	Sensilla Number	Array Diameter	Sensillum Diameter	Distance to Distal Tip	Distal *MD* Number	Reference Figures
Paruroctonus arenicola nudipes	2	80.6	14.2	226.7	4	Fig. 16
Paruroctonus arnaudi	2	67.2	15.7	286.7	6	Figs. 9, 29
Paruroctonus bantai saratoga	2	55.2	13.4	231.1	3	Fig. 8
Paruroctonus becki	2	54.5	10.8	238.8	8	Fig. 15
Paruroctonus boreus	2	85.8	15.7	386.7	5	Fig. 11
Paruroctonus borregoensis	2	44.8	13.4	177.8	2	Fig. 7
Paruroctonus gracilior	2–3 (2)*	62.5	15.4	228.6	10	Fig. 13
Paruroctonus hirsutipes	2	34.3	10.5	208.9	3	–
Paruroctonus luteolus	2	51.2	10.4	145.0	3	Fig. 1
Paruroctonus silvestrii	2	96.3	14.9	295.5	5	Figs. 10, 24
Paruroctonus stahnkei	2	64.5	13.3	197.5	6–7	Fig. 14
Paruroctonus surensis	2	63.6	12.5	222.5	2	Figs. 5, 23
Paruroctonus utahensis	2	115.0	14.9	288.9	4	Fig. 12
Paruroctonus ventosus	2	85.1	14.9	191.1	3	Fig. 6
Paruroctonus xanthus	2	70.2	12.7	213.3	11	–
Smeringurus aridus	2	95.1	14.4	405.7	7–9	Figs. 19, 30
Smeringurus grandis	2	78.8	15.4	445.7	8–9	Figs. 18, 25
Smeringurus mesaensis	2	62.7	12.0	233.7	9	Figs. 2, 17
Smeringurus vachoni immanis	2	128.9	23.1	233.7	13	Figs. 27, 28
Smeringurus vachoni vachoni	2	67.9	14.2	328.1	6	Fig. 20
Vejovoidus longiunguis	2	73.1	12.5	405.7	7–8	Figs. 3, 26
Paravaejovis pumilis	3	35.5	13.3	137.5	2–3	Fig. 4
Mean ± SD		**72.1 ±24.9**	**13.9 ±2.8**	**262.3 ±92**		

Table 1: Constellation array statistics for vaejovid genera *Paruroctonus*, *Smeringurus*, *Vejovoidus*, and *Paravaejovis*. "Array Diameter" = distance between sensilla centers (note for genus *Paravaejovis*, distance is measured from the two most proximal sensilla). "Distance to distal tip" = distance from the most distal sensillum to distal edge of distal denticle. Number of distal *MD* denticles is counted from *OD–1* to distal denticle. *OD–1* = outer denticle-1; *MD* = median denticles. Measurements in micrometers. * range (mode).

two sensilla are located on the ventral half of the finger, definitely ventrad of the horizontal midpoint**.** The major seta **Ms** is positioned proximad of both **ms1** and **ms2**, whereas in the other three genera we see **Ms** is always distad of **ms1** and usually **ms2** as well. In those small species of *Paruroctonus* that have minimal number of distal *MD* denticles (i.e., 2–3), **Ms** may be slightly proximad of **ms2** (species *P. surensis*, *P. borregoensis* and *P. luteolus*).

In summary, the sensilla are positioned more distad from the setal landmark region in species whose distal denticle tip is more removed from this region, that is, the area between outer (*OD*) denticle-1 and the distal denticle contains more median (*MD*) denticles. This may imply that the sensilla must be at a certain distance from the finger tip in order to adequately "perform their function". Also important about this data is the fact that the number of sensilla remained the same across a sizable, diverse species set whose adult size ranged from small species at 30 mm to large species exceeding 90 mm. Table 1 provides measurements of constellation array size for 21 studied species (we measured the distance between two sensilla, diameter of a sensillum, and the distance from the finger tip).

