

## A new species of larval *Paraphanolophus* (Trombidiformes: Erythraeidae) from Mexico with a key to species

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### Abstract

Larvae of *Paraphanolophus mexicanensis* Noei & Šundić **sp. nov.** (Trombidiformes: Erythraeidae) collected by a Malaise trap from Tamaulipas, Mexico, is described and illustrated. The newly described species is the second representative of the genus *Paraphanolophus* Smiley in Mexico. A key to the larval species of *Paraphanolophus* of the world is presented and a key to the world genera of larval Erythraeinae Robineau-Desvoidy is updated.

**Key words:** Acari, Erythraeinae, identification key, Neotropical, Prostigmata

### Introduction

Małol & Sevsay (2015) synonymized the genus *Abalakeus* Southcott, 1994 with *Eatoniana* Cambridge, 1898 by experimental rearing, and a key to the world genera (larva) of Erythraeinae Robineau-Desvoidy, 1828 was presented by Noei *et al.* (2018). Afterwards, the validity of the genus *Abalakeus* was discussed by Saboori *et al.* (2023) and the genera of *Abalakeus* and *Eatoniana* were redefined. Therefore, the subfamily Erythraeinae (Trombidiformes: Erythraeidae) comprises 27 genera of which 16 are based on larva or active postlarval forms (Małol & Wohltmann 2012, 2013; Noei *et al.* 2018; Saboori *et al.* 2023). The genus *Paraphanolophus* Smiley, 1968 (Erythraeidae: Erythraeinae) consists of only two species based on larvae as follows: *P. halfpteri* Beron, 1996 collected from a tube, containing many different insects (host unknown), Mexico (Tabasco); and *P. metcalfei* Smiley, 1968 collected ectoparasitic on *Saccharosydne saccharivora* (Westwood, 1833), (Hemiptera: Auchenorrhyncha: Delphacidae), Belize (Smiley 1968; Beron 1996; Beron 2008; Małol & Wohltmann 2012).

In this paper, the genus *Paraphanolophus* is recorded for the second time from Mexico represented by a new species that is here described and illustrated. A key to world genera of larval Erythraeinae is amended.

## Material and Methods

Two larvae were collected from Tamaulipas, Mexico using Malaise trap and separated under the stereomicroscope. The specimens were found in the vials, containing many different insects; hence, it was not possible to identify the true host of the larvae. The specimens were cleared in Nesbitt's fluid and mounted on a glass microscope slide using Hoyer's medium (Walter & Krantz 2009). Measurements (given in micrometres,  $\mu\text{m}$ ) were calculated using a CH30 Olympus microscope and illustrations were drawn by an BX51 Olympus microscope equipped with a drawing tube. Photographs were taken with a Olympus U-Tv0.63XC digital camera attached to a BX51 phase contrast Olympus microscope. The terminology and abbreviations are adapted from Robaux (1974), Wohltmann *et al.* (2006) and Saboori *et al.* (2009).

