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NEW SYNONYMY, NEW SPECIES, NEW KEYS TO *NEIVAMYRMEX* ARMY ANTS OF THE UNITED STATES

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ABSTRACT

The United States species of *Neivamyrmex* are here reviewed. The following **new synonymy** is proposed (senior synonym listed first): *N. moseri* Watkins = *N. isodentatus* Mackay; *N. swainsoni* (Shuckard) = *N. mexicanus* (F. Smith) = *N. fallax* Borgmeier; *N. halidaii* (Shuckard) = *N. mexicanus* (E. V. Enzmann), not *N. mexicanus* (F. Smith). *N. mandibularis* (M. R. Smith) is elevated to species level, **new status**, having previously been regarded as a subspecies of *N. pilosus* (F. Smith). One species, *N. graciellae* (Mann) is recorded from the United States (Arizona) for the first time. Four new species are described: *N. goyahkla* (southern Arizona; workers only), *N. kiowapache* (Kansas to southern Arizona; all castes), *N. ndeh* (southern Arizona; males only) and *N. wilsoni* (southern California; workers). New keys are presented for the separation of worker and male castes of all known United States species, and most species are illustrated.

Key words: Hymenoptera, Formicidae, Ecitoninae, *Neivamyrmex*, army ants, new species.

INTRODUCTION

The systematics of the New World army ants has been fairly stable since the massive revision by Borgmeier (1955). The few species described since 1955 are mostly included in the keys to New World army ants by Watkins (1972, 1976, 1982, 1990).

Borgmeier's classification of the New World army ants divided them into five genera: *Cheliomyrmex* (the sole member of the tribe Cheliomyrmecini), *Labidus*, *Eciton*, *Nomamyrmex*, and *Neivamyrmex*, all in the tribe Ecitonini, and all hitherto regarded as subgenera within *Eciton*. The three genera *Eciton*, *Neivamyrmex*, and *Nomamyrmex* should possibly be recombined to form a single genus, *Eciton*. As defined by Borgmeier the characters separating these genera are trivial and the distinguishing feature for *Neivamyrmex* (the absence of a tooth on the pretarsal claw of the worker) is equivocal. Genera should be based on characters of a more fundamental nature. Despite numerous papers on the Ecitonini, Watkins never attempted a critical analysis of the status of the various genera. A detailed study of character states in the numerous species of Ecitonini must be made before any substantive conclusion can be reached; such a study is far beyond the scope of this paper.

Borgmeier, as had Creighton (1950) before him, abandoned the quadrinomial system of classification and instead recognized geographical subspecies for many of the species treated. These were often based on trivial features of color and the proposed system has since proven untenable for many species. Watkins, in his various contributions to the taxonomy of New World army ants avoided entirely the matter of geographical variation. Strangely, while he included the infraspecific names in his various regional lists, he never attempted to analyze populations in an effort to determine whether or not these forms represented taxonomically significant entities, even though he commonly used the subspecific names when identifying material. This short-coming had little impact on those species of *Neivamyrmex* found in the United States, from which he listed only two subspecies, both attributed to a single species.

MATERIALS AND METHODS

Specimens utilized in the course of this study have been examined from the following institutional and private collections:

American Museum of Natural History, New York, New York, U. S. A. (AMNH)
 Arizona State University, Tempe, Arizona, U. S. A. (ARSU)
 California Academy of Sciences, San Francisco, California, U. S. A. (CASC)
 Clemson College, Clemson, South Carolina, U. S. A. (CLMC)
 Cornell University, Ithaca, New York, U. S. A. (CUIC)
 Essig Entomological Museum, University of California, Berkeley, California, U. S. A. (UCBC)
 Gordon C. Snelling, personal collection, Apple Valley, California, U. S. A. (GCSC)
 Jamie King, personal collection, San Diego, California, U. S. A. (JAKC)
 Kenneth W. Cooper, personal collection, Riverside, California, U. S. A. (KWCC)
 Natural History Museum of Los Angeles County, Los Angeles, California, U. S. A. (LACM)
 Lloyd Davis, personal collection Gainesville, Florida, U.S.A. (LDPC)
 University of Michigan, Ann Arbor, Michigan, U. S. A. (MICH)
 University of Minnesota, Minneapolis, Minnesota, U. S. A. (MINN)
 Museum of Comparative Zoology, Cambridge, Mass., U. S. A. (MCZC)
 University of Pennsylvania, Philadelphia, Pennsylvania, U. S. A. (PENN)
 Robert A. Johnson personal collection, Tempe, Arizona, U. S. A. (RAJC)
 Snow Entomological Museum, University of Kansas, Lawrence, Kansas, U. S. A. (SEMC)
 Texas A & M University, College Station, Texas, U. S. A. (TAMU)

