustrations were made with a drawing tube. Measurements are given in micrometres (µm); width of the idiosoma was taken at the level of coxae IV. Abbreviations: RPW: Red Palm Weevil, St: sternal setae, ad: adanal setae.

### DESCRIPTIONS

#### *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992

*Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992; WIŚNIEWSKI *et al.* (1992: 313-316. Figs 1-2).

*Centrouropoda almerodai*: LONGO & RAGUSA (2006); PORCELLI *et al.* (2009); RAGUSA *et al.* (2009); MAZZA *et al.* (2011); MORTON & GARCIA-DEL-PINO (2011); KONTSCHÁN *et al.* (2014).

*Aegyptus rhynchophorus* EL-BISHLAWY & ALLAM (2007) (synonymy by KONTSCHÁN *et al.* 2014).

*Aegyptus rhynchophorus*: AL-DHAFAR & AL-QUAHTANI (2011); ALLAM & EL-BISHLAWI (2010); MAZZA *et al.* (2014).

*Uroobovella* sp.: AL-DEEB *et al.* (2011) (misidentification).

MATERIAL EXAMINED – Two males, five females, seven deutonymphs, (CRA ABP), Italy, Catania (I), collected on pupae in cocoon of *R. ferrugineus* on palm (v38). 27. December 2012, R. Nannelli coll. One male and 12 deutonymphs (CRA-ABP), Italy, Catania (I), collected in cocoon of *R. ferrugineus* on palm (v24). 27 December 2012, R. Nannelli coll. Four deutonymphs (CRA-ABP), Italy, Catania (I), collected on body of female *R. ferrugineus*, (v. 2) 30 January 2013, R. Nannelli coll. Two deutonymphs (CRA-ABP), Italy, Catania (I), collected on sub-elytra of *R. ferrugineus* male, (v.10) 30. January, 2013, R. Nannelli coll. Five larvae and four protonymphs (CRA-ABP), Italy, Catania (I), collected on pupae of *R. ferrugineus*, (v. 100) 28. March 2013, R. Nannelli coll.

DESCRIPTION OF FEMALE - Length of idiosoma 410-440  $\mu\text{m}$ , width 330-350  $\mu\text{m}$  ( $n=5$ ). Oval shape of idiosoma.

Dorsal idiosoma (Fig. I, 1). Marginal and dorsal shields completely separated. Majority of dorsal setae smooth, needle-like (ca 20-24  $\mu\text{m}$ ) and very narrow. Twelve pairs of dorsal setae long, robust and apically serrate (ca 25-35  $\mu\text{m}$ ), two pairs of setae on caudal area of dorsal shield situated close to each other on a small platelets and extremely long (ca 48-50  $\mu\text{m}$ ) and apically serrate. One pair of marginal setae, similar in shape and length to longer dorsal setae. Surface of dorsal and marginal shields smooth, only some muscle scars visible medially.

Ventral idiosoma (Fig. I, 2). Sternal setae short (ca 8-10  $\mu\text{m}$ ), smooth and needle-like. St1 placed near anterior margin of sternal shield, St2 at level of central area of coxae II, St3 at level of central area of coxae III and St4 near basal edges of genital shield, St5 absent. Surface of sternal shield smooth. Ventral shield without ornamentation. Four pairs of ventral setae anterior and two pairs of setae posterior to anal opening, all smooth and needle-like (ca 14-16  $\mu\text{m}$ ),

four pairs of ventral setae long, wide, and robust like (ca 40-48  $\mu\text{m}$ ). Adanal (*ad1* and *ad2*) setae similar in shape and length to the shorter ventral setae, postanal seta (*pa*) needle-like and short (ca 8-9  $\mu\text{m}$ ). Genital shield oblong, apically rounded, widest between coxae II and III, without sculptural pattern, extending from anterior margin of sternal shield to anterior margins of coxae IV. Stigmata situated between coxae II and III, prestigmatid part of peritremes long and U-shaped, inner margins undulate, poststigmatid part absent. Tritosternum (Fig. I, 3) with narrow base, tritosternal laciniae divided into three smooth branches.