Systematic observations

Stockwell (1989: 287, fig. 257), in his important unpublished Ph.D. thesis, suggested the following topology for our study group: ***Paravaejovis*** + (***Paruroctonus*** + ***Smeringurus*** + ***Vejovoidus***). Under Stockwell's (1989) scheme, this assemblage formed a major clade within family Vaejovidae (he assigned it its own tribe under subfamily Syntropinae). Based on preliminary cladistic analysis, we agree that this clade as suggested by Stockwell is monophyletic and is quite removed from the other vaejovid aggregates (even more so than that shown by Stockwell, 1989: fig. 257). We also agree with Stockwell's split into two primary subclades, therefore ***Paruroctonus*** + ***Smeringurus*** + ***Vejovoidus*** is also monophyletic in our opinion. In addition to the major neobothriotaxy found on the chelal palm, the monotypic genus *Paravaejovis* exhibits important differences in the location of orthobothriotaxic trichobothria. In this paper we have demonstrated yet another character that separates the two subclades, the constellation array, with different number of sensilla and different landmark setal topologies. The taxonomic placement of these four genera within the framework of family Vaejovidae will be established in an upcoming paper (Soleglad & Fet, in progress).

Comparison to other vaejovids. Based on preliminary analysis (Fet et al., in progress) we have also detected a certain consistency in the number of constellation array sensilla in other closely related vaejovid genera and groups. Here is a list of groups and species so far examined:

Tribe Stahnkeini with five to seven sensilla: *Serradigitus gertschi gertschi* and *S. joshuaensis* with five sensilla, *S. minutis* with six sensilla, and *Stahnkeus subtilimanus* with seven sensilla

"punctipalpi" group of *Vaejovis* with six sensilla: *Vaejovis hirsuticauda* and *V. punctipalpi*

"eusthenura" group of *Vaejovis* with three to five sensilla: *Vaejovis confusus*, *V. eusthenura*, and *V. puritanus* with five sensilla; *V. viscainensis* and *V. vittatus*, with three sensilla

"mexicanus" group of *Vaejovis* with three sensilla: *Vaejovis carolinianus*

Pseudouroctonus with three sensilla: *Pseudouroctonus andreas* and *P. reddelli*

These data are very preliminary and the number of species examined quite small but we expect, after the evaluation of several more species and additional specimens of a species, that these trends will show the same consistency as that exhibited in the four genera discussed in this paper. In addition, we also suspect that the occurrence and/or location of the four landmark setae defined in this study will also exhibit different configurations in the other vaejovid groups and genera thus providing additional characters for future cladistic analysis. Compared to these limited but diverse data, one general trend that can be already seen in *Paruroctonus* and allied genera, is the *reduction* of sensilla number (with *Paravaejovis* an outgroup with three sensilla). It appears that this trend is exhibited at the systematic level higher than genus, and can thus be synapomorphic feature for a tribe or a subfamily. Indeed, two sensilla are the lowest number so far confirmed in scorpions (as one sensilla in *Vejovoidus* appears to be an aberration) while the highest number reaches 15 (genus *Calchas*, Iuridae; Fet et al., 2006). Note that another, unrelated chactoid genus, *Nullibrotheas* (Chactidae) has two sensilla while other chactids have higher number (up to 14; Fet et al., 2006); thus, reduction trend seems to be derived.

Following the examination of a reasonably representative set of constellation array sensilla in all major scorpion groups, the next step will be to hypothesize possible homology among individual sensilla, thus providing even further information on their evolution and increasing their impact on the overall systematic revision of extant scorpions.

Variability and aberrations in sensilla occurrence

In our material, several analyzed specimens of *Paruroctonus gracilior* presented an example of variability in number of sensilla within a species. Out of six investigated specimens, four possessed two sensilla as in all other studied *Paruroctonus* species; these were a male and a female from Cuatro Cienegas (Coahuila, Mexico), a male from Brewster Co., Texas, and a male from Hidalgo Co., New Mexico. On the other hand, two specimens (another male from Texas and another male from New Mexico) had *three* sensilla. At this moment, the only observation we can make is that this variability does not seem to be gender-related, or geographically specific. We must remember that systematically *P. gracilior* is separated in a group of its own from all other 28 known species of the genus *Paruroctonus* (Sissom, 2000: 506). It is also geographically unique, being the most southern species in this genus.

At the same time, we stress the overall consistency in the many specimens of *Paruroctonus*, *Smeringurus*, and *Vejovoidus* examined, with two sensilla found across this diverse group everywhere. These specimens were selected randomly from both genders, and across several sources and localities, where two sensilla was the norm. In 14 our of 15 examined species of *Paruroctonus* (except *P. gracilior*), we observed a solid consistency of two sensilla in constellation array.