The Natural History Museum, London, United Kingdom (BMNH)
 University of California, Davis, California, U. S. A. (UCDC)
 University of California, Riverside, California, U. S. A. (UCRC)
 University of Arizona, Tucson, Arizona, U. S. A. (UNAR)
 William P. MacKay, personal collection, El Paso, Texas, U. S. A. (WPMC)

Other collections cited:

ANSP Academy of Natural Sciences, Philadelphia, Pennsylvania, U. S. A.
 IBVB Instituto de Biologia Vegetal, Brazil
 MCSN Museo Civico di Storia Naturale, Genoa, Italy
 MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland
 NHMV Naturhistorisches Museum, Vienna, Austria

TERMINOLOGY

All measurements were made from mounted, fully dry, specimens under a binocular microscope with 10× oculars, and a Mitutoyo, x-y axis stage and Mitutoyo digital micrometers. Images were made with a Hitachi S-3000 scanning electron microscope.

We do not use the term “occiput” when referring to the posterior margin of the head; that term is morphologically incorrect. Instead we refer to the posterior margin as the preoccipital margin; in *Neivamyrmex* species it is often marked by a more or less distinct preoccipital carina.

Traditionally, the lengths of the petiolar and postpetiolar nodes are measured in dorsal view, beginning at the anterior margin of the node; this margin is often difficult to define and resulting measurements may thus be inaccurate to an unacceptable degree. We have made all petiole and postpetiole measurements in side view, starting at the anterior edge of the spiracle to the posterior margin of the segment. Although the spiracle may not correspond exactly to the anterior edge of the node it provides an easily recognized and consistent starting point with which to begin a measurement.

Also brought into conformity with generally accepted usage elsewhere among the Hymenoptera are two terms used in describing male genitalia of army ants: the “stipes” or “stipites” are here called the parameres (= gonostylus); the sagitta is more correctly to be referred to as the aedeagus and that is employed here.

In the keys and descriptions, the following acronyms are employed:

CI Cephalic index: (HW/HL) (100).
 EL Male only: maximum length of compound eye in lateral view.
 EW Male only: maximum width of compound eye in lateral view.
 FI Femoral Index: (HFW/HFL) (100).
 HFL Hind femur length, greatest length along dorsal margin, base to apex.
 HFW Hind femur width, measured perpendicular to HFL
 HL With head in full face view, the maximum length from anteriormost margin of clypeus (the thin lamelliform clypeal apron) to vertexal margin.
 HW Worker and queen: with head in full face view, the maximum width, exclusive of eyes; male HW measured *across* eyes.
 IOD Male only: The minimum distance between the inner margins of the posterior ocelli.
 OD Male only: The transverse diameter of the anterior ocellus.
 OI Ocular index: (EL/HL) (100).

- OMD The distance between the lower margin of the compound eye and the base of the mandible, measured in lateral view.
 OOD Male only: The minimum distance between the outer margin of a posterior ocellus and the adjacent inner margin of the compound eye.
 OVD Male only: With the head in frontal view, the shortest distance between either posterior ocellus and the preoccipital margin.
 PL Petiole length as defined above.
 PPL Postpetiole length, using the same criteria as for PL.
 PPW Maximum width of postpetiole in dorsal view.
 PW Petiole width in dorsal view.
 SI Scape index: (SL/HL) (100).
 SL Maximum length of scape, exclusive of basal condyle.
 WL Diagonal length of mesosoma in profile, from anterior declivity of pronotum (exclusive of pronotal "neck") to apex of propodeal lobe

MAPS

An attempt has been made to produce range maps, which are as accurate as possible. All maps were produced with the "shareware" mapping program Versamap, available at Versamap.com. For localities that did not contain coordinate data but were a known distance from a known locality the program Geocalc was used to determine the correct coordinates of the site. Geocalc is available from Victor Fraenckel (victorf@windreader.com).