## Systematics

**Family Erythraeidae Robineau-Desvoidy, 1828**

**Erythraeinae Robineau-Desvoidy, 1828**

**Genus *Paraphanolophus* Smiley, 1968**

**Type species: *Paraphanolophus metcalfei* Smiley, 1968**

***Paraphanolophus mexicoensis* Noei & Šundić sp. nov. (Figs. 1–21)**

### *Diagnosis of larva*

#### **Description (n = 2): Larva**

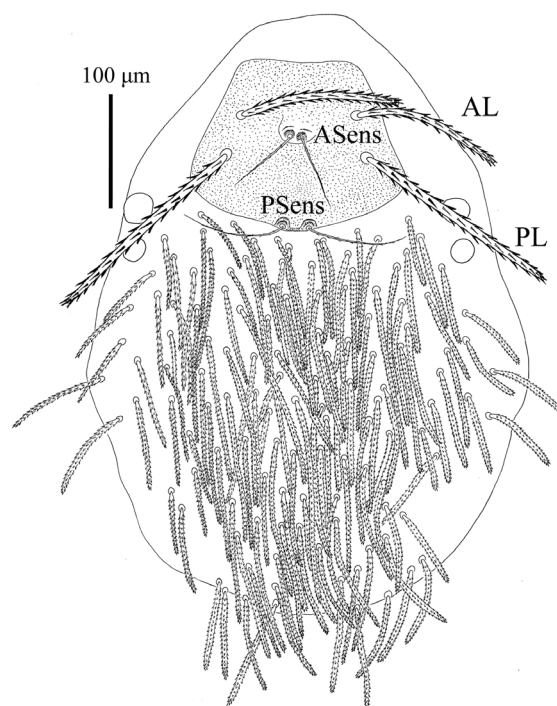
**Dorsum** (Figs. 1–3). Idiosoma with 123–128 barbed setae. All dorsal setae serrated (with coarse barbs). Scutum wider than long, punctate, with two pairs of sensilla (ASens and PSens) and two pairs of normal setae (AL and PL). ASens posterior to the level of AL. PSens longer than ASens, both barbed at distal half. Setae PL longer than AL, both serrated (with coarse barbs). Posterolaterally on each side of the scutum one pair of eyes, not on platelets, anterior lens (diameter 25–27), posterior lens (diameter 20–22).

**Venter** (Fig. 4). Idiosoma ventrally with three pairs of barbed sternal setae (*1a*, *2a*, *3a*); 30–32 setae behind coxae III, most of them with coarse barbs. Coxal plates punctated and each with one barbed seta. A peg-like supracoxal seta (*elc* I) present on coxa I, 5 long. NDV= 153–160.

**Gnathosoma** (Figs. 5–9). Cheliceral bases punctate on the dorsal surface (some coarse longitudinal striations seen in lateral parts in Fig. 9 are because of pressure during the mounting and not seen in paratype), cheliceral base 157–162 long; cheliceral blade curved, 35 long, without teeth. Subcapitulum with a barbed (minute barbs) galealae (*cs*) and two hypostomalae (*as*, *bs*), anterior (*as*) nude and posterior (*bs*) barbed; palp trochanter 35 long, palp femur 92–100 long, with one barbed dorsal seta, palp genu 41–44 long, with one barbed dorsal seta. Palp tibia 55 long, with three barbed setae; palp tibial claw bifurcate, 45; palp tarsus 20 with one nude and five barbed setae, one solenidium and one eupathidium with a companion seta; fPp= 0-B-B-BBB<sub>2</sub>-5BN $\omega$ ζz. Palpal supracoxal seta (*elc* P) peg-like, 6 long.

**Legs** (Figs. 10–21). Segmentation formula: 7-7-7. Leg setal formula: **Leg I:** Ta 1 $\omega$ , 1 $\epsilon$ , 2 $\zeta$ , 1z, 26n (26b\*); Ti 2 $\phi$ , 1 $\kappa$ , 15n (2s\* + 13b); Ge 1 $\sigma$ , 1 $\kappa$ , 8n (3s + 5b); TFe 5n (3s + 2b); BFe 4n (3s + 1b); Tr 1n; Cx 1n (Figs. 10, 13, 16, 19). **Leg II:** Ta 1 $\omega$ , 2 $\zeta$ , 1z, 26n (26b); Ti 2 $\phi$ , 15n (5s + 10b); Ge 1 $\kappa$ , 8n (7s + 1b); TFe 5n (5s); BFe 4n (3s + 1b); Tr 1n; Cx 1n (Figs. 11, 14, 17, 20). **Leg III:** Ta 1 $\zeta$ , 27n (27b); Ti 1 $\phi$ , 15 (8s + 7b); Ge 8n (8s); TFe 5n (5s); BFe 4n (4s); Tr 1n; Cx 1n (Figs. 12, 15, 18, 21). Each leg tarsus with lateral pulvilliform claws and a hook-like empodium.

