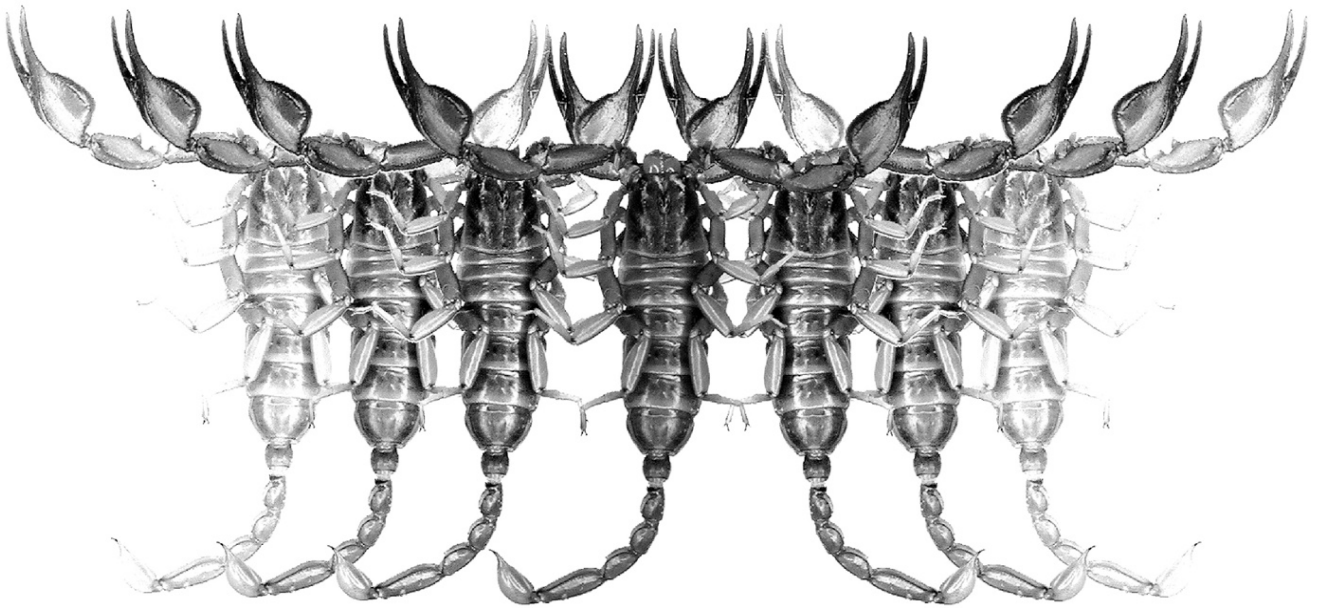


# *Euscorpius*

Occasional Publications in Scorpiology



**A new species of *Kochius* from  
Avra Valley, southern Arizona  
(Scorpiones: Vaejovidae)**

**Richard F. Ayrey, Lawrence L. C. Jones & Brandon Myers**

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# *Euscorpius*

## *Occasional Publications in Scorpiology*

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# A new species of *Kochius* from Avra Valley, southern Arizona (Scorpiones: Vaejovidae)

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<http://zoobank.org/urn:lsid:zoobank.org:pub:77089C55-A5A0-4513-AEC0-794BE2ABE9FA>

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## Summary

A new scorpion species, *Kochius colluvius* sp. n. is described (Scorpiones: Vaejovidae). This small brown species is found in the Avra Valley near Tucson, Arizona, USA. It appears to be most similar to *Kochius sonorae* (Williams, 1971) and *K. hirsuticauda* (Banks, 1910). On all fingers examined, the fixed finger has 6 ID denticles and the movable finger has 7. There is no scalloping of the chela fingers. This species differs from all other vaejovids in Arizona by having a coarsely granulated exoskeleton.

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## Introduction

Several years ago it was reported, to the first author, by Kari McWest that *Kochius sonorae* (Williams, 1971) had been observed near Tucson, Arizona. This seemed unlikely due to the distance from Tucson, Arizona, USA to the type locality of *Kochius sonorae* in Alamos, Sonora, Mexico (approximately 475 miles); however, the first author listed the species as living in Arizona on the website [www.azscorpion.com](http://www.azscorpion.com). In August of 2016, the second author posted online a photograph (Figure 1) of a scorpion found on a *bajada* (a fan of alluvial deposits at a mountain foot) in the Avra Valley near Tucson, Arizona. The first author contacted the second author about his discovery, and we decided to collaborate to determine the identity of this species. After collecting more specimens, it became clear that the scorpion was not *K. sonorae*, but a new species, described here as *Kochius colluvius* sp. n.

There have been a large number of vaejovid scorpion species described from Arizona in the last two decades such as: *Vaejovis cashi* Graham, 2007; *V. deboerae* Ayrey, 2009; *V. patagonia* Ayrey, 2018; *Pseudouroctonus santarita* Ayrey & Soleglad, 2015, and others. With the exception of *Serradigitus miscionei* Ayrey, 2011, they all belong to the genera found at relatively high altitudes. The term “sky island *Vaejovis*” was used by Graham (2007) to describe the high-altitude *Vaejovis* species. Here, we use the term “sky island scorpions” with reference to all the high-elevation Vaejovidae found north of Mexico. These include the three genera found in Arizona (*Vaejovis* “vorhiesi group”, *Pseudouroctonus*, and *Uroctonites*), as well as four additional genera found in California (*Uroctonus*, *Kovarikia*, *Graemeloweus*, and *Catalinia*).