We also have to mention observed occurrences of "missing", petite, or partially formed sensilla as aberrations. We need to stress the delicate nature of an individual sensillum thus suggesting it can be easily damaged, especially in older adult specimens. As an example of this, our observation (Fet et al., 2006: fig. 23) of *Vejovoidus* exhibiting only one sensillum was incorrect; in fact, the second sensillum is visible in this figure in a "modified" (damaged?) form. We have seen also occurrences of petite, or partially formed, sensilla – in the same sense as petite trichobothria known in many scorpion species (Vachon, 1974; Soleglad & Fet, 2003). It seems reasonable to assume that a petite sensillum is underdeveloped, compared to fully developed sensillum of specific size.

Finally, in many images taken, surrounding setae (including landmark setae) are often broken off, especially in old specimens, and under a low magnification the broken stubs of these setae could be confused with the sensilla of the constellation array.

Acknowledgments

We thank Graeme Lowe and Douglas Gaffin for the generous gift of specimens, and Matt Graham for a specimen used for SEM study. We also extend our gratitude to Graeme Lowe and Douglas Gaffin for reviewing this paper.

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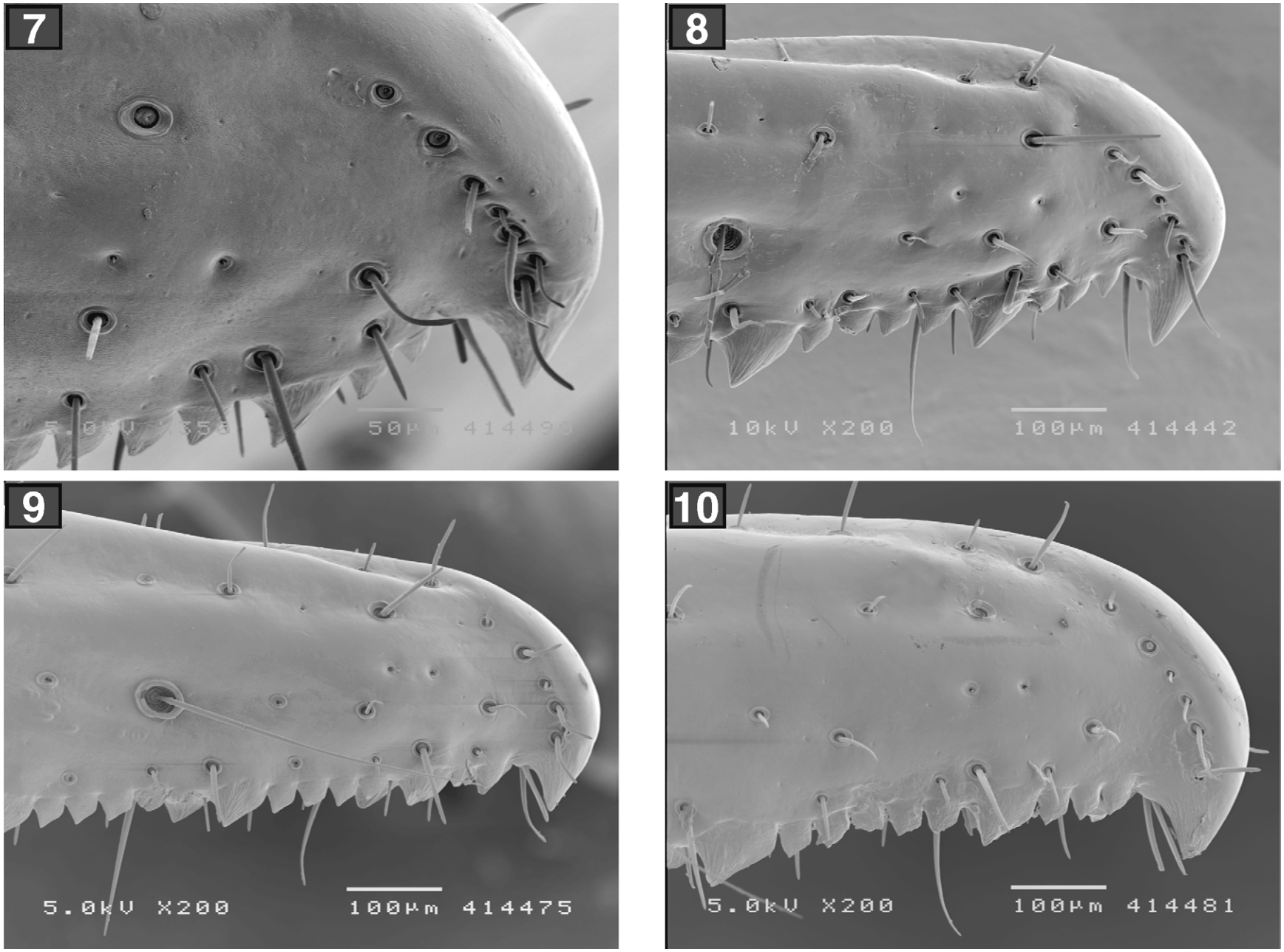
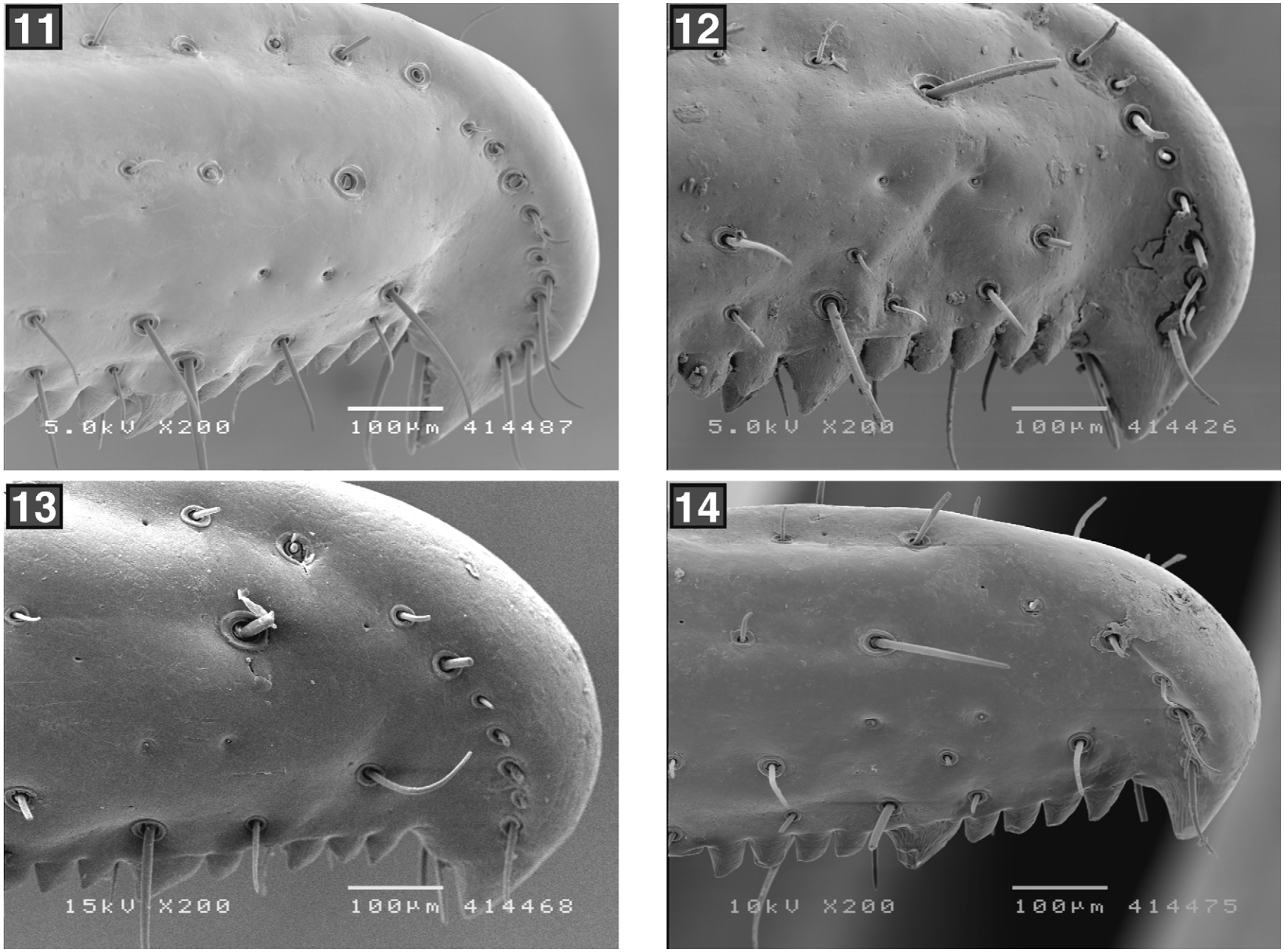
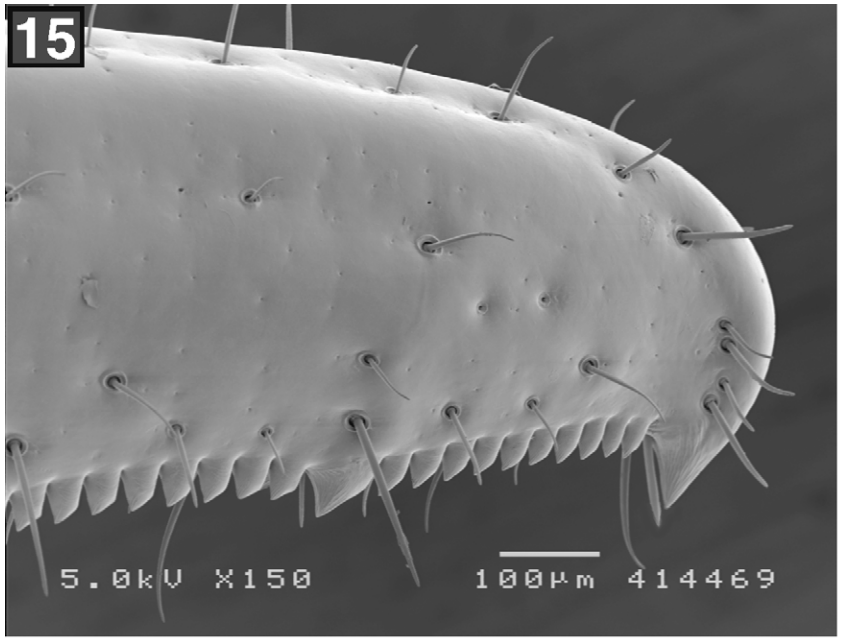
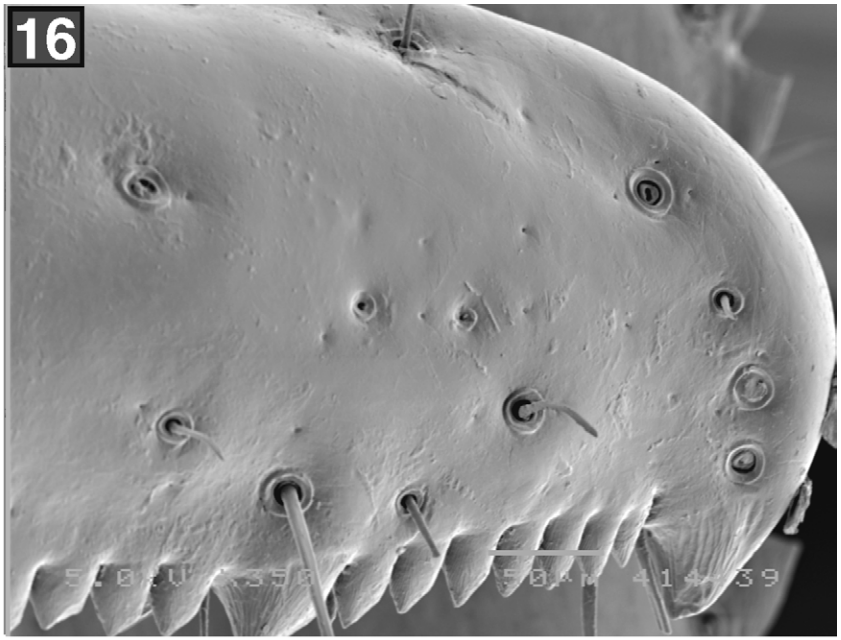