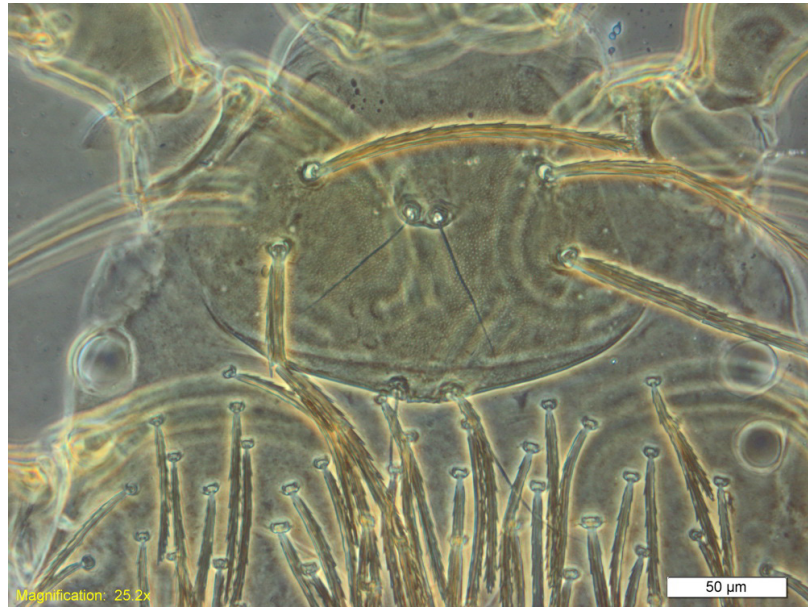
\* Serrated setae = s; barbed setae = b.



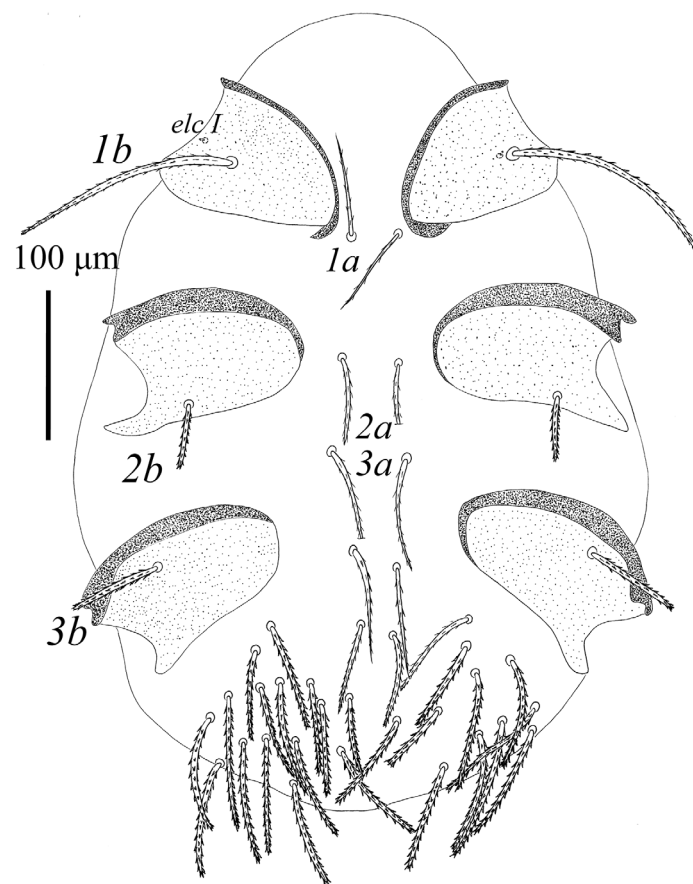
**FIGURE 1.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Dorsal view of idiosoma.



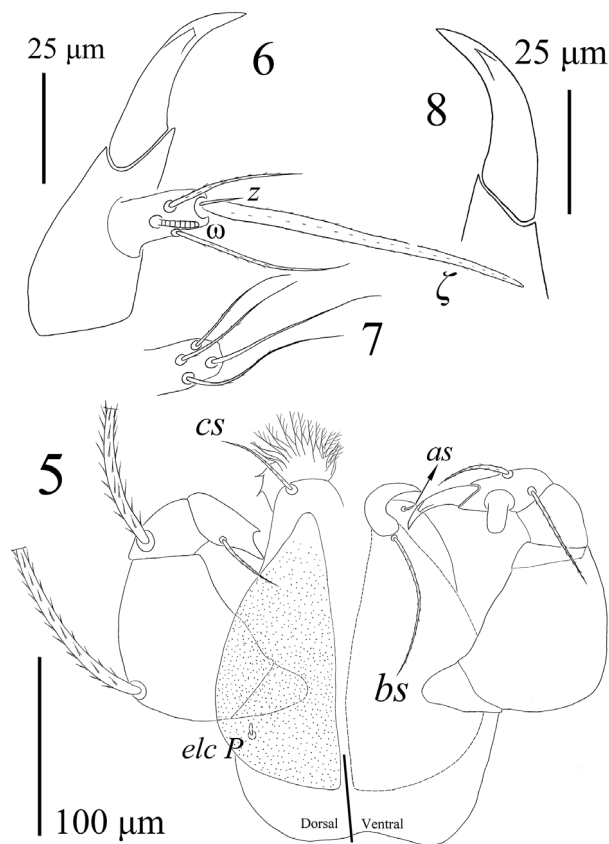
**FIGURE 2.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), photo of dorsal view of idiosoma.