The species described herein is only the second of recently described 17 new Arizona species that is not a “sky island scorpion”.

We have included photographs of two additional *Kochius* species, *K. sonorae* (Fig. 3) and *K. hirsuticauda* (Fig. 4) in order to illustrate the coarsely granulated exoskeleton of those species and the proposed species *K. colluvius* sp. n.

## Material and Methods

*Terminology and conventions.* The systematics adhered to in this paper follows the classification as established in Fet & Soleglad (2005) and as modified by Soleglad & Fet (2006), Graham & Soleglad (2007), Fet & Soleglad (2007), Soleglad et al. (2007), and Soleglad & Fet (2008).

Measurements are as described in Stahnke (1971), trichobothrial patterns are as in Vachon (1974), and pedipalp finger dentition follows Soleglad & Sisso m (2001).

*Abbreviations.* RFA, personal collection of Richard F. Ayrey, Flagstaff, Arizona, USA; USNM, United States National Museum, Smithsonian Institution, Washington, DC, USA.

*Material.* In addition to type material listed below under new species description, the following specimens were examined: *Kochius sonorae* (Williams, 1971). Mexico: Sonora, near Alamos. (27.06448, -109.00672; 498 m asl), 05 July 2008, leg. R. F. Ayrey & M. DeBoer-Ayrey, 2 ♀ (RA117 & RA118). *Kochius hirsuticauda* (Banks, 1910). USA: Arizona, Mojave Co.: near Bullhead City. (35.21686, -114.40465; 986 m asl), 14 April 2013, leg. R. F. Ayrey, 1 ♀ (RA848, RFA); same locality, 30 September 2013, leg. R. F. Ayrey, 2 ♂ (RA864 & RA866).



Figures 1–2. *Kochius colluvius* sp. n., holotype male live (1) and paratype female in natural habitat (2).

Dimensions (mm)		<i>Kochius colluvius</i> sp. n.			
		♂ holotype RA2443	♂ paratype RA2561	♂ paratype RA2445	♀ paratype RA2447
Carapace	L	3.60	3.62	3.71	4.98
CaL/MetV_L		0.95	0.91	0.99	1.13
Mesosoma	L	7.18	8.39	7.12	13.56
Metasoma + telson	L	13.13	13.71	13.15	14.98
Segment I	L / W	1.88 / 2.04	1.91 / 2.14	1.82 / 1.99	2.06 / 2.20
Segment II	L / W	2.16 / 1.84	2.38 / 1.76	2.24 / 1.76	2.48 / 2.02
Segment III	L / W	2.41 / 1.66	2.54 / 1.78	2.43 / 1.52	2.61 / 1.68
Segment IV	L / W	2.91 / 1.82	2.92 / 1.63	2.92 / 1.48	3.41 / 1.96
Segment V	L / W	3.77 / 1.51	3.96 / 1.49	3.74 / 1.46	4.42 / 1.38
Telson	L / W	3.51 / 1.22	3.52 / 1.09	3.31 / 1.14	4.08 / 1.49
Vesicle	L	1.94	1.97	1.82	2.31
Pedipalp	L	12.1	12.46	11.67	14.91
Femur	L / W	3.02 / 1.11	3.11 / 1.12	2.86 / 1.03	3.51 / 1.19
Patella	L / W	3.23 / 1.39	3.20 / 1.28	3.10 / 1.28	3.60 / 1.54
Chela	L	5.85	6.15	5.71	7.80
Manus	L / W / D	2.84 / 2.19 / 2.08	3.51 / 2.43 / 2.22	3.20 / 2.29 / 2.12	3.49 / 2.32 / 2.12
Movable finger	L	3.23	3.31	3.11	4.12
<b>Total</b>	<b>L</b>	<b>27.42</b>	<b>29.24</b>	<b>27.29</b>	<b>37.60</b>
Pectinal teeth		14/14	15/14	14/14	14/13

Table 1. Morphometrics (mm) of *Kochius colluvius* sp. n.

## Systematics

Order SCORPIONES C. L. Koch, 1850

Superfamily Chactoidea Pocock, 1893

Family Vaejovidae Thorell, 1876

Tribe Syntropini Graham & Soleglad, 2007

Subtribe Thorelliina Soleglad & Fet, 2008

Genus *Kochius* Soleglad & Fet, 2008

### *Kochius colluvius* Ayrey, Jones & Myers, sp. n.

(Figures 1–2, 5–18; Tables 1–2)

<http://zoobank.org/urn:lsid:zoobank.org:act:7BD1525F-8FC8-408C-8A32-535468674A87>

**TYPE LOCALITY.** The type specimens were found, using a blacklight at night in Avra Valley, near Tucson, Pima County, Arizona (32.23694°N, 111.17148°W) at an elevation of 818 m a. s. l. The vegetation type is Sonoran Desert Scrub (Fig. 11). *Hoffmanius spinigerus* (Wood, 1863), *Hoffmannius confusus* (Stahnke, 1940), *Hadrurus arizonensis* Ewing, 1928, and *Centruroides sculpturatus* Ewing, 1928 were found syntopically with *Kochius colluvius* sp. n.