Gnathosoma (Fig. I, 4). Corniculi horn-like, internal malae longer than corniculi, apically fringed, rounded paracinae-like processes present behind internal malae. Hypostomal setae smooth and needle-like, h1 situated on anterior margin of gnathosoma and long (ca 20  $\mu\text{m}$ ), h2 short (ca 6  $\mu\text{m}$ ), h3 long (ca 12  $\mu\text{m}$ ) and h4 (ca 6  $\mu\text{m}$ ) short. Palp bearing smooth and needle-like setae. Apical part of epistome spatuliform with a long serrate tongue-like appendage (Fig. I, 5).

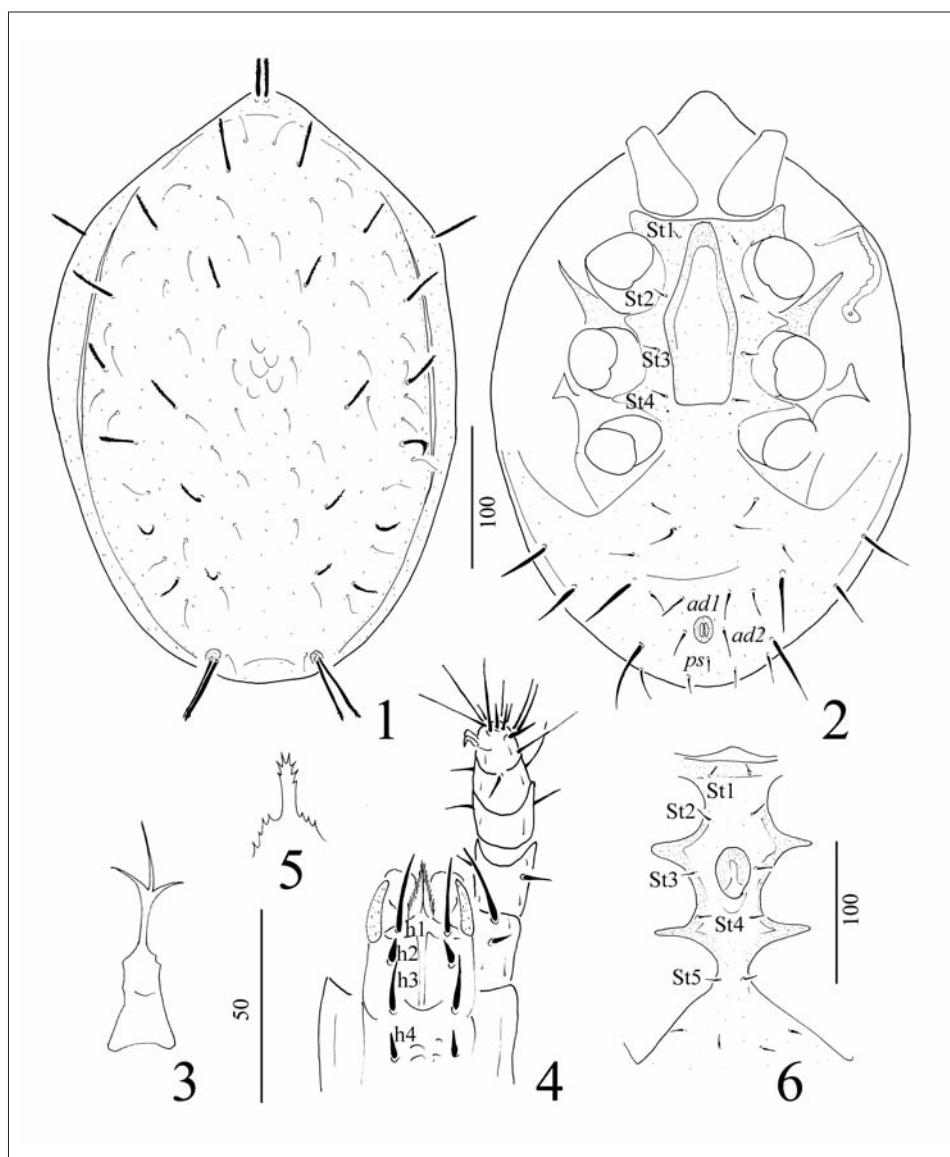


Fig. I – *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992. Female: 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma; 3. Tritosternum; 4. Ventral view of gnathosoma; 5. Epistome. 6. Male: intercoxal area of male.