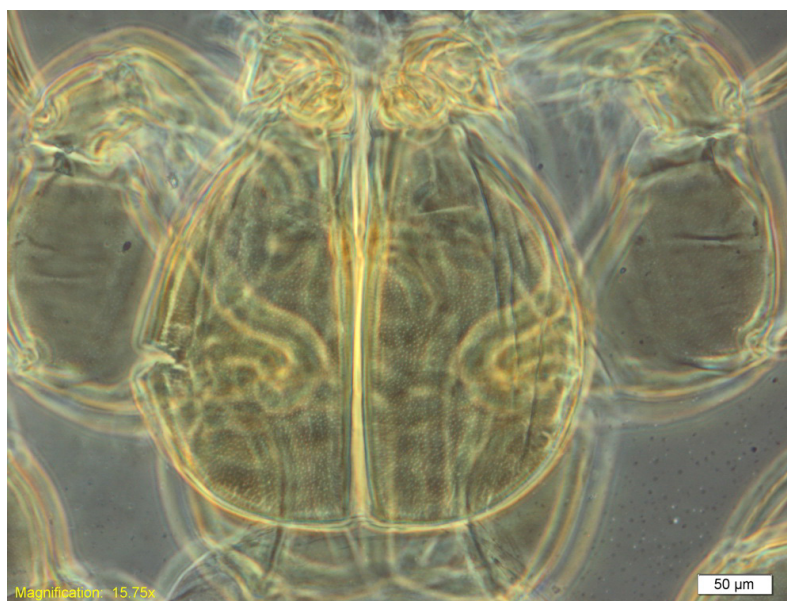
**FIGURE 3.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), photo of scutum.



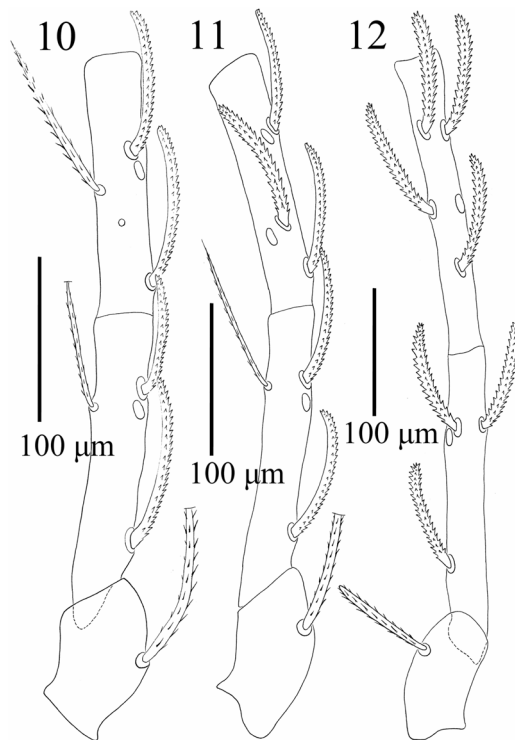
**FIGURE 4.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Ventral view of idiosoma.