**TYPE MATERIAL.** Holotype: ♂, Avra Valley, Pima County, Arizona, USA, 8 August 2016, leg. L. Jones, specimen

RA2443 (USNM). Paratypes: 1♂, same locality, 12 April 2017, leg. L. Jones, specimen RA2561 (RFA); 1♂, same locality, 8 August 2016, leg. L. Jones, specimen RA2445 (RFA); 1♀, same locality, 10 October 2016, leg. R. F. Ayrey, specimen RA2447 (RFA).

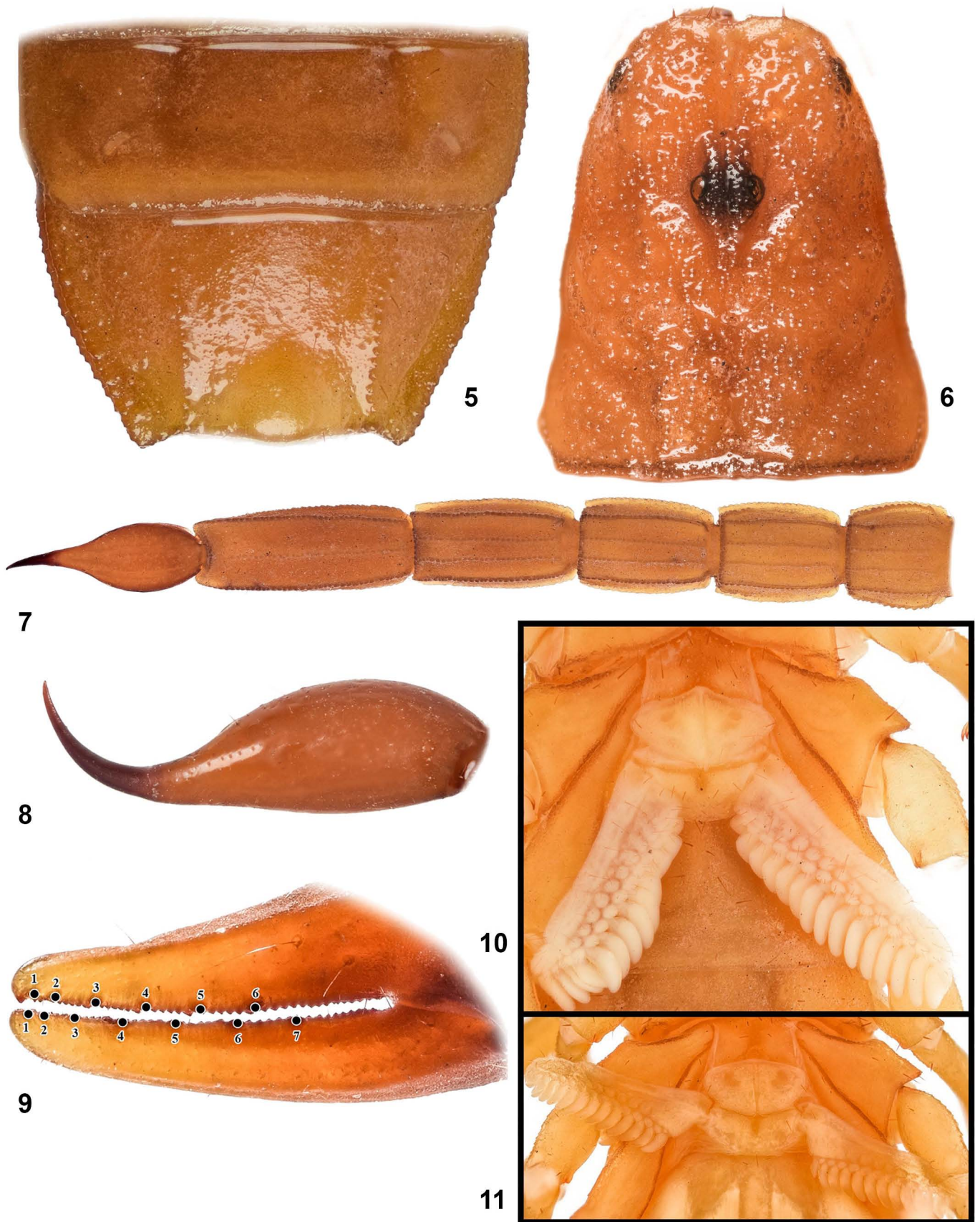
**OTHER MATERIAL EXAMINED.** 2♂ (RA 2557 and RA 2444), 5♀ (RA2446, RA2558, RA2559, RA2560, RA2567), Avra Valley, Pima County, Arizona, USA, 12 April 2017, leg. L. Jones (RFA).