Legs (Fig. II, 1, 2, 3, 4). Legs bearing smooth and simple setae, legs I without claws, tarsi II-IV bearing thick and robust setae, femora II-IV with flap-like processes.

**DESCRIPTION OF MALE** - Length of idiosoma 410-420  $\mu\text{m}$ , width 270-310  $\mu\text{m}$  ( $n = 3$ ). Shape of idiosoma, ornamentation, dorsal chaetotaxy and gnathosoma as in female. Sternal shield very narrow between coxae IV. Five pairs of sternal setae smooth, needle-like and short (ca 8-10  $\mu\text{m}$ ), their positions as illustrated in Fig. I, 6. Surface of sternal shield without sculptural pattern. Position and shape of ventral setae as in female. Genital shield oval, placed between coxae III.

**DESCRIPTION OF DEUTONYMPH** - Length of idiosoma 370-380  $\mu\text{m}$ , width 280-290  $\mu\text{m}$  ( $n=21$ ). Shape of idiosoma oval.

**Dorsal idiosoma** (Fig. III, 1, 2): Majority of dorsal setae smooth, needle-like (ca 15-19  $\mu\text{m}$ ) and very narrow; nine pairs long, robust and apically serrate. Surface of dorsal shield smooth, body margin undulate.

**Ventral idiosoma** (Fig. III, 3): Surface of sternal shield smooth, sternal shield narrow between coxae IV. Sternal setae smooth and needle-like (ca 6-9  $\mu\text{m}$ ), St1 placed at level of anterior margin of coxae II, St2 at level of posterior margin of coxae II, St3 at level of anterior margin of coxae III, St4 at level of posterior margin of coxae III, St5 at level of central area of coxae IV. Ventrianal shield without sculptural pattern, with four pairs of smooth and needle-like ventral setae (ca 7-9  $\mu\text{m}$ ). Adanal setae (ca 5-6  $\mu\text{m}$ ) shorter than ventral setae. Prestigmatid part of peritremes long with undulate inner margins (Fig. III, 4). Tritosternum with narrow base, its laciniae divided into three branches (Fig. III, 5).

**Gnathosoma** (Fig. III, 6). Corniculi horn-like and shorter than internal malae, internal malae needle-like, inner margins fringed. Hypostomal setae smooth and needle-like, h1 situated on apical margin of gnathosoma. Setae h1 ca 15  $\mu\text{m}$ , h2 and h4 ca 8  $\mu\text{m}$ , h3 ca 19  $\mu\text{m}$ . Fixed digit of chelicerae longer than movable digit, with several teeth, movable digit bearing three teeth. Cheliceral internal sclerotised node present (Fig. III, 8). Apical part of epistome with three spine-like branches (Fig. III, 7).

**DESCRIPTION OF PROTONYMPH** - Length of idiosoma 330-340  $\mu\text{m}$ , width 220-240  $\mu\text{m}$  ( $n=4$ ). Shape of idiosoma oval.

**Dorsal idiosoma** (Fig. IV, 1). Dorsal idiosoma with podonotal and pygidial shields, plus two pairs of lateral shields. Podonotal shield with five pairs of smooth and needle-like setae (ca 9-13  $\mu\text{m}$ ), lateral shields without setae, pygidial shield bearing one pair of long apically serrate setae (ca 36-40  $\mu\text{m}$ ). Membranous cuticle with numerous smooth and needle-like setae (ca 9-11  $\mu\text{m}$ ) and with three pairs of longer (ca 18-23  $\mu\text{m}$ ), wider and apically serrate setae.