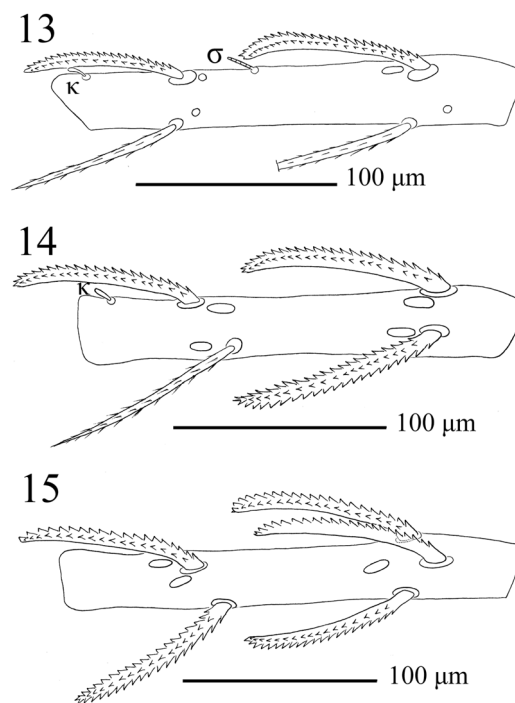
**FIGURES 5–8.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva); 5. Dorsal view (left) and ventral view of gnathosoma (right); 6. Ventral view of palpal tarsus (ventral prong of palp tibial claw broken in holotype); 7. Dorsal view of palpal tarsus; 8. Ventral view of palp tibial claw in paratype.



**FIGURE 9.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), photo of chelicerae.

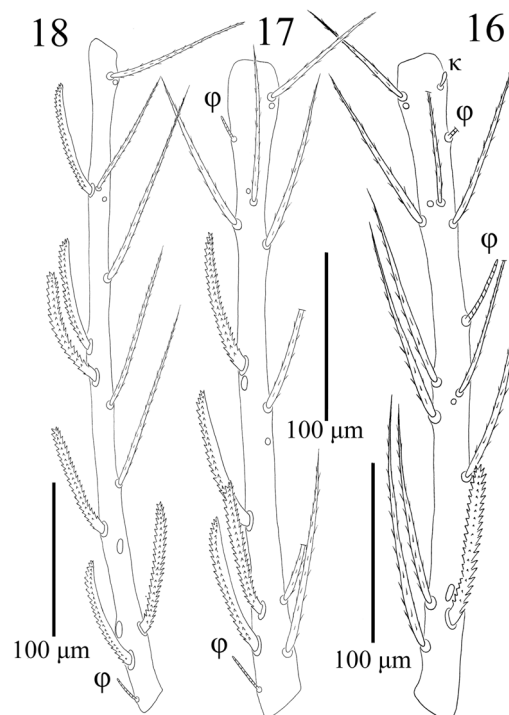


**FIGURES 10–12.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Leg I–III: 10. Tr–TFe I; 11. Tr–TFe II; 12. Tr–TFe III.

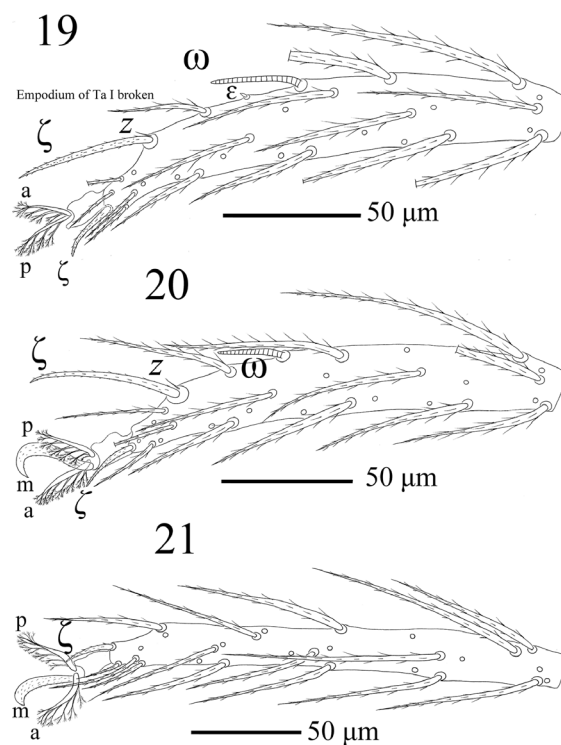


**FIGURES 13–15.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Leg I–III: 13. Ge I; 14. Ge II; 15. Ge III.





**FIGURES 16–18.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Leg I–III: 16. Ti I; 17. Ti II; 18. Ti III.



**FIGURES 19–21.** *Paraphanolophus mexicoensis* Noei & Šundić **sp. nov.** (larva), Leg I–III: 19. Ta I; 20. Ta II; 21. Ta III.

