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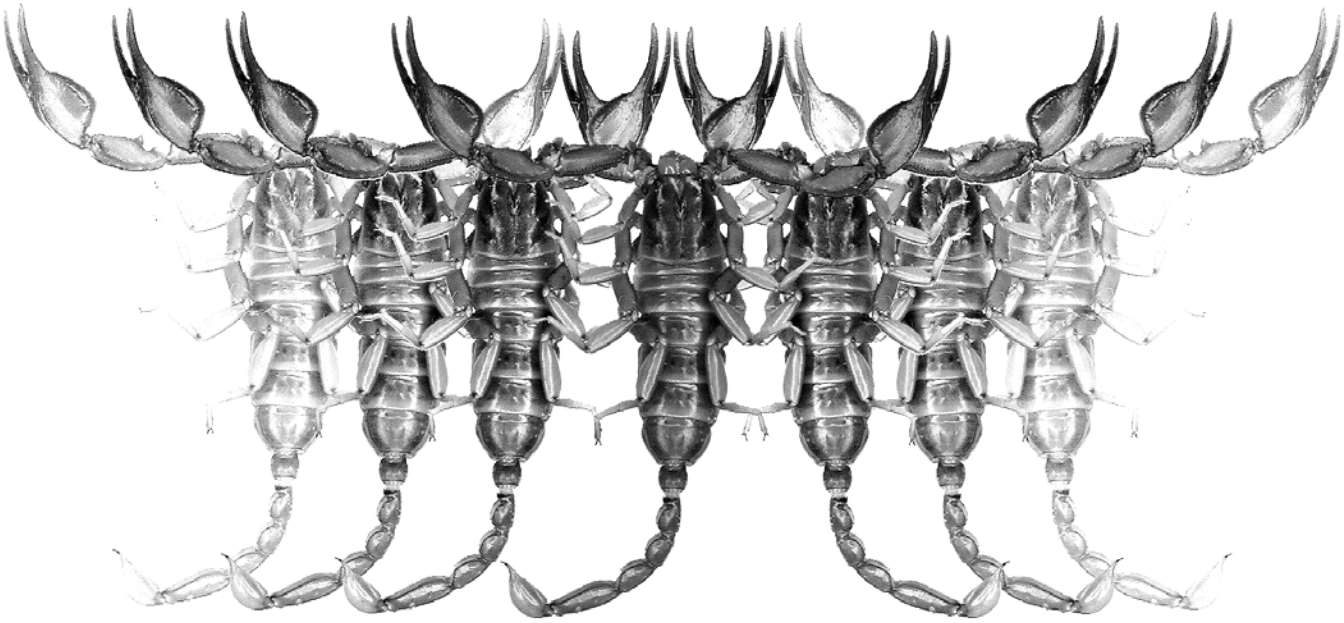

A New Scorpion Genus Representing a Primitive Taxon of Tribe Stahnkeini, with a Description of a New Species from Sonora, Mexico (Scorpiones: Vaejovidae)

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A new scorpion genus representing a primitive taxon of tribe Stahnkeini, with a description of a new species from Sonora, Mexico (Scorpiones: Vaejovidae)

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Summary

A new scorpion genus, *Gertschius* **gen. nov.**, and species, *Gertschius crassicorpus* **sp. nov.**, (Scorpiones: Vaejovidae) from Sonora, Mexico is described. *Gertschius* exhibits a reduced modification of the basal pectinal teeth in the female holotype and serration of the chelal finger denticles is limited to the median denticles (*MD*), thus we consider it a relict member of tribe Stahnkeini. *Serradigitus agilis* Sissom et Stockwell, 1991, is transferred to this new genus; *Gertschius agilis*, **comb. nov**.

Introduction

In this work, we describe a new species and genus discovered in Sonora, Mexico, *Gertschius crassicorpus*, **gen. nov.**, **sp. nov.**, and transfer a member of *Serradigitus* into this new genus, *Gertschius agilis* (Sissom et Stockwell, 1991), **comb. nov**. Especially interesting to us, this new genus represents a primitive form of tribe Stahnkeini, and provides a "missing link" to this group of scorpions.

We include a detailed analysis comparing *Gertschius* to the other two genera of Stahnkeini, *Serradigitus* and *Stahnkeus*, as well as comparisons to several other related species found throughout Sonora and Baja California, Mexico. Likewise, rationale is provided for the taxonomic placement of this genus within family Vaejovidae.

Methods & Material

Terminology and conventions

The systematics adhered to in this paper is current and therefore follows the classification as established in Fet & Soleglad (2005) and as modified by Soleglad & Fet (2006). Terminology describing pedipalp chelal finger dentition follows that described and illustrated in Soleglad & Sissom (2001), that of the sternum follows that in Soleglad & Fet (2003), and the metasomal and pedipalp carination, and leg tarsus armature follows that described in Sissom (1990). Much of the information concerning the structure of the hemispermatophore of Vaejovidae, with the construction of the mating plug terminus in particular, is based on Stockwell's (1989) doctoral dissertation. Although we have verified many of the generalized statements made by Stockwell (1989) for many species, they have not been confirmed for *all* species.

Systematics

Order **SCORPIONES** C. L. Koch, 1850
Suborder Neoscorpiones Thorell et Lindström, 1885
Infraorder Orthosterni Pocock, 1911
Parvorder Iurida Soleglad et Fet, 2003
Superfamily Chactoidea Pocock, 1893
Family Vaejovidae Thorell, 1876

Gertschius Graham et Soleglad, gen. nov.

Diagnosis. These taxa comprise primitive members of tribe Stahnkeini. Genital operculum of female connected along its entire length, operating as a single unit. Leg tarsus with a single pair of ventral distal spinules. Hemispermatophore mating plug barb smooth (yet to be confirmed for *G. crassicorpus*). Cheliceral movable finger with well developed serrula. Pectinal basal teeth (1–2) of the female are smooth, lack a sensorial area, are not swollen or elongated, and exhibit some exterodistal angling. Chelal finger median denticle (*MD*) groups are serrate and visible due to 4–5 distinct intervening outer denticles (*OD*) which are non-serrate; distal denticle of fingers not overly elongated or "hook-like", either lacking "whitish" patch, or present in limited form.

Chelal trichobothrium *Dt* is located proximal of palm midpoint, *Dt*_pos / palm length 0.449–0.482; trichobothrium *Db* is situated on the digital (*D1*) carina; and trichobothrium *it* is positioned adjacent to or proximal of inner (*ID*) denticle (*ID*-6) and *ib* is proximal of *ID*-6; (*ib*_pos/ fixed finger) / carapace length ratio is low, 0.063–0.068.