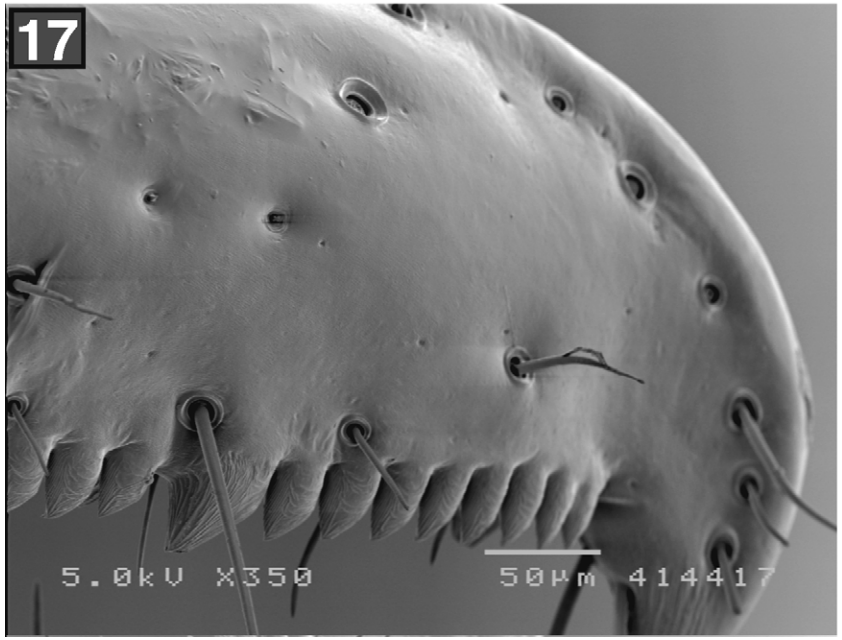
Figures 7–10: Closeup of distal aspect of chelal fixed finger, external view, showing *constellation array* in genus *Paruroctonus*. **7.** *Paruroctonus surensis*, male, Las Bombas, Baja California Sur, Mexico. **8.** *P. ventosus*, female, El Socorro, Baja California, Mexico. **9.** *P. borregoensis*, male, Palo Verde Wash, ABDSP, California, USA. **10.** *P. bantai saratoga*, juv., Death Valley, Inyo County, California, USA.