Measurements are given in Table 1.

**Etymology.** The specific epithet is derived from the type locality, Mexico.

**TABLE 1.** Metric data of *Paraphanolophus mexicanensis* Noei & Šundić **sp. nov.** (larva).

Character	Holotype	Paratype	Character	Holotype	Paratype
IL	500	465	PaScFed	115	broken
IW	370	350	PaScGed	87	92
SD	145	157	Ta I	172	190
W	192	212	Ti I	372	375
AW	100	108	Ge I	237	250
MW	125	140	TFe I	162	165
PW	45/50	50	BFe I	192	217
AA	11	11	Tr I	97	105
SB	23	22	Cx I	125	111
ISD	77	85	Leg I	1357	1413
AP	35	42	Ta II	170	182
AL	140	147	Ti II	388	390
PL	190	broken	Ge II	210	215
ASens	70	77	TFe II	172	172
PSens	87	100	BFe II	192	212
DS Min	57	57	Tr II	112	112
DS Max	175	200	Cx II	137	137
<i>la</i>	67	72	Leg II	1381	1420
<i>lb</i>	150	broken	Ta III	202	225
<i>2a</i>	broken	broken	Ti III	560	552
<i>2b</i>	43	broken	Ge III	235	237
<i>3a</i>	77	77	TFe III	237	235
<i>3b</i>	63	62	BFe III	245	257
GL	207	205	Tr III	105	110
<i>cs</i>	52	57	Cx III	137	145
<i>as</i>	8	8	Leg III	1721	1761
<i>bs</i>	85	95	IP	4459	4594

**Type material.** The Holotype larva (ARS-20240410-3a) was collected by Malaise trap, MEXICO: Holotype: in ‘La cienega’ Jaumave municipality, Tamaulipas: 23° 24' 18" N, 99° 22' 32" W, 760 m. a. s. l., thorny scrub vegetation, 29 October-12 November 2016; coll. E. Ruiz C., and J. M. Coronado and the paratype larva (ARS-20240410- 3b) in ‘Llano de Azua I’, Palmillas municipality, Tamaulipas: 23° 10' 07" N, 99° 33' 35" W, 1609 m. a. s. l. grassland vegetation, 30 October-12 November 2016; coll. E. Ruiz C., and J. M. Coronado.

**Type deposition.** The holotype and paratype larvae are deposited in the Acarological Collection, Jalal Afshar Zoological Museum, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.



## Remarks and discussion

The new species belongs to the genus *Paraphanolophus* by having the fn Bfe 4-4-4 and legs with serrate setae. *Paraphanolophus mexicanensis* Noei & Šundić **sp. nov.** differs from *P. halffteri* Beron, 1996 in the shape of the scutum (pentagonal vs. not pentagonal in *P. halffteri*; although Beron (1996) has mentioned that the upper part of scutum was not well seen), shorter AA (11 vs. 19), DS min. (57 vs. 80), in the longer ISD (77–85 vs. 63), palp tibial claw (bifid vs. entire\*), number of ventral setae (30–32 vs. 80) and the position of posterior trichobothria (at the posterior pole vs. anterior to posterior pole) and from *P. metcalfei* Smiley, 1968 in Ti III (552–560 vs. 346) and Ta III (202–225 vs. 172). Unfortunately, there is not enough information about *P. halffteri* and *P. metcalfei* for further comparison.

Only two species of the genus *Paraphanolophus* were described so far (*P. halffteri* and *P. metcalfei*), which along with the newly described species (*P. mexicanensis* Noei & Šundić **sp. nov.**) are confined to the Neotropical region and Central America. *Paraphanolophus halffteri* (Tabasco, located in southeast Mexico) and *P. mexicanensis* **sp. nov.** (Tamaulipas, located in northeast Mexico), both from Mexico respectively, and *P. metcalfei* from Belize. The host spectrum of the *Paraphanolophus* species is still limited to Hemiptera (Auchenorrhyncha: Delphacidae). Unfortunately, there is not enough data about the previously described species. The difference of more than 200 micrometres in the length of Ti III (552–560 vs. 346 in *P. metcalfei*) allowed us to described it as new species. We hope to collect more specimens of these two species from the original location in future research. In the present identification key to the larval species, characters such as the shape of palp tibial claw, number of ventral setae and the length of Ta & Ti III are used, and key to the world genera of larval Erythraeinae Robineau-Desvoidy is updated.