Can be distinguished from other Stahnkeini genera as follows: Chelal finger *OD* denticles are distinct, numbering five, showing little or no serration; chelal trichobothrium *Dt* is situated proximal of palm midpoint and *Db* is located on *D1* carina. In *Serradigitus* and *Stahnkeus*, *OD* denticles are serrate and are indistinguishable beyond *OD*-3; *Dt* is situated at or distal of palm midpoint and *Db* is located ventral of *D1* carina. *Gertschius* lacks inner accessory (*IAD*) denticles whereas *Stahnkeus* exhibits *IAD* on both chelal fingers.

Etymology. This genus is named after the late Willis J. Gertsch (1906–1998), renowned arachnologist of the American Museum of Natural History. This is especially an honor for the second author who was fortunate enough to collaborate with Dr. Gertsch many years ago on two important North American scorpion contributions.

Type species. *Gertschius crassicorpus* **Graham et Soleglad, sp. nov.**

Distribution. USA (southern Arizona and southeast New Mexico), Mexico (Sonora and potentially in adjacent Chihuahua).

Species list. The following two species comprise this genus (locality data based on material examined and Sissom & Stockwell (1991). See map in Fig. 13):

Gertschius agilis (Sissom et Stockwell, 1991), **comb. nov.**, southern Arizona, southwestern New Mexico, USA; northern Sonora, and potentially far northwestern Chihuahua, Mexico.

Gertschius crassicorpus, **sp. nov.**, southern Sonora, Mexico.

Gertschius crassicorpus Graham et Soleglad, sp. nov.

(Figs. 1–12)

Diagnosis. Small scorpion, 17–25 mm in total length; basal tooth of pectines lacking sensorial area, exhibiting minimal exterodistal angling; chelal finger median denticles (*MD*) serrate basally, outer denticles (*OD*) not overly serrate and distinct the entire finger length; chelal finger distal denticle not formed in an elongated hook and lacking a "whitish" patch; cheliceral movable finger with well developed serrula; metasomal segments considerably wide, segments I–III wider than long, segments IV and V length/width 1.06|1.40 and 1.15|1.54 for female and male; telson vesicle wide, vesicle width/telson length 0.49 and 0.51 for female and male; ventral submedian carinae of metasoma obsolete to smooth; hemispermatophore lamellar hook considerably elongate, lamina length / hook length ratio of 2.22, lamina length / hook length ventral surface ratio of 3.2; pectinal tooth counts 13 female, 15 male.

Can be distinguished from sister species *Gertschius agilis* as follows. Metasoma segments and telson vesicle are wider in *Gertschius crassicorpus*, segments IV and V length/width are 14–21 and 17–32 % wider and telson vesicle is 20–23 % wider (females and males combined). Ventral submedian carinae are smoother in *Gertschius crassicorpus*, obsolete to smooth, whereas in *Gertschius agilis*, they are obsolete to granular or crenulate. Hemispermatophore lamellar hook is quite elongate in *Gertschius crassicorpus*, dorsal and ventral lamina length/hook length is 2.22 and 3.2, whereas in *Gertschius agilis* the lamellar hook is not particularly elongate with ratios of 2.727–2.830 and 4.884–6.714, exhibiting a 25 to 81 % difference.

Type Data. Holotype ♀: 1 adult, 17 mi. S Navojoa, Sonora, Mexico, 12 October 1973 (S. C. Williams, K. B. Blair). Paratype ♂: 1 adult, 17 mi. S Navojoa, Sonora, Mexico, 12 October 1973 (S. C. Williams, K. B. Blair). Deposited in the private collection of MES.

Etymology. The specific name is derived from the Latin roots *crassi-* and *-corpus*, in reference to the robustness of this species, especially of metasomal and pedipalpal segments.

Distribution. Known only from the type locality, 17 mi. S Navojoa, Sonora, Mexico.

Description

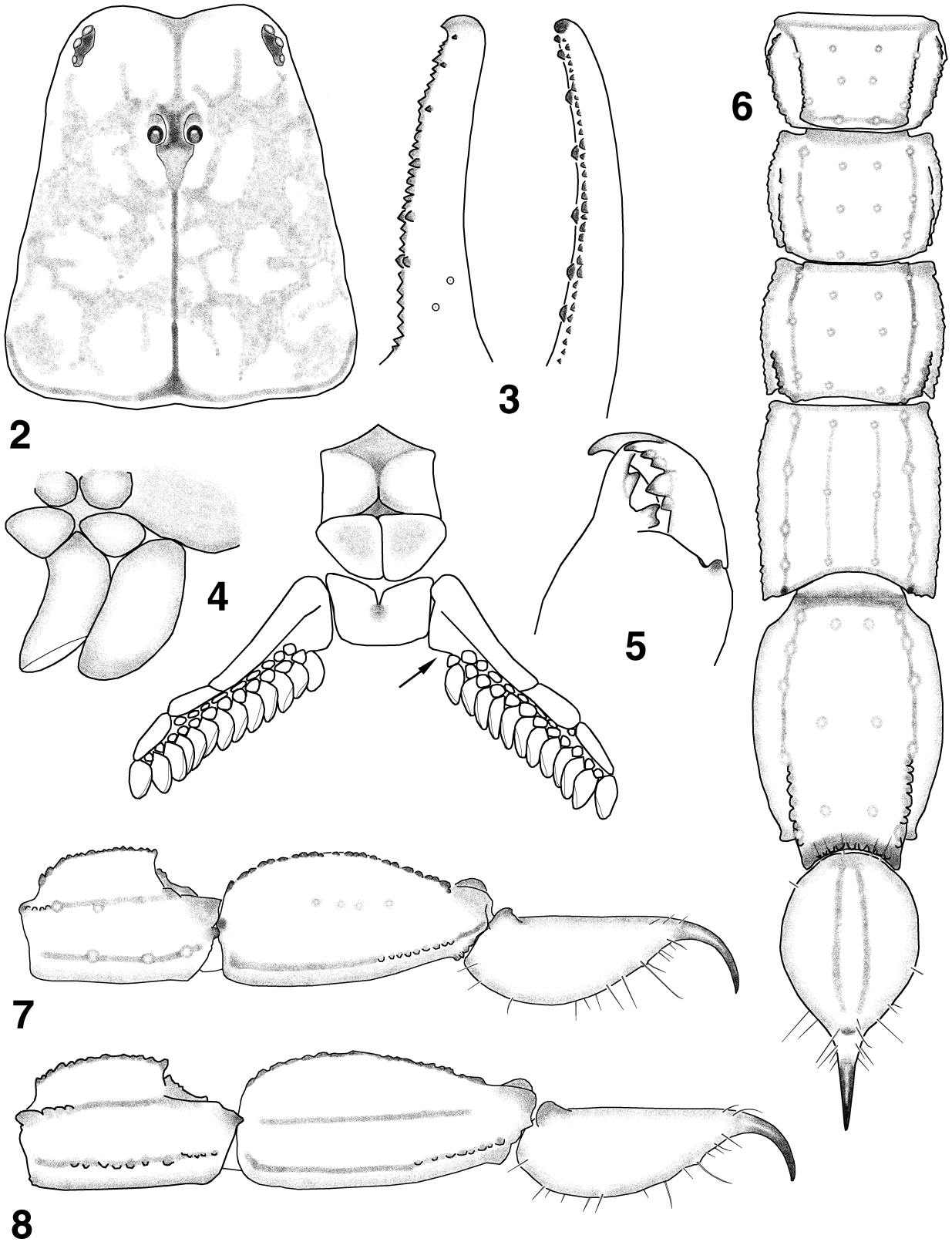
Female. Description based on holotype female. See Figure 1 for a dorsal view of the female holotype. Metasoma is detached between segments I and II and right pedipalp is detached.