**ETYMOLOGY.** The species is named after the colluvial soil microhabitat where all of the type specimens were found.

**DIAGNOSIS.** Small (27.42 mm) scorpions. Color is brownish yellow, lighter on the legs with underlying mottling on the carapace and mesosoma, red on tips of chela fingers (Figs. 1–2). Pedipalp fingers not scalloped. Carapace coarsely granular. Mesosoma coarsely granular. Pedipalp movable finger has 7 ID denticles and fixed finger has 6. Carapace of male is shorter than the fifth metasomal segment. Pectinal tooth count for males 14.30 [n=10], females 13.42 [n=12]. No subaculear tubercle present. Ventral surface of tarsomere II with single median row of spinules terminating distally with multiple spinule pairs.



**Figures 3–4.** *Kochius hirsuticauda* male, in natural habitat, showing macrosetal comb on telson (3) and *Kochius sonoreae* female, in natural habitat (4).



**Figures 5–11:** *Kochius colluvius* sp. n. **Figures 5–10.** Paratype male. **Figure 5.** Sternites VI–VII. **Figure 6.** Carapace. **Figure 7.** Metasoma, ventral view. **Figure 8.** Telson, lateral view. **Figure 9.** Chela, internal view showing fixed and movable finger ID denticles. **Figure 10.** Pectines. **Figure 11.** Paratype female, pectines.



**Figure 12.** *Kochius colluvius* sp. n., paratype male, right legs I–IV ventral aspect (tibia, basitarsus, and telotarsus), showing lack of setal combs (A–D). Letters E–H show legs 1–4, each with median row of spinules terminating distally with multiple spinule pairs.

**DESCRIPTION.** Based on holotype male, unless otherwise noted.

**Color.** Color is brownish yellow, lighter on the legs with underlying mottling on the carapace and mesosoma, red on tips of chela fingers.

**Carapace.** Anterior margin of carapace slightly emarginated. Carapace coarsely granular. Three lateral eyes on each side. Median furrow moderate, traversing the entire length but becoming less obvious distally. Ratio of median eyes location from anterior edge/carapace length 0.39; carapace length/width at median eyes 1.20. Carapace of male is shorter than metasomal segment V.

**Mesosoma.** Tergites densely granular. Tergites III–VI tricostate. Tergite VII with two pairs of granular lateral carinae and one pair of crenulate carinae. Sternites III–VI finely granular and without carinae. Sternite VII with raised, whitish boss, restricted to the posteromedial third, “shaped like a truncated triangle” (González-Santillán & Prendini, 2013). Sternite VII with granular ventral lateral carinae. Presternites finely granular. Spiracles ovoid with median side rotated 35 degrees from posterior sternite margin.

**Sternum** (Figs. 2, 8). Sternum is type 2.

**Genital operculum** (Figs. 2, 8). Sclerites separated on posterior edge.

**Pectines.** Pectinal tooth count 14/14 for holotype male and 14/13 for paratype female. All pectinal teeth have exterodistal angling with large sensorial area. Middle lamellae 9/9. Fulcra are present. Each fulcrum with 1-2 central setae.