\* Shown entire by Beron (1996) in figure 2: 26. Our communication with Dr. Beron was not successful.

## Key to world genera of larval Erythraeinae [updated after Noei *et al.* (2018)]

1. Scutum with three or more pairs of scutalae ..... 2
- Scutum with two pairs of scutalae ..... 6
2. Two setae on coxa I ..... *Makolia* Saboori, Khaustov & Hakimitabar
- One seta on coxa I ..... 3
3. Coxal setal formula 1-3-3, two setae on palpal femur ..... *Forania* Southcott
- Coxal setal formula 1-1-1, one seta on palpal femur ..... 4
4. Scutal sensillary setae unexpanded ..... 5
- Scutal sensillary setae clavate ..... *Erythroides* Southcott
5. Scutum with more than 6 pairs of scutalae, Ge I without solenidion. .... *Ramsayella* Zhang
- Scutum with less than 5 pairs of scutalae, Ge I with one solenidion ..... *Erythrites* Southcott
6. Trochanteral setal formula 4-4-3, two setae on palpal femur. .... *Curteria* Southcott
- Trochanteral setal formula 1-1-1 or 2-2-2, one seta on palpal femur. .... 7
7. Trochanteral setal formula 1-1-1 ..... 8
- Trochanteral setal formula 2-2-2 ..... 15
8. Basifemoral setal formula 2-2-1 ..... 9
- Basifemoral setal formula otherwise ..... 12
9. PL level with or anterior to ASens, anterior eyes much larger (> ~3 times\*) than posterior eyes ..... *Neophanolophus* Shiba
- PL well behind ASens, anterior and posterior eyes similar in size ..... 10
10. fn TFe 5-5-5, posterior claw feathered or spoon-like. .... 11
- fn TFe 5-4-4, posterior claw falciform, evenly curved ..... *Proterythraeus* Vercammen-Grandjean
11. TFe I and Ge II without solenidion, posterior claw on Ta I–III feather-like ..... *Eatoniana* Cambridge

- TFe I and Ge II each with one solenidion, posterior claw on Ta I–III with spoon-like rod and covered with numerous onychotrichs. . . . . *Abalakeus* Southcott
  - 12. Basifemoral setal formula 1-1-1 or 2-1-1. . . . . *Collemboerythraeus* Noei, Saboori and Hakimitabar
  - Basifemoral setal formula otherwise . . . . . 13
  - 13. Basifemoral setal formula 2-2-2 or 3-3-3, anterior pedotarsal claw hook-like . . . . . *Erythraeus* Latreille
  - Basifemoral setal formula 4-4-3 or 4-4-4, anterior pedotarsal claw otherwise . . . . . 14
  - 14. Basifemoral setal formula 4-4-3, legs without serrate setae, palpal tibial claw with median denticle . . . . . *Lasioerythraeus* Welbourn & Young
  - Basifemoral setal formula 4-4-4, legs with serrate setae, palpal tibial claw without median denticle . . . . . *Paraphanolophus* Smiley
  - 15. Palpal tibial claw trifurcate. . . . . *Rainbowia* Southcott
  - Palpal tibial claw bifurcate. . . . . *Taranakia* Southcott
- \* Based on Kapankaya *et al.* (2025: 3061)

### Key to the larval species of *Paraphanolophus* of the world

- 1. Palp tibial claw entire\*, number of ventral setae 80 . . . . . *P. halffteri* Beron, 1996
  - Palp tibial claw bifid, number of ventral setae  $\leq 39$ . . . . . 2
  - 2. Ti III 346, Ta III 172, fV 39. . . . . *P. metcalfei* Smiley, 1968
  - Ti III 552–560, Ta III 202–225, fV 30–32. . . . . *P. mexicoensis* Noei & Šundić **sp. nov.**
- \* Not mentioned in the text by Beron (1996), but in figure 2: 26, the palp tibial claw is entire.

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