**Ventral idiosoma** (Fig. IV, 2). Sternal shield short, posterior margin reaching to coxae III, its surface smooth. Sternal setae smooth and needle-like (ca 9-11  $\mu\text{m}$ ), St1 placed near anterior margin of sternal shield, St2 at level of posterior margin of coxae II, St3 at level of central area of coxae III. Four pairs of smooth needle-like (ca 9-12  $\mu\text{m}$ ) setae situated on membranous cuticle anterior and lateral to anal shield. Anal shield with one pair of adanal setae (ca 9-11  $\mu\text{m}$ ), postanal seta absent. Peritremes straight and placed on small peritrematal shields. Metapodal shields oval and situated near coxae IV.

**Gnathosoma** (Fig. IV, 3). Corniculi horn-like, internal

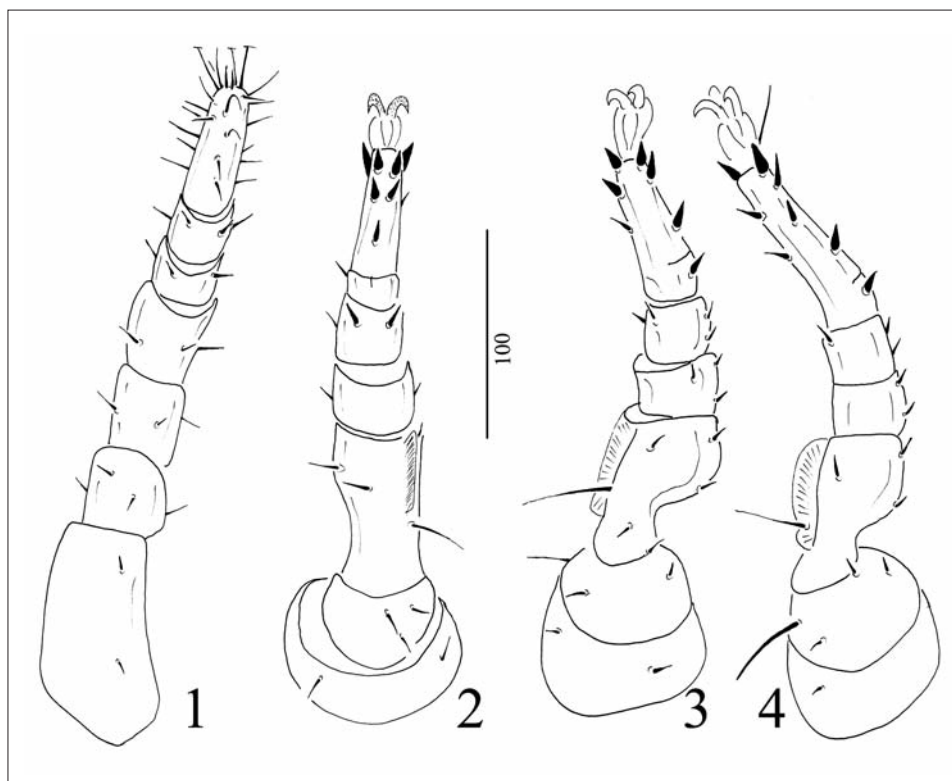


Fig. II – *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992. Female: 1. Leg I in ventral view; 2. Leg II in ventral view; 3. Leg III in ventral view; 4. Leg IV in ventral view.

malae apically fringed and longer than corniculi. Hypostomal setae smooth and needle-like, and h1 long (ca 19  $\mu$ m), h2 and h3 short (ca 5  $\mu$ m), h4 not clearly visible, covered by coxae I. Setae h1 situated on lateral part of gnathosoma and on protuberances. Epistome apically serrate. Fixed digit of chelicera longer than movable digit, movable digit bearing three teeth. Cheliceral internal sclerotised node present (Fig. IV, 4).

**DESCRIPTION OF LARVA** - Length of idiosoma 235-240  $\mu$ m, width 130-140  $\mu$ m (n=5). Shape of idiosoma oval.

Dorsal idiosoma (Fig. V, 1). Podonotal, pygidial and four pairs of shorter shields presented on dorsal idiosoma. Podonotal shield with six pairs of smooth and needle-like setae (ca 11-12  $\mu$ m) on central area, and three pairs of setae on margins. Three pairs of lateral plates without setae, one pairs of them bearing one smooth and needle-like setae. Pygidial shield with one pair of smooth setae (ca 12  $\mu$ m). Membranous cuticle with some smooth and needle-like setae (ca 11-14  $\mu$ m).