Color (based on specimens preserved in alcohol). Base color light brown with faint slightly darker variegations on carapace and tergites. Ocular tubercle beset with dark brown diamond-shaped regions and lateral eyes flanked posteriorly by a small dark brown patch. Metasoma darkens posteriorly, from light brown on segment I to mahogany on segment V. Telson orange-brown with reddish brown aculeus. Pedipalps light brown to orange-brown with carinae and dentate margin of chelal fingers mahogany. Pleural membranes beige.

Measurements (in mm). *Holotype*: total length 24.93; carapace length 3.33; mesosoma length 9.14; metasoma length 9.40; Metasoma: segment I length/width/depth 1.21/2.05/1.51; segment II length/width/depth 1.43/2.10

Figure 1: Dorsal view of *Gertschius crassicorpus*, **sp. nov.**, female holotype (note metasoma, between segments I and II, and right pedipalp have been digitally attached).

/1.60; segment III length/width/depth 1.58/2.10/1.60; segment IV length/width/depth 2.22/2.10/1.53; segment V length/width/depth 2.96/2.12/1.48. Telson: length 3.07; vesicle length/width/depth 1.98/1.51/1.01; aculeus length 1.09. Pedipalps: total length 11.11; femur length/width 3.31/1.01; patella length/width 3.01/1.14; chela length 4.79; palm length/width/depth 2.57/1.48 /1.58; movable finger length 2.81; fixed finger length 2.22. Sternum: length 0.64; anterior/posterior width 0.86/0.94; lateral side of apex length 0.49; coxa II



Figures 2–8: *Gertschius crassicorpus*, **sp. nov.**. 2, 4–7, female holotype. 3 & 8, male paratype. **2.** Carapace. **3.** Chelal finger dentition, fixed finger, internal view, showing trichobothria *ib–it* (left); movable finger, external view (right). **4.** Pecten, closeup of basal area showing tooth without peg sensilla (left); sternum, genital operculum and pectines (right). Note arrow points to missing basal tooth. **5.** Chelicera, dorsal view. **6.** Metasoma and telson, ventral view. **7 & 8.** Metasomal segments IV–V and telson, lateral view.

length 1.28; coxa III length 1.46; coxa IV length 2.42. *Paratype male:* total length 16.70; carapace length 2.41; mesosoma length 4.84; metasoma length 7.27; Metasoma: segment I length/width/depth 0.94/1.47/1.08; segment II length/width/depth 1.13/1.52/1.06; segment III length/width/depth 1.20/1.54/1.11; segment IV length/width/depth 1.71/1.49/1.08; segment V length /width/depth 2.29/1.49/1.08. Telson: length 2.17; vesicle length/width/depth 1.37/1.11/0.70; aculeus length 0.80. Pedipalps: total length 8.18; femur length/width 2.12/0.70; patella length/width 2.27/0.75; chela length 3.79; palm length/width/depth 1.86/1.08 /0.96; movable finger length 1.93; fixed finger length 1.57. Hemispermatophore: lamina to dorsal trough 2.00; hook to dorsal trough 0.90; lamina to ventral trough 1.60; hook to ventral trough 0.5.

Carapace (Fig. 2). Anterior margin of carapace slightly emarginate, with three lateral eyes found on each side. Median furrow weak on anterior three-fourths, moderate on posterior one-fourth. Carapace smooth with scattered finely granular areas that constitute about half of overall surface. Ratio of median eyes location (from anterior edge)/carapace length 0.33; carapace length/width at median eyes 1.44. Entire carapace dorsolaterally convex, especially the posterior half. Carapace longer than pedipalp movable finger, but approximately the same length as femur.

Mesosoma. Tergites smooth to very finely granular except for tergite VII which has scattered slightly larger granules. Very weak median carinae on I–VI, tergite VII with weak median carina on anterior half and moderate dorsal lateral and lateral supramedian granular carinae. Pretergites smooth. Sternites III–VI smooth and without carinae. Sternite VII with granular ventral lateral carinae on posterior one fifth to posterior three-fifths. Presternites smooth with weak carinae on posterior half of VII. Spiracles ovoid with median side rotated 35 degrees away from posterior sternite margin. Posterior margin of sternites bearing variable numbers of fine microsetae.

Genital Operculum (Fig. 4). Posterior aspect somewhat acuminate with a slight separation. Sclerites move as single unit.

Sternum (Fig. 4). Type 2, emargination present posteriorly. Sternal ratios: coxa III_L/coxa II_L 1.14, coxa IV_L/coxa II_L 1.89, coxa II_L/sternum$_{AL}$ 2.61, sternum$_{PW}$ /sternum$_{AW}$ 1.09, and sternum$_L$/sternum$_{PW}$ 0.68. L = length, AL = apex lateral side length, PW = posterior width, AW = anterior width (see Soleglad & Fet, 2003: fig. 1, for method of measurement).

Pectines (Fig. 4). Pectinal tooth count 13/13. Middle lamellae 8/9. The single most basal tooth lacking sensillae and semi-symmetric in shape, exhibiting a slight exterodistal angling. Basal piece large with deep anterior indentation, 1.53 times wider than long.

Metasoma (Figs. 6–8). Ratio of segment I length/width 0.59; of segment II length/width 0.68; of segment III length/width 0.75; of segment IV length/width 1.06; of segment V length/width 1.40. *Segments I-IV*: dorsolateral carinae moderate and granular with distal denticle of II–IV slightly larger than granules and spinoid. Lateral supramedian carinae I–III strong and granular with slightly enlarged spinoid distal denticle; on IV smooth to crenulate with small distal spine, terminus flared, not meeting with articulation condyle. Lateral inframedian carinae on segment I–III moderate and granular, but smooth to obsolete on posterior one-third of II and III, and absent on IV. Ventrolateral carinae I weakly crenulate; smooth on II–IV. Ventral submedian carinae obsolete on I–III, weak and smooth on IV. Dorsal and lateral intercarinal spaces smooth. Segment I–IV setal counts: ventrolateral setae 2/2:3/3:3/3:4/4; ventral submedian setae 3/3:3/3:3/3:3/3. *Segment V*: Dorsolateral carinae weakly crenate, ending distally with a slightly larger spinoid granule. Lateromedian carinae obsolete basal 3/4, smooth to repand on distal 1/4. Ventrolateral carinae smooth on basal half, granular on distal half. Ventromedian carinae obsolete. Intercarinal spaces smooth. Segment V setal counts: ventrolateral setae 4/4; ventral median setae 3/3.