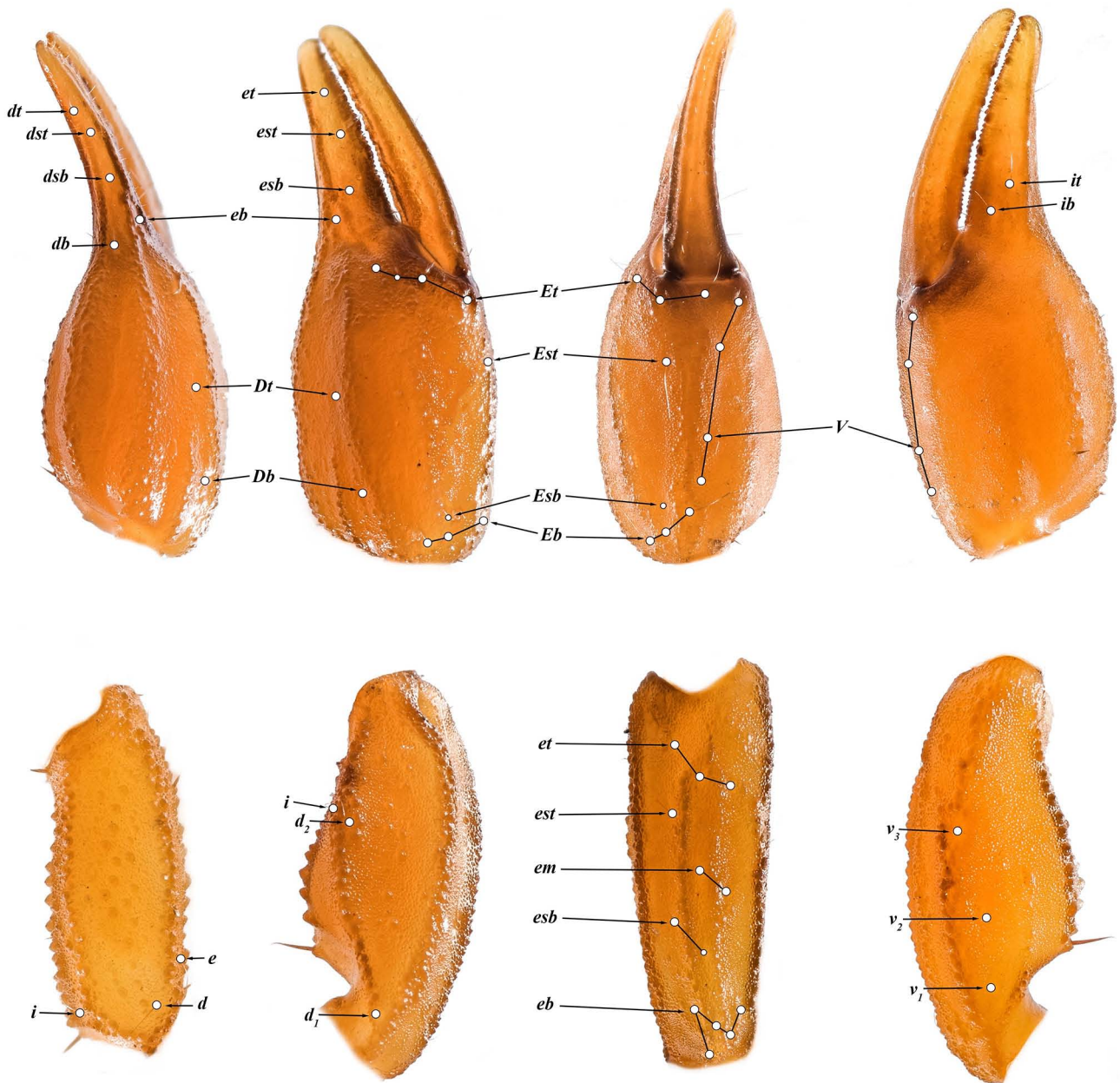
**Metasoma.** Carapace of male is shorter than the fifth metasomal segment. Ratio of segment I length/width 0.92; of segment II length/width 1.17; of segment III length/width 1.45; of segment IV length/width 1.60; of segment V length/width 2.50. Segments I–IV: dorsolateral carinae moderate, granular. Lateral suprmedian carinae I–IV moderate, granular. Lateral inframedian carinae moderately granular on posterior 4/5 of segment I, posterior 3/5 of II, 3/5 of III, and obsolete on 2/5 of IV. Ventrolateral carinae I–IV moderate, granular. Ventral submedian carinae I–IV moderate. Dorsal and lateral intercarinal spaces very finely granular. Segment V: Dorsolateral carinae moderate. Lateromedian carinae weak and granular on basal 3/5, obsolete on distal 2/5. Ventrolateral and ventromedian carinae moderate. Intercarinal spaces finely granular.

**Telson.** Smooth. No subaculear tubercle present. Lateral aculear serrations (LAS) present in all specimens studied; males have 6–7 LAS “teeth” (n=2).

**Chelicerae.** Dorsal edge of movable cheliceral finger with two subdistal (*sd*) denticles. Ventral edge is smooth, with well developed serrula on distal half.

**Pedipalps.** Trichobothrial pattern type C (Vachon, 1974) (Fig. 13). Pedipalp fingers not scalloped. Trichobothria *ib* and *it* at base of fixed finger. Pedipalp ratios: chela length/width 2.67; femur length/width 2.72; patella length/width 2.32; fixed finger length/carapace length 0.67. **Chela.** Well developed, mostly granular carinae. Fixed finger Median (MD) denticles aligned and divided into 6 subrows by 5





**Figure 13.** *Kochius colluvius* sp. n., male paratype trichobothrial pattern.

outer (OD) denticles and 6 ID denticles. Movable finger with 6 subrows, 5 OD denticles and 7 ID denticles (Soleglad & Sissom, 2001). *Femur*. Carinae moderate. *Patella*. Carinae strong, internal surface with very large granules on the *DPSc* carina.