Ventral idiosoma (Fig. V, 2). Sternal shield not visible, three pairs of sternal setae smooth and needle-like (ca 11-12  $\mu$ m), St1 situated at level of anterior margin of coxae II, St2 at level of posterior margin of coxae II, St3 at level of

central area of coxae III. One pair of smooth and needle-like (ca 20  $\mu$ m) setae situated between sternal and anal shields on membranous cuticle. Anal shield with one pair of adanal setae (ca 19  $\mu$ m), postanal seta absent.

**NOTES ON BIOLOGY** - *Centrouropoda almerodai* is the best known mite associated with RPWs in the Italian regions (MAZZA *et al.*, 2014). Adults and nymphs were collected from cocoons formed by RPW, while deutonymphs were collected from the body of this weevil, in particular under the elytra and wings as already found by LONGO & RAGUSA (2006). Protonymphs and larvae were associated with the pupae of RPW. MAZZA *et al.* (2011) found that the majority of the pupae and adults of RPW, at least in Sicily (Italy), were infected by *C. almerodai* and these data agree with our results. MORTON & GARCIA-DEL-PINO (2011) reported that adults of *C. almerodai* can feed on the entomopathogenic nematode *Steinernema carpocapse* and therefore may interfere with the use of this entomopathogenic nematode in the biological control of RPW. We speculate that this species may also feed on insect larvae, fungi or organic matter that clusters on and around the cocoons, and may use the weevils only as a means of transportation. The status of this species however as a predator needs fur-