Telson (Figs. 6–8). Short aculeus with wide and bulbous vesicle, bearing flared "tabs" on proximal dorsolateral edges that terminate as a spine. Dorsal surface of vesicle smooth with many small scattered setae. Ventral vesicle surface smooth and concave on anterior one-third. Aculeus base lacking lateral aculear serrations (LAS).

Chelicerae (Fig. 5). Dorsal edge of movable cheliceral finger with two subdistal (*sd*) denticles; ventral edge smooth with conspicuous serrula on distal half comprised of approximately 27 tines.

Pedipalps (Figs. 3, 9). Pedipalpal ratios: chela length /width 3.24; femur length/width 3.28; patella length/width 2.64; fixed finger length/carapace length 0.67. Trichobothrial pattern type C orthobothriotaxy (see pattern in Fig. 9): Chelal trichobothria *ib–it* positioned just proximal of *ID*-6; trichobothrium *Dt* positioned proximal of palm midpoint in ratio (*Dt*_pos / Palm_length) 0.449; *Db* positioned on digital carina. Patellar trichobothrium v_3 located on external surface,

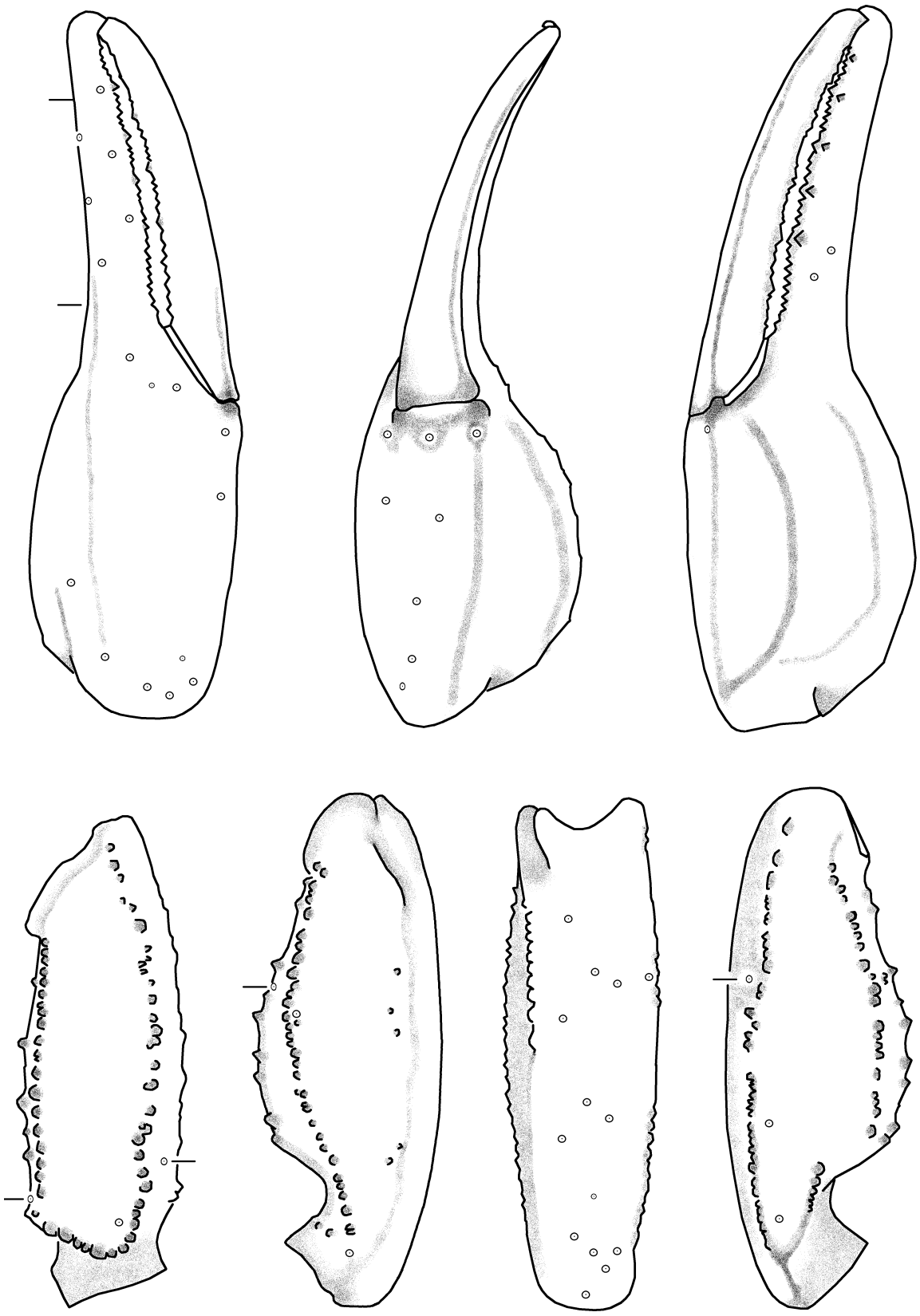
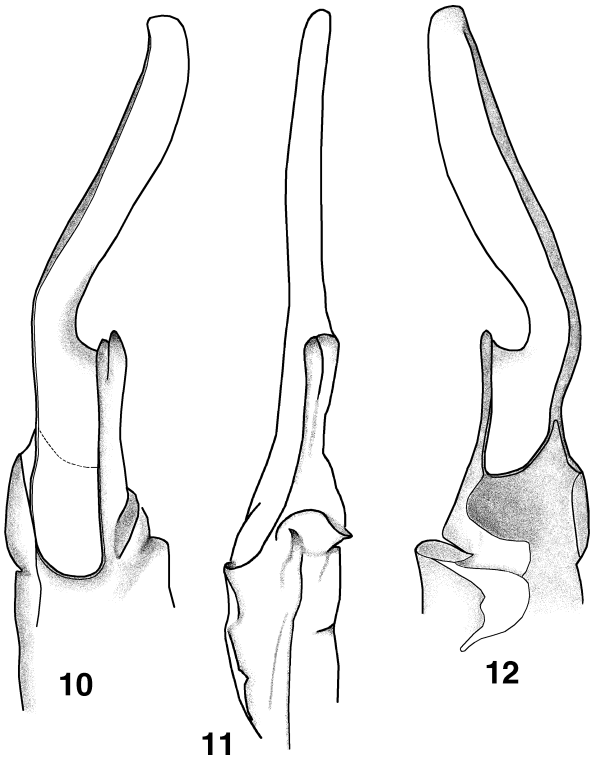


Figure 9: Trichobothrial pattern of *Gertschius crassicorpus*, **sp. nov.**, female holotype.