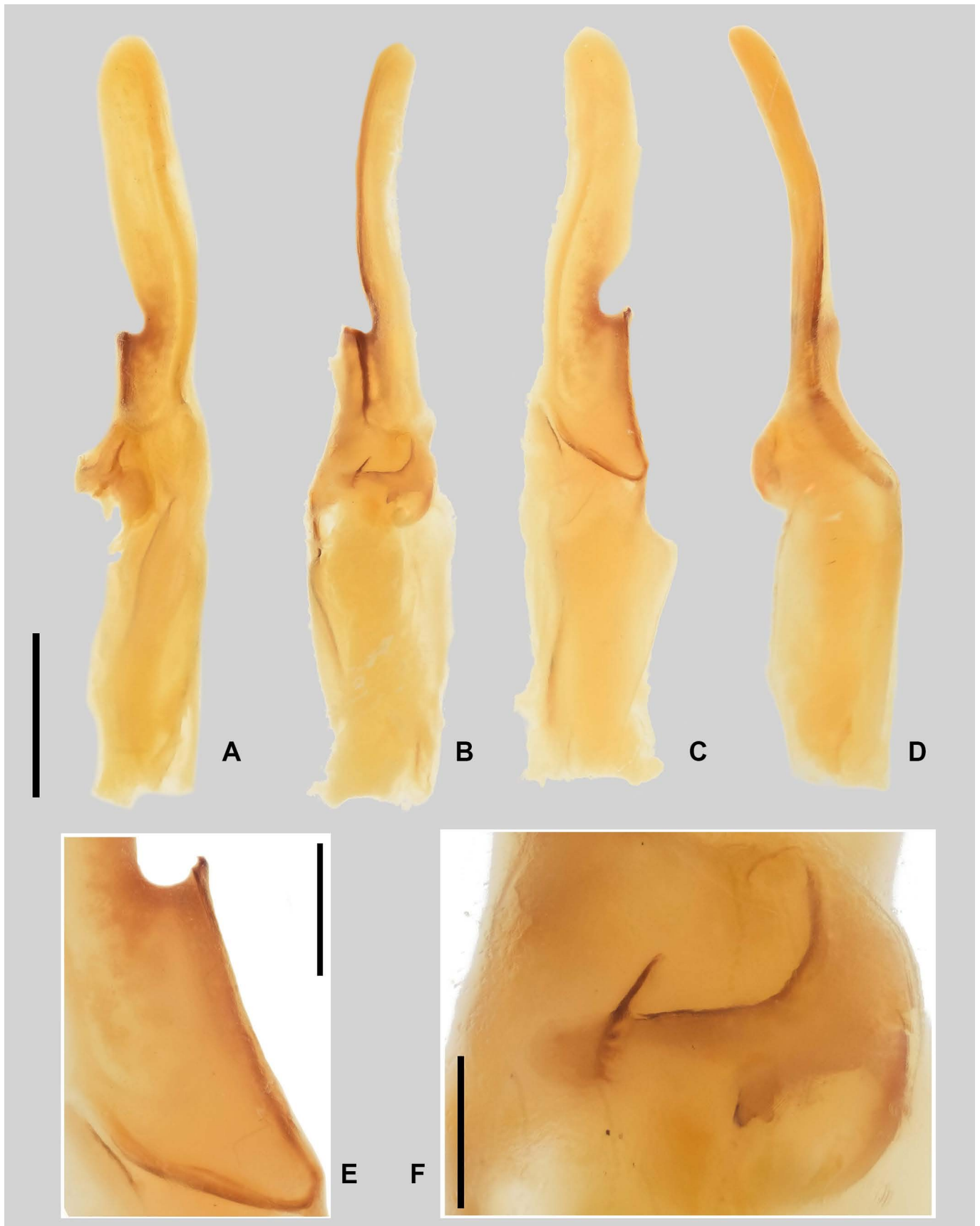
**Legs.** Tarsi are lacking setal combs (Fig. 12, A–D). Ventral surface of leg tarsomeres I–IV with single median row of spinules terminating distally with multiple spinule pairs (Fig. 12).

**Hemispermaphore.** The lamina has a rounded terminus and lacks a distal crest. Due to a significant basal constriction, the internal edge of the lamina base curves inwards at the lamellar hook terminus. The terminus of the lamellar hook is modestly bifurcated. The base of the lamellar hook originates from *both* the dorsal and ventral troughs. The mating plug's barb is toothed on its dorsal edge. Ratios: Lamellar\_hook\_L / Lamina\_L =