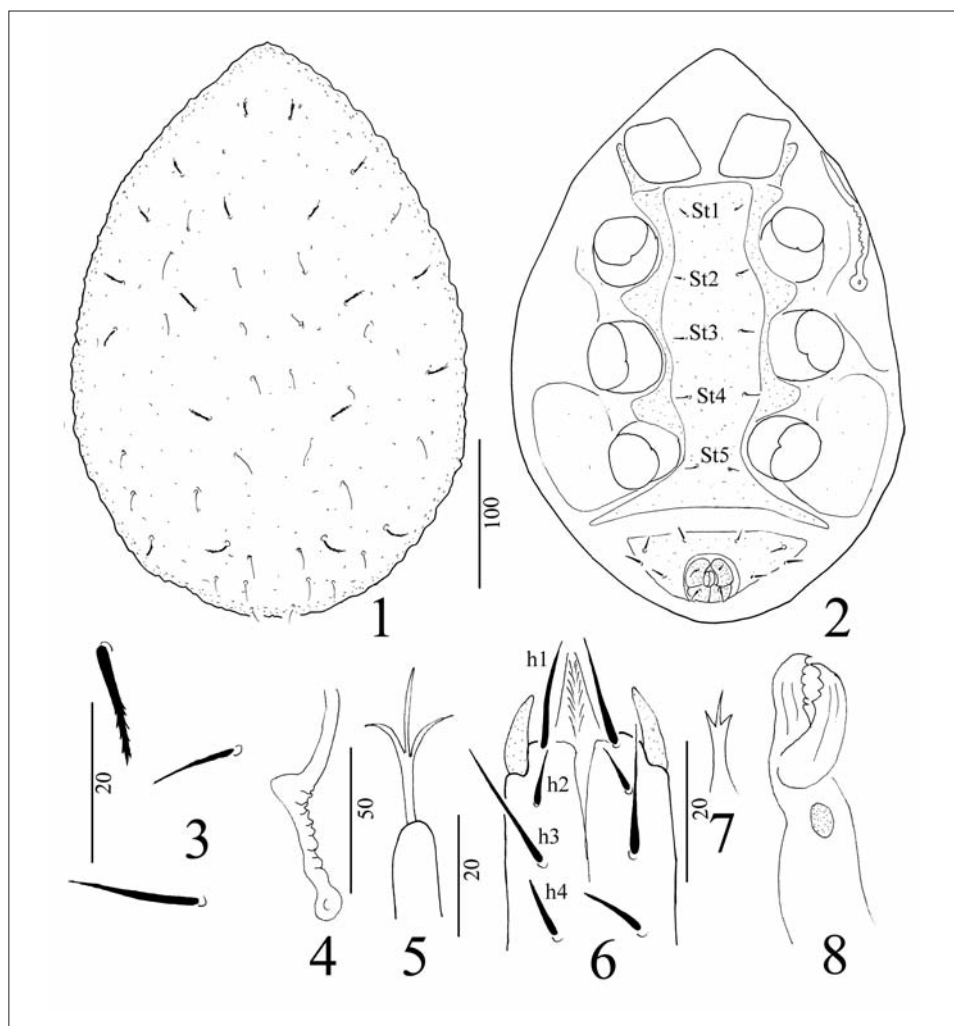


Fig. III – *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992. Deutonymph: 1. Dorsal view of idiosoma; 2. Dorsal setae; 3. Ventral view of idiosoma; 4. Peritreme; 5. Tritosternum; 6. Ventral view of gnathosoma; 7. Apical part of epistome; 8. Chelicera.



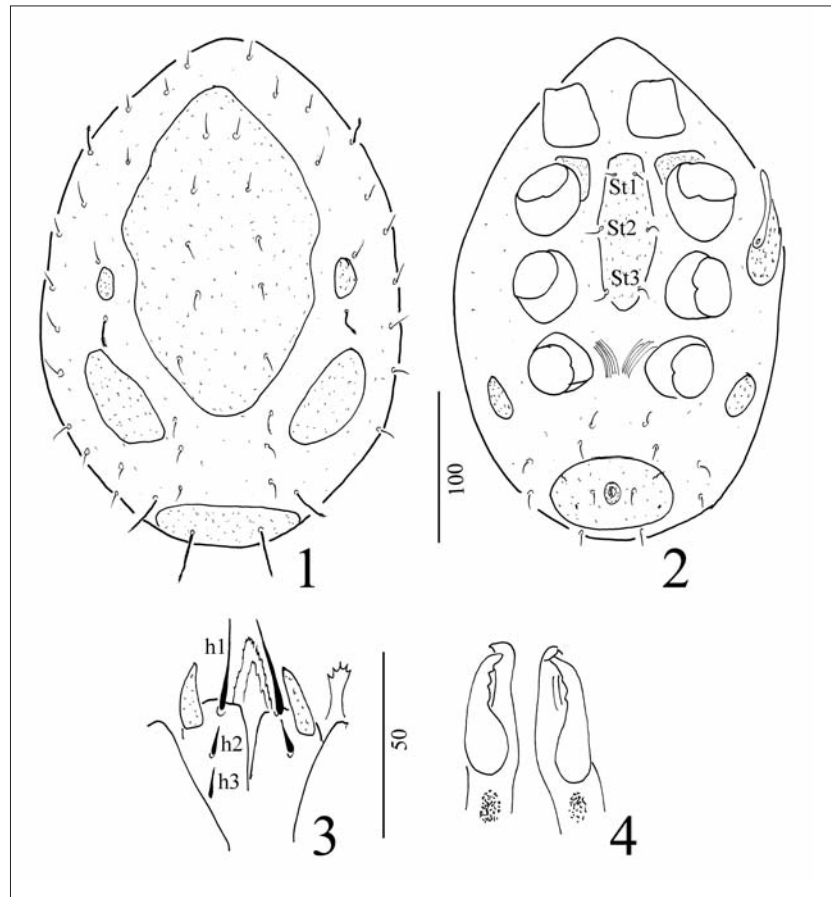


Fig. IV – *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992. Protonymph: 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma; 3. Ventral view of gnathosoma; 4. Chelicerae.