Figures 10-12: Right hemispermatophore of *Gertschius crassicorpus,* **sp. nov.**, male paratype**. 10.** Dorsointernal view, showing bifurcated lamellar hook. Dotted line indicates position of ventral trough, see Fig. 12. **11.** Internal view. **12.** Ventral view showing capsular area.

distal to et_3. Femoral trichobothrium *d* basal to *i* and positioned next to dorsoexternal carina.

Chela (Figs. 3, 9). All carinae weak and smooth except for dorsointernal and distal one-fourths of dorsomedian carinae which are crenulate to repand. Median denticles (*MD*) of fixed finger aligned and divided into six subrows by five outer denticles (*OD*); flanked by six inner denticles (*ID*). Movable finger with six subrows, five *OD* denticles and seven *ID* denticles. *MD* denticles are serrated basally, less so on distal aspects. *ID* denticles of movable finger are quite large. Basal two *ID* denticles of fixed and movable fingers are positioned closer to each other than to next denticle. Distal denticles of both fingers not unusually elongate and do not possess a "whitish" patch.

Femur (Fig. 9). Carinae strong, granulose; internal surface with scattered coarse granules that almost form carinae on the proximal three-fourths.

Patella (Fig. 9). Internal carinae oblique and comprised of 6–7 large set apart granules; all other carinae moderate to strong and granulose.

Legs. Ventral surface of tarsus with a single median row of spinules terminating distally with a single spinule pair.

Male Paratype (Figs. 3, 8, 10–12). See measurements for male paratype under holotype description.

Hemispermatophore (Figs. 10–12). Lamelliform type with well developed distal lamina lacking distal crest; truncal flexure present. Conspicuous basal constriction located just proximal of lamina midpoint where it terminates in a well developed bifurcated lamellar hook (= flange). Lamellar hook is considerably elongated, exhibiting a lamina length / hook length ratio = 2.22 (lamina length is measured from distal tip to dorsal trough, hook length is from hook tip to dorsal trough). Lamina / hook ratio for ventral surface (using ventral trough as the basal point of measurement) is 3.2. A sclerotized mating (= sperm) plug was not found in either hemispermatophore, presumably due to a combination of poor preservation and the possible partial development of the hemispermatophore. Consequently, the construction of the mating plug barb is not known (i.e., whether it is smooth or toothed).

The male paratype differs from the holotype in the following characters. Smaller in size with total length only 70% that of female. Metasoma and telson lighter in color, being brown instead of mahogany. Pectine tooth counts are 15/15 rather than 13/13. Genital operculum sclerites are separated most of their length and two protruding papillae are visible posteriorly. Ventrolateral carinae of metasomal segments I–III are smooth to weakly crenulate rather than entirely smooth. Dorsolateral carinae I–IV and lateral supramedian carinae I–V are more strongly granulose. Dorsointernal and distal one-fourth of dorsomedian pedipalpal carinae granular. Distal half of internal median carinae crenulate, not smooth. The male also differs in the following morphometrics ratios (holotype in parentheses): median eyes location (from anterior edge) /carapace length 0.34 (0.33); coxa III_L/coxa II_L 1.02 (1.14), coxa IV_L/coxa II_L 1.77 (1.89), coxa II_L/$sternum_{AL}$ 2.30 (2.61), and $sternum_L$/$sternum_{PW}$ 0.76 (0.68); metasoma segment I length/width 0.63 (0.59), segment II length/width 0.74 (0.68), segment III length/width 0.78 (0.75), segment IV length/width 1.15 (1.06), and segment V length/width 1.54 (1.40); pedipalp chela length/width 3.51 (3.24), femur length/width 3.03 (3.28), patella length/width (3.03) 2.64.

Gertschius agilis (Sissom et Stockwell, 1991), comb. nov.

Serradigitus agilis Sissom & Stockwell, 1991: 205–207, figs. 38–52, tab. 1.

Serradigitus agilis: Sissom, 2000: 519; Soleglad & Fet, 2006: 26, fig. 46.

Diagnosis. Small scorpion, 16–22 mm; basal two teeth of pectines lacking sensorial area, exhibiting minimal exterodistal angling; chelal finger median denticles (*MD*) serrate, outer denticles (*OD*) not overly serrate and distinct the entire finger length; metasomal segments wide, segments I–III wider than long, segments IV and V length/width 1.28, 1.31 and 1.84, 1.80 for female and male; vesicle width/telson length 0.40, 0.41 for female and male; ventral submedian carinae of metasoma obsolete to granular to crenulate; hemispermatophore lamellar hook not particularly elongate, lamina length / hook length ratio 2.727–2.830, lamina length / hook length ventral surface ratio 4.884–6.714; pectinal tooth counts 14–15 female, 14–17 male.

Type Data. Holotype ♂: 5–6 mi W Pena Blanca Lake and Sycamore Canyon, Atacosa Mts., Santa Cruz County, Arizona, USA, 21 April 1969 (M. A. Cazier, et al.). Deposited in the American Museum of Natural History, New York (AMNH). Paratypes: 1♂ 1♀ (AMNH), 2 ♂ 1♀ (private collection of W. David Sissom (WDS)), same data as holotype; 1♂ (AMNH), 10 mi S Nacozari, Sonora, Mexico; 2♀ (WDS), 7 mi W Animas, Hidalgo Co., New Mexico, USA (Sissom & Stockwell, 1991; Sissom, 2000).

Distribution. USA (southern Arizona and southwestern New Mexico), Mexico (northern Sonora).

Comments. All above data for *Gertschius agilis* **comb. nov.** are after Sissom & Stockwell (1991: pp. 205–207, figs. 38–52, tab. 1).

Discussion

In Fig. 4 we see that the basal tooth of the right pecten is smooth and lacking a sensorial area, a characteristic exclusively found in tribe Stahnkeini. This modification in *Gertschius crassicorpus* is restricted to the basal tooth, and the adjacent teeth are formed normally. The basal tooth of the left pecten is missing, therefore this is the only information available on *Gertschius crassicorpus* for this character, though the other teeth are not modified. In their diagnosis of tribe Stahnkeini, Soleglad & Fet (2006: 14) describe three modifications to the basal teeth of the pectines (affecting at least one tooth and sometimes as many as four): 1) smooth, lacking sensorial areas, 2) tooth usually swollen and elongated (though there are many exceptions); and 3) the exterodistal angling of the tooth is reduced or absent altogether, providing a quasi-symmetric appearance. The basal tooth in *Gertschius crassicorpus* complies with the first modification of lacking a sensorial area and also exhibits minimal exterodistal angling, but the tooth is approximately the same size as the other teeth, not showing any swollenness or elongation. This reduced configuration seen in *Gertschius crassicorpus* is quite similar to that illustrated in Soleglad & Fet (2006: figs. 25, 27) for species *Serradigitus hearnei* (Williams, 1980) and *S. haradoni* (Williams, 1970). These species, as in *Gertschius crassicorpus*, have only a single modified tooth with reduced angling and little or no swollenness. There are several other Stahnkeini species that exhibit modifications to only the basal pectinal tooth, but the tooth may be elongated, swollen, or sometimes even shortened and ovoid: *S. littoralis* (Williams, 1980), *S. joshuaensis* (Soleglad, 1972), *S. minutis* (Williams, 1970), *S. bechteli* (Williams, 1980), and *S. pacificus* (Williams, 1980) (see Soleglad & Fet, 2006: figs. 17–32; table 4).