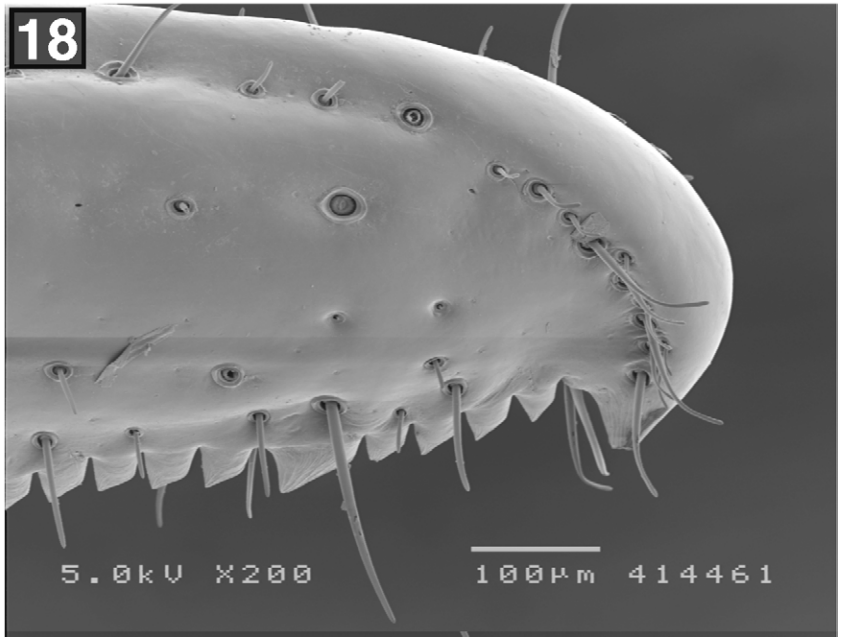


Figures 11–14: Closeup of distal aspect of chelal fixed finger, external view, showing *constellation array* in genus *Paruroctonus*. **11.** *Paruroctonus arnaudi*, male, El Socorro, Baja California, Mexico. **12.** *P. silvestrii*, male, Chihuahua Road, ABDSP, California, USA. **13.** *P. boreus*, male, Mercury, Nevada, USA. **14.** *P. utahensis*, female, Kermit, Winkler Co., Texas, USA.









Figures 15–18: Closeup of distal aspect of chelal fixed finger, external view, showing *constellation array* in genus *Paruroctonus*. **15.** *Paruroctonus gracilior*, male, Cuatro Cienegas, Coahuila, Mexico. **16.** *P. stahnkei*, Mesa, Maricopa Co., Arizona, USA. **17.** *P. becki*, male, San Bernardino Co., California, USA. **18.** *P. arenicola nudipes*, male, Kelso Dunes, San Bernardino Co., California, USA.