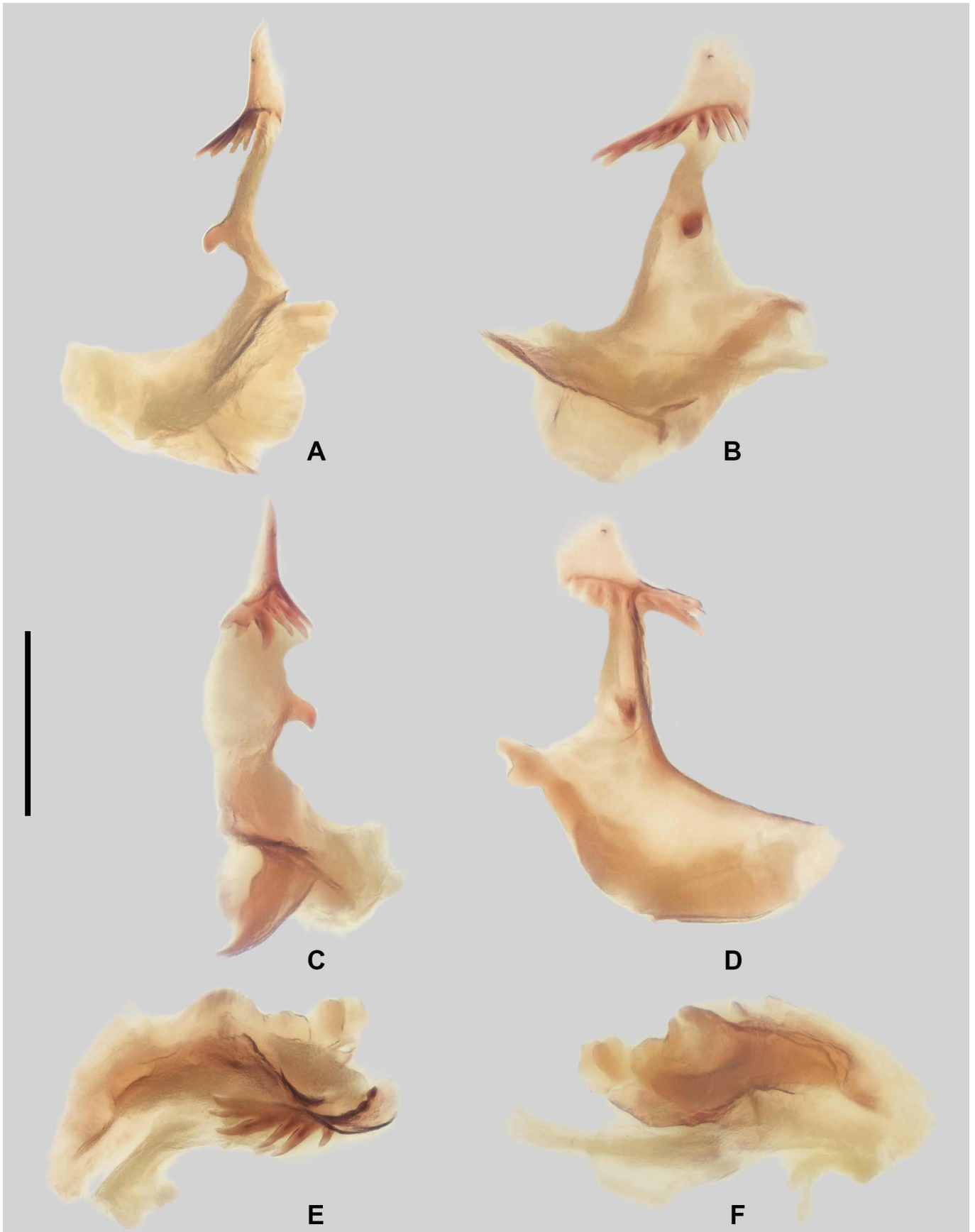
0.378 and Trough\_Diff / Lamellar\_hook\_L = 0.293. Mating plug barb toothed with 9 teeth visible (Fig. 15, B).

**VARIABILITY.** Pectinal tooth count 14/14 [n=3], 15/14 [n=1] and 15/15 [n=1], with a mean of 14.30 [n=10], standard deviation 0.483 for males and 13/13 [n=2], 13/14 [n=2], 14/13 [n=1] and 14/14 [n=1] with a mean of 13.42 [n=12], standard deviation 0.515 for females.

**REPRODUCTION.** Two adult females were kept alive in captivity to observe reproductive behavior. They were collected on 24 October 2016 and were assumed to be gravid. On 09 September 2017, first instars were observed on the back of specimen RA2447 (Fig. 11). The juvenile count was 19. The 1<sup>st</sup> instar orientation on the mother's back was random,



**Figure 14.** *Kochius colluvius*, sp. n., paratype male hemispermatophore, ventral (A), internal (B), dorsal (C), external (D), close-up of dorsal trough and lamellar hook (E), and close-up of embedded mating plug (F). Scale bars = 1 mm (photographed submerged in alcohol).



**Figure 15.** *Kochius colluvius*, sp. n., paratype male, mating plug from the right hemispermatophore, ventral (A), ventroexternal (B), dorsal (C), dorsoexternal (D), internal (E), and external (F) views. Scale bar = 1 mm.

		<i>Kochius</i> male ratio comparisons		
		<i>K. colluvius</i> sp. n. (n=3)	<i>K. sonorae</i> (n=1)	<i>K. magdalensis</i> (n=1)
Carapace	L	3.60 – 3.71	3.70	5.10
CaL/MetV_L		0.91 – 0.99	1.03	0.88
Metasoma:				
Segment I	L : W	0.89 – 0.92	0.95	1.00
Segment II	L : W	1.17 – 1.35	1.18	1.29
Segment III	L : W	1.43 – 1.60	1.38	1.39
Segment IV	L : W	1.60 – 1.97	1.80	1.95
Segment V	L : W	2.50 – 2.66	2.40	2.76
Telson	L : W	1.59 – 1.81	1.82	2.00
Pedipalp:				
Femur	L : W	2.72 – 2.78	2.80	2.86
Patella	L : W	2.32 – 2.50	2.55	2.21
Chela	L : W	2.49 – 2.67	3.06	3.13
Ff L / Ca L		0.64 – 0.67	0.59	0.60
Ff L / Ch L		0.41 – 0.42	0.42	0.41
<b>Total</b>	<b>L</b>	<b>27.29 – 29.24</b>	<b>28.00</b>	<b>39.00</b>
Pectinal teeth		14.30 (n=10)	15.00 (n=2)	18.00 (n=2)

**Table 2.** Morphometrics (mm) of males of *Kochius colluvius* versus other *Kochius* species. Highlighted ratios are those for which there is no overlap for *K. colluvius* sp. n. Data on *K. sonorae* and *K. magdalensis* from the original species descriptions (Williams, 1971).

a not often seen behavior in Vaejovidae (Hjelle, 1974; Ayrey, 2013). Postpartum behavior is as described in Ayrey (2013). On 20 September 2017, all of the juveniles were found to have molted to second instar (Figure 12). They left the mother's back on 22 September 2017. First instars were observed on the back of the second specimen on 20 September 2017 and postpartum behavior was as described above. The juvenile count on the second female was 17. Mean number of first instars was 18 (n=2).