For the unique serrated chelal finger dentition exhibited in Stahnkeini, Soleglad & Fet (2006: 6–14) state the following: the median (*MD*) and outer denticles (*OD*) are sharp, elongated, and flatten. In particular, the *OD* denticles are placed directly inline with the *MD* denticles, showing no basal swollenness, and become indistinguishable from *MD* denticles after the third *OD*. Other secondary characteristics of the serrated condition are a reduction of the number of *MD* + *OD* denticles (stated as a density quotient) and the elongation of the *MD* denticles. *Gertschius crassicorpus* (Figs. 3, 9) complies to two of these characters, in part: the basal *MD* denticles are noticeably serrated, but less so on the distal aspect, and a low number of *MD* + *OD* denticles occur on the movable finger (= 33), providing a density quotient of 39, approximating the mean value of 37 reported for Stahnkeini by Soleglad & Fet (2006: tables 1 & 2). In contrast, however, the *OD* denticles of *Gertschius crassicorpus* are typical of other vaejovids, not unusually elongated or sharp and five *OD* denticles are clearly observable on both fingers. In addition, the distal denticle is not elongated or hook-like and does not exhibit the "whitish patch" as seen in Stahnkeini and many other lithophiles (note, *Gertschius crassicorpus* appears not to be a lithophile). As suggested by Soleglad & Fet (2006: 20), the location of the fixed finger trichobothria *ib–it* in Stahnkeini is based on the species size, not to a specific *ID* denticle, thus their position is variable. The position of *ib–it* in *Gertschius crassicorpus* (Figs. 3, 9) is somewhat basal on the fixed finger, with *it* adjacent to slightly proximal of *ID*-6 and *ib* definitely proximal of this inner denticle. Interestingly, we see that the (*ib* / finger length) / carapace length ratio as defined in Soleglad & Fet (2006: table 5) is somewhat low, 0.063, consistent with other Stahnkeini species with somewhat basal *ib–it* trichobothria, such as *Gertschius agilis* (Sissom et Stockwell, 1991) and *S. pacificus*.

Other characters *Gertschius crassicorpus* shares with Stahnkeini, though not exclusive to these taxa, are the single pair of ventral distal spinules on the leg tarsus and the highly developed serrula on the cheliceral movable finger. The barb of the hemispermatophore mating plug is smooth in Stahnkeini but is unknown in *Gertschius crassicorpus* (based on other characters, we suspect the barb will prove to be smooth as illustrated by Sissom & Stockwell (1991: figs. 47, 48, 51, 52) for *G. agilis*).

Comparison with other species

In Table 1 we present diagnostic characters that separate *Gertschius crassicorpus* from other species of interest. In particular, due to the placement of *Gertschius crassicorpus* in tribe Stahnkeini, we contrast it against six species of *Serradigitus* either found in its geographical area and/or resemble *G. crassicorpus* in one or more aspects. We also consider *Vaejovis pequeno* Hendrixson, 2001, a small somewhat stocky "similar looking" species found in the same vicinity as *G. crassicorpus* (see map in Figure 13 for the distribution of these species).

With respect to two Sonoran Stahnkeini species, *G. agilis* and *S. yaqui*, *G. crassicorpus* has by far the stockiest metasoma; segment IV is 8–21% stockier and segment V is 14–32 % stockier. *S. yaqui* is stockier than *G. agilis*, but has a longer chelal movable finger than *G. crassicorpus*, as trichobothria *ib–it* are positioned just distal to *OD*-6 (in *G. crassicorpus* they are proximal). The ventral metasomal carinae are less developed and smoother in *G. crassicorpus* than these two species, and the ventrosubmedian carinae in particular are highly reduced and usually obsolete or smooth on both genders (Fig. 6). The three east coast Baja Sur *Serradigitus* species, *S. littoralis*, *S. hearnei* and *S. haradoni*, have considerably thinner metasoma; *G. crassicorpus* 14–34 % heavier on segment IV and 28–55 % on segment V. In addition, as with the Sonoran species, *G. crassicorpus* has less developed ventrosubmedian carinae on the metasoma. The west coast Baja species, *S. baueri* and *S. pacificus*, are also of interest, as they exhibit a conservative modification to the pectinal basal teeth similar to that seen in *G. crassicorpus* (only *S. pacificus* has been explicitly confirmed with this modification as illustrated in Soleglad & Fet, 2006: 21; fig. 29). Also of interest is the extremely wide metasoma seen in these two species, particularly in *S. baueri* whose segments IV–V are even stockier than those in *G. crassicorpus*. As discussed in some detail by Soleglad & Fet (2006), these two *Serradigitus* species, along with *S. littoralis*, have had a somewhat erratic taxonomic history. This was caused, in part, by the strict less-generalized interpretation of the pectinal tooth modifications found in Stahnkeini and by disagreements as to what constitutes the "serrated condition" of the chelal fingers. *S. baueri* and *S. pacificus* are restricted to two geographically close islands off the western coast of central Baja California. They, with species *S. littoralis*, exhibited the lowest *ib* / fixed finger ratio in the tribe Stahnkeini (see Soleglad & Fet, 2006: table 5). The ratio of 0.63, found in *G. crassicorpus*, is the next lowest and both fixed finger trichobothria are located adjacent to or proximal of the basal inner (*ID*-6) denticle. The *ib–it* positions are either adjacent or proximal to the basal *ID* denticles in *S. baueri*, *S. pacificus*, and *S. littoralis*, consistent with that of *G. crassicorpus*.