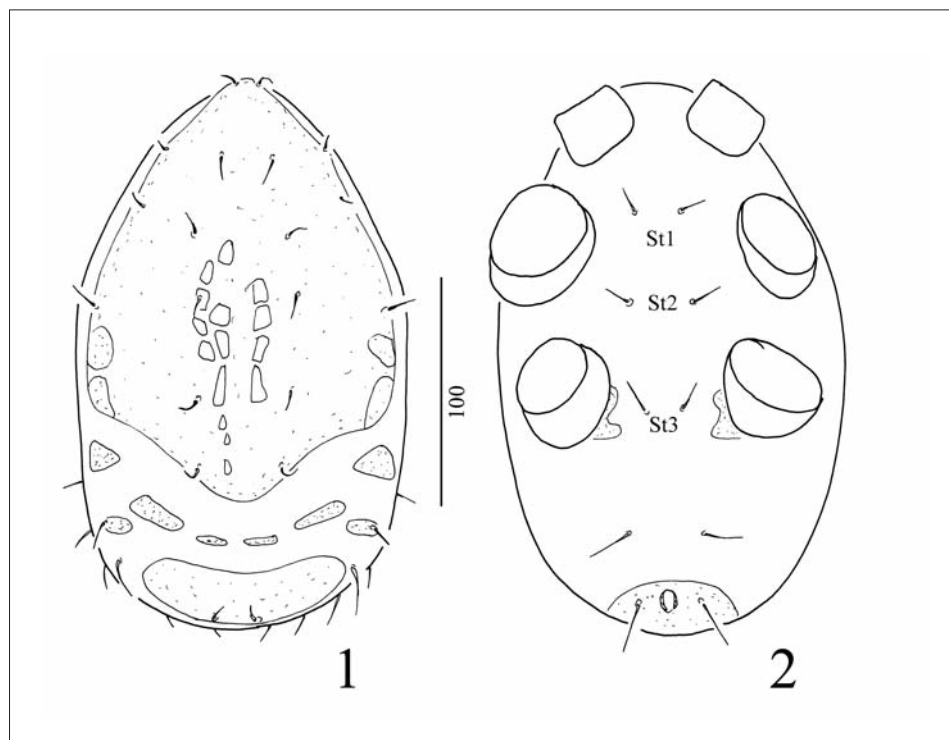


Fig. V – *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992. Larva: 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma.

ther studies (MAZZA *et al.*, 2014); indeed MAZZA *et al.* (2011) reported that *C. almerodai* imposes a cost on its carrier host reducing its lifespan.

#### IDENTIFICATION AND RECOGNITION OF THE *C. ALMERODAI*

The male and the deutonymphs are easy to distinguish from the other RPW-dwelling Uropodina mites. The narrow sternal shield between coxae IV is a unique character state among the Uropodina, and makes this species easy to identify. The shape and length of the female genital shield in *C. almerodai* differ from the other RPW associated mites, where this structure is usually scutiform or linguliform and not oblong.

The occurrence of the *C. almerodai* in Panama (RODRÍGUEZ-MORELL *et al.*, 2012) is very questionable. The specimens found in Panama differ from the original illustrations in WIŚNIEWSKI *et al.* (1992) and from the newly collected specimens from Italy in the number and position of the setae on the ventrianal shield. Only three pairs of setae on ventrianal shield can be found in the specimens collected in Panama, in contrast, the specimens from Italy and from the original illustration have four pairs of setae. First pair of central setae situated close to the anterior margin of ventrianal shield in the Italian specimens and in the original illustration, but these setae are placed same distances from anterior margin of ventrianal shield and anterior margin of anal platelets. One pair of long setae situated on caudal margin of the idiosoma in the specimens collected in Panama (due to the wrong quality of the photo it is impossible to decide these are presented on ventral or dorsal side), which are not observed in the Italian ones and on the original illustration. Unfortunately other characters are not observed on the presented photos. Besides these small illustrated morphological differences, the host species in Central America, *Rhynchophorus palmarum* (Linnaeus, 1758), differs from the European and Asian host, *Rhynchophorus ferrugineus* (Olivier, 1790). We believe that *C. almerodai* is not present in Central America and the specimens cited in RODRÍGUEZ-MORELL *et al.* (2012) belong to a new and undescribed species, but comprehensive studies will be necessary in the future on the Central America specimens to decide these two species are conspecific or not.

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