**DISTRIBUTION.** Known only from the Avra Valley, Pima County, Arizona, USA.

### Species Comparison

*Chihuahuanus russelli* (Williams, 1971) and *C. crassimanus* (Pocock, 1898): differ from *K. colluvius* sp. n. by having “subtle but distinct proximal scallop leaving small open space

between fingers when chela closed” (Williams, 1971). These species are also widely allopatric with *K. colluvius* sp. n.

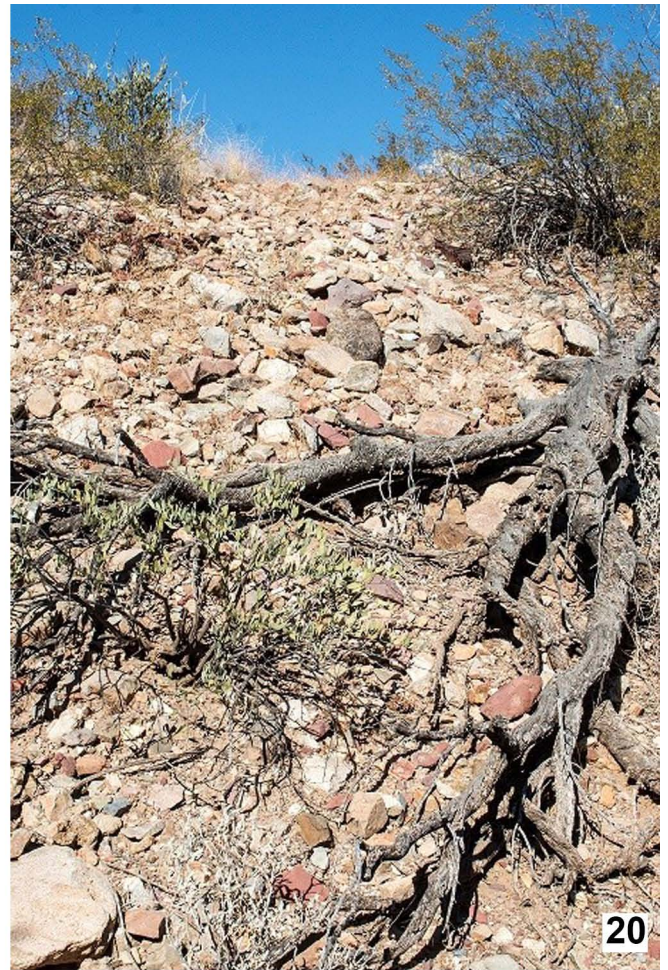
*Kochius hirsuticauda* (Banks, 1910): differs from *K. colluvius* sp. n. by having higher pectinal tooth counts and by having a large number of macrosetae on the telson, of the male, giving it the appearance of a comb (Fig. 3). *K. colluvius* sp. n. is also widely allopatric with *K. hirsuticauda* (distance 340 miles).

*Kochius magdalensis* (Williams, 1971): differs from *K. colluvius* sp. n. by having “subtly scalloped pedipalp fingers in both sexes” (Williams, 1971), higher pectinal tooth count and by 9 important morphometric ratios (Table 2). *K. colluvius* is also widely allopatric with *K. magdalensis*, which is limited to Baja California Sur, Mexico.

*Kochius sonorae* (Williams, 1971): differs from *K. colluvius* sp. n. by 9 important morphometric ratios (Table 2). *K. colluvius* sp. n. is also widely allopatric with *K. sonorae* (distance 475 miles).



Figures 16–18: *Kochius colluvius* sp. n. **Figure 16.** Gravid female. Note the individual juveniles as they appear through her lateral membrane. **Figure 17.** Female RA2447 with 1st instar juveniles. **Figure 18.** Female RA2447 with 2nd instar juveniles.



Figures 19–21: *Kochius colluvius* sp. n. Figures 19–20. Habitat. Figure 21. Microhabitat.

## Acknowledgments

We would like to thank Rachel Clark for joining the second author in finding the first specimen and for the use of her photograph of it (Fig. 1); the first author's wife Melinda DeBoer-Ayrey for joining us on two field trips to the Avra Valley, Arizona; and Michael E. Soleglad for his assistance with the hemispermaphore analysis and the manuscript. We also thank two anonymous reviewers for their comments. Specimens were collected under Pima County Natural Resources, Parks and Recreation Department, Scientific Research and Collecting Permits, issued March 31, 2016 and March 2, 2017 to Lawrence L. C. Jones.

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