The overall appearance of *Vaejovis pequeno* (Hendrixson, 2001), a species found in central southern Sonora, is similar to that of *G. crassicorpus*; both small scorpions with a somewhat stocky metasoma. This species was not placed in any of the *Vaejovis* groups currently defined, since it exhibited a combination of characters found in two or more of these assemblages. Hendrixson (2001) compared it to *Vaejovis waueri*, a member of the "eusthenura" group, to which it resembles superficially (though *V. waueri* exhibits differences from this group which it shares with *V. bilineatus* Pocock, 1898; Soleglad & Fet, in progress). Of course, *V. pequeno* does not exhibit the modified basal tooth of the pectines nor is its chelal finger dentition "declared serrated", characters used to place *G. crassicorpus* in Stahnkeini. However, it does share with *G. crassicorpus* a single ventral distal spinule pair on the leg tarsus, well developed cheliceral serrula, and a smooth mating plug barb (as in Stahnkeini, but unknown in *G. crassicorpus*). Since it is not clear what actually constitutes a serrated denticle edge in some workers interpretations (this was discussed in detail by Soleglad & Fet, 2006), we contrast the two species using other species-level characters. *G. crassicorpus* can be distinguished from *V. pequeno* by the following: morphometrics – the chela is much wider in *G. crassicorpus*, chela length / palm width = 3.24/3.51 for female/male whereas the ratio is 4.0/4.08 in *V. pequeno* (16–23 % difference); the metasoma is stockier in *G. crassicorpus*, segments IV and V are 11–26 % thicker; and the movable finger is 20–21 % longer in *G. crassicorpus* when compared to metasomal segment V. Metasomal carination – ventrosubmedian carinae of segments IV–V are obsolete to smooth in *G. crassicorpus* whereas they are crenulate to serrate in *V. pequeno*. Trichobothrial positions – fixed finger trichobothria series *db–dt* is positioned quite proximal in *V. pequeno*, *dst* located proximal of *est* (Hendrixson, 2001: figs. 8–9), a position only seen in *Paruroctonus* and related taxa; patellar trichobothrium v_3 is not shown by Hendrixson (2001: fig. 7) on the external surface which we suspect is an omission since the external placement of v_3 on this segment is a synapomorphy for family Vaejovidae. Hemispermatophore proportions – the distance from the

		Metasoma Segments (L/W)							Metasoma Carinae		
		I	II	III	IV	V	Ca_L/ MF_L	V_L/ MF_L	Ventrolateral (I-V)	Ventromedian (I-V)	Pectinal Tooth Counts
G. crassicorpus	♀	0.590	0.681	0.752	1.057	1.396	1.185	1.053	cr,sm,sm,sm,sm-gr	ob,ob,ob,sm,ob	13
	♂	0.639	0.743	0.779	1.148	1.537	1.249	1.187	cr,sm-cr,sm-cr,sm-cr,sm-cr	ob,ob,sm,sm,sm	15
G. agilis [1]	♀	0.622	0.750	0.829	1.281	1.844	1.176	1.185	-	-	14-15
	♂	0.643	0.803	0.889	1.308	1.797	1.232	1.211	gr,cr,cr,cr,cr	ob,ob,gr,gr,cr	14-17
S. baueri [3]	♀	0.667	0.710	0.781	0.917	1.364	0.923	0.865	ob,gr,gr,gr,gr	ob,gr,gr,gr,gr	13-15
	♂	0.707	0.773	0.841	1.020	1.375	0.932	0.904	-	-	14-15
S. pacificus [2]	♀	0.840	0.960	0.960	1.269	1.769	1.150	1.150	cr,cr,cr,cr,cr	sm-cr,sm-cr,cr,cr,cr	15-17
	♂	0.795	0.889	0.915	1.130	1.500	0.900	1.000	-	-	17
S. littoralis [2]	♀	0.727	0.900	0.950	1.200	1.789	1.200	1.133	cr,cr,cr,cr,cr	cr,cr,cr,cr,cr	12-14
	♂	-	-	-	-	-	-	-	-	-	14-16
S. yaqui [1]	♀	0.637	0.688	0.737	1.144	1.596	1.033	0.984	-	-	13-15
	♂	0.725	0.856	0.932	1.314	1.805	1.066	1.000	cr,cr,cr,cr,cr	ob,gr,cr,cr,cr	16-17
S. haradoni [2]	♀	0.714	0.923	1.000	1.417	2.167	1.120	1.040	-	-	12-14
	♂	0.714	0.846	1.000	1.500	2.000	1.200	1.200	cr,cr,cr,cr,cr	cr-sm, cr-sm,cr-sm,cr,cr	13-15
S. hearnei [2]	♀	0.700	0.842	0.944	1.333	1.778	1.063	1.000	cr,cr,cr,cr,cr	ob-sm,ob-sm,sm,cr,cr	17
	♂	0.769	0.923	1.083	1.500	2.000	1.200	1.200	-	-	18-19
V. pequeno [4]	♀	0.667	0.833	0.867	1.179	1.759	1.325	1.275	-	-	11-13
	♂	0.667	0.880	0.880	1.280	1.760	1.419	1.419	cr,cr,cr,cr,cr-sr	ob,sm-gr,sm-gr,sr,cr-sr	12-13

[1] after Sissom & Stockwell (1991). [2] after Williams (1980). [3] after Gertsch (1958). [4] after Hendrixson (2001). Other based on measurement of specimens.

Table 1: Comparison of diagnostic characters of genus *Gertschius*, **gen. nov.**, with *Serradigitus* species of interest, and *Vaejovis pequeno*, a species from the same locality. Ca_L = carapace length, MF_L = movable finger length, V_L = metasomal segment V length, ob = obsolete, sm = smooth, gr = granulate, cr = crenulate, sr = serrate.

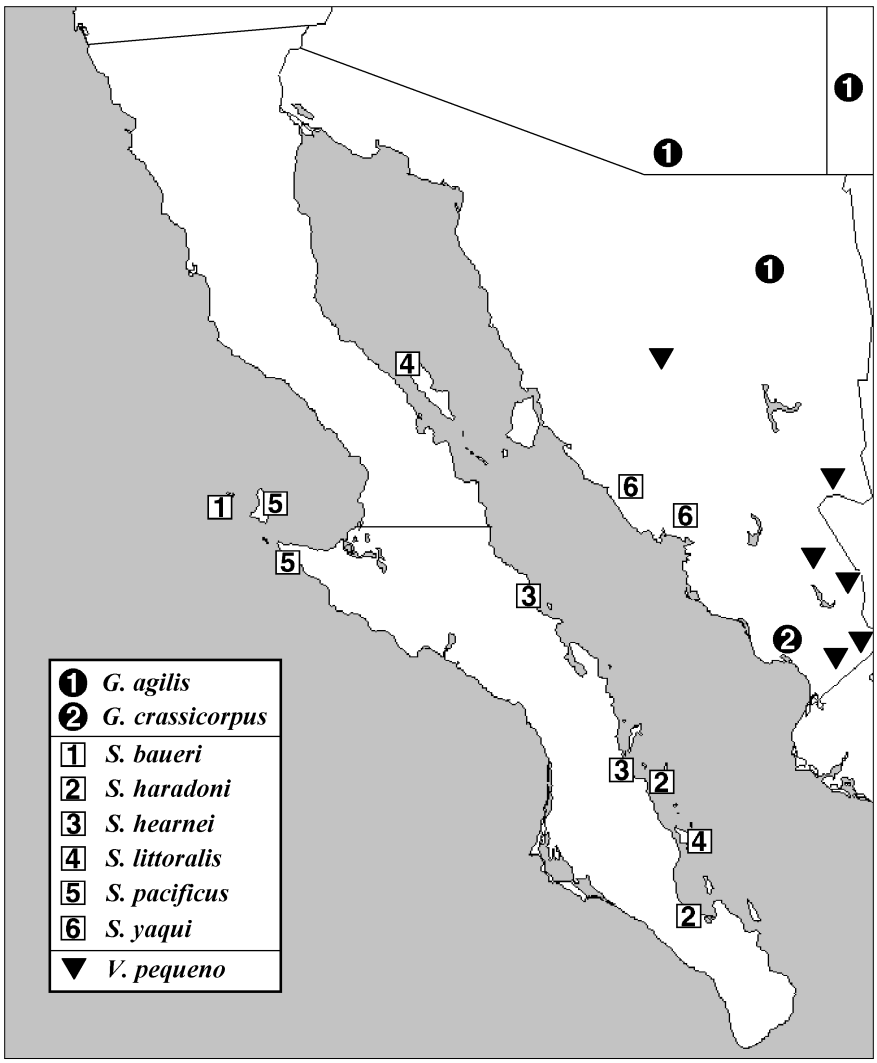


Figure 13: Distribution of genus *Gertschius* (= *G*) and select species of *Serradigitus* (= *S*) and *Vaejovis* (= *V*). Localities based on specimens examined and Williams (1980), Sissom & Stockwell (1991) and Hendrixson (2001).

dorsal trough to the distal aspect of the lamellar hook is shorter in *V. pequeno* (compare Figs. 10, 12 to Hendrixson, 2001, figs. 12, 14), lamina length / hook length = 2.77 whereas in *G. crassicorpus*, which has a longer lamellar hook, it is 2.22 (a 25 % difference). This difference is visible from both the dorsal and ventral aspect, where for the latter, the ventral trough is situated quite close to the lamellar hook terminus in *V. pequeno*.

Position within Vaejovidae

Below we discuss the placement of *Gertschius* within family Vaejovidae, providing rationale for its assignment to tribe Stahnkeini.

Gertschius can be assigned to a well defined clade within the Vaejovidae (substantiated by preliminary cladistic analysis; Soleglad & Fet, in progress). Based on the female genital operculum of *Gertschius*, with its sclerites essentially connected along their entire length and moving as a single unit, this genus is clearly a member of the clade Stahnkeini + ((“eusthenura” group + *Syntropis*) + “punctipalpi” group) (see Soleglad et al., 2007, for more information on this assemblage). Other vaejovids exhibit some separation on the posterior aspect of the female genital operculum, and in the related genera *Paruroctonus*, *Smeringurus*, *Vejovoidus* and *Paravaejovis*, the sclerites also move separately. Other vaejovid assemblages such as *Pseudouroctonus*, *Uroctonites*, *Franckeus*, and the “nigrescens” and “mexicanus” groups of *Vaejovis*, have *ib*–*it* trichobothria located basal on the finger, well removed from the proximal *ID* denticle. In addition, for *Gertschius* the ventral edge of the cheliceral movable finger is smooth and has well developed serrula, the dorsolateral carinae terminus on metasomal segment IV is flared, setal combs are absent, the spacing between chelal trichobothria V_1 and V_2 is approximately the same as V_2 and V_3, and the fixed finger trichobothrium *dst* is

positioned between *et* and *est* (not proximal of *est*); all characters which excludes it from the group containing *Paruroctonus* and related taxa.

Based on the affinities *Gertschius* shares with Stahnkeini (discussed above), we consider *Gertschius* to be closer to this tribe than the other three taxonomic elements of this clade, and therefore a member of Stahnkeini. This relationship is based on the serrated *MD* denticle row of the chelal fingers which are also reduced in their numbers, the partially modified basal tooth of the pectines, the placement of *ib–it* trichobothria, and the heavy development of the cheliceral serrula, which in turn, excludes *Gertschius* from the other three elements of this clade. In addition, ("eusthenura" group + *Syntropis*) + "punctipalpi" group share a toothed mating plug barb and two or more distal ventral spinule pairs on the leg tarsus, whereas in Stahnkeini and *Gertschius* they have a single ventral spinule pair and the mating plug barb is smooth (note, the composition of the mating plug barb is unknown in *G. crassicorpus*).

Within Stahnkeini, *Gertschius* can be contrasted from genera *Serradigitus* and *Stahnkeus* with its non-serrated *OD* denticles, five of which are discernible on both fingers, the lack of exaggerated elongated distal finger denticles, and the absence or near absence of the "whitish" patch; the position of chelal palm trichobothrium *Dt* is proximal of palm midpoint (ratio = 0.449–0.482 (0.466)) whereas in other species, it is slightly distal of midpoint (ratio = 0.504–0.716 (0.604), based on 23 species) and *Db* is located on the digital carina, not ventral of as in the other species (*S. adcocki* is an exception). Also, with respect to *Stahnkeus*, inner accessory (*IAD*) denticles are absent.

The exact taxonomic status of *G. agilis* seems somewhat in question if one reads Sissom & Stockwell's (1991) statements very carefully. Here are excerpts from their paper concerning *G. agilis*:

> "… female pectinal teeth all approximately same size or with most proximal only slightly larger; proximal two teeth elliptical in shape, lacking sensilla …", "…four or five subrows of denticles on the chelal fingers (compared to other *Serradigitus*), this species resembles *S. littoralis* …", "… enlarged terminal denticles of the chela fingers (although not as exaggerated in some *Serradigitus* …".

It is clear that Sissom & Stockwell (1991) considered *G. agilis* to be a little distant from the other *Serradigitus* species. In particular, the reduced modification to the basal pectinal teeth, the distinct identification of more than three *OD* denticles on the fingers, and the lack of a highly enlarged distal denticle on the fingers.

We hypothesis that *Gertschius* is a relict genus within Stahnkeini forming the topology Stahnkeini = (*Gertschius* + (*Stahnkeus* + *Serradigitus*)), thus constituting a primitive component of this clade. In accordance with this hypothesis, we suggest that the following *Serradigitus* species may be the closest known relatives of *G. crassicorpus* and *G. agilis*: *S. baueri*, *S. pacificus*, and possibly *S. littoralis*.

These species appear related to *G. crassicorpus* with their reduced modification of the pectines basal teeth and a somewhat basal disposition of fixed finger trichobothria *ib–it*. In these species, unlike *G. crassicorpus* and *G. agilis*, the *OD* denticles are serrated and not distinguishable beyond *OD*-3. Related species *S. baueri* and *S. pacificus* also exhibit a somewhat stocky metasoma, like that found in *G. crassicorpus*, although in our opinion, this must be considered a secondary character. Whether these species belong to *Gertschius* remains to be seen, as ample material of all three species, the female gender in particular, must be examined.

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