NEIVAMYRMEX: KEY TO MALES

- | | | |
|------|---|---------------------|
| 1 | Vertex concave in profile and preoccipital margin raised and collar-like (Figs. 101, 111) | 2 |
| -- | Vertex flat or low-convex and preoccipital margin not collar-like (Fig. 98, 107, 109) ... | 3 |
| 2(1) | Inner margin of mandible moderately convex at midlength (Fig. 110); paramere narrowly rounded at apex (Fig. 135) | <i>pilosus</i> |
| -- | Inner margin of mandible straight or weakly convex at midlength (Fig. 100); paramere blunt and broadly truncate at apex (Fig. 127) | <i>mandibularis</i> |
| 3(1) | Mandible strongly curved, rapidly tapering to acute apex (Figs. 94, 95, 102, 104) | 4 |
| -- | Mandible blade straight or weakly curved, sometimes parallel-sided (Figs. 96, 97, 106, 108) | 12 |
| 4(3) | Larger species, HW at least 2.0 mm | 5 |
| -- | Smaller species, HW less than 2.0 mm | 6 |
| 5(4) | ML subequal to EL; OD less than 2.5 x OOD (Fig. 94); paramere with rectangular dorsal process and triangular ventral process (Fig. 124) | <i>andrei</i> |
| -- | ML greater than EL; OD more than 2.7 x OOD; paramere broadly rounded with shallow dorsal concavity (Fig. 136) | <i>swainsonii</i> |
| 6(4) | Apicodorsal process of aedeagus broad and beak-like, extending beyond apicoventral process in lateral view (Fig. 114, 115) | 7 |
| -- | Apicodorsal process of aedeagus not beak-like, not extending beyond apicoventral process (Fig. 113, 116) | 8 |

- 7(6) Larger species, HW at least 1.5mm; pilosity of body appressed; volsella with apical fork *fuscipennis*
 -- Smaller species, MHW not over 1.2mm; pilosity of body consisting of long sparse suberect to erect hairs; volsella without apical fork (Fig. 139) *melshaemeri*
- 8(6) Ocelli small, OOD equaling or exceeding OD (Fig. 102, 103) 9
 -- Ocelli larger, OOD not more than 0.30× OD (Fig 104, 105) *minor*
- 9(8) Head in frontal view without prominent dorsolateral angles (Figs. 96, 97, 102, 104, 106, 108, 112, 109); volsella with apical fork (Figs 140, 141, 142, 143) 10
 -- Head in frontal view with prominent dorsolateral angles (Fig 95); volsella without apical fork *baylora*
- 10(9) Head and mesosoma black, gaster reddish brown (Arizona, California, Baja California). 11
 -- Head and entire body dark charcoal gray (Arizona) *microps*
- 11(10) Very small species, HW less than 1.0 mm; head and mesosoma blackish brown, gastral segments 1-2 mostly brown, merging into more reddish distal segments; posterior margin of head concave, preoccipital margin forming low upturned collar; first two gastral terga brownish, following segments more distinctly reddish (Arizona) *ndeh*
 -- Larger species, HW over 1.3 mm; posterior margin of head broadly convex; preoccipital margin inconspicuous, forming a small ridge or lip; gaster uniformly reddish brown (California, Baja California) *mojave*
- 12(3) OOD exceeding OD, usually at least 2.0× OD 13
 -- OOD no more than about 0.5× OD, usually less (Fig. 104, 105) *harrisi*
- 13(12) Distal 0.66 of mandible slightly convex along inner margin, usually wider than base, apex narrow and slightly pointed (Figs. 106, 108, 112,) 14
 -- Distal 0.66 of mandible no wider than base and apex usually blunt (Figs. 96, 97) 15
- 14(13) Frons, on each side, prominently swollen above antennal fossa (Figs. 106, 107); proximal flange on ventral margin of paramere complete (Fig. 133) *nigrescens*
 -- Frons not swollen above antennal fossa; (Figs, 108, 109); proximal flange on ventral margin of paramere incomplete (Fig. 134) *opacithorax*
- 15(13) Mandible evenly tapering to broadly rounded tip (Fig 96, 97); paramere without prominent apicodorsal process (Fig 125, 126) 16
 -- Mandible about equally wide for most of its length, abruptly narrower near apex (Fig. 112); paramere with prominent apicodorsal process, small sharp hooked tooth at tip of apicodorsal process (Fig. 137) *texanus*
- 16(15) Larger species maximum HW ca 1.75 mm; scape approximately parallel-sided, 3× longer than broad (Fig. 96) *carolinensis*
 -- Smaller species, HW not over 1.5 mm; scape approximately pyriform, 2× longer than broad (Fig. 97, 99) *kiowapache*

NEIVAMYRMEX: KEY TO WORKERS

1	Eye present as a distinct convex facet.....	2
--	Eye absent (pigmented eye-spot may be present)	14
2(1)	Suture between promesonotum and mesepisternum incomplete or absent (Fig.32-49) ...	3
--	Suture present and complete between promesonotum and mesepisternum (Fig. 31).....	
	<i>agilis</i>
3(2)	Concave portion of preoccipital margin not distinctly wider than greatest width of pronotum (dorsal view) and strongly tapered, neck-like in appearance and vertex without prominent dorsolateral angles (Figs. 13a-c, 28).....	4
--	Concave portion of preoccipital margin as wide as or wider than greatest width of pronotum; vertex strongly developed dorsolaterally, angulate or not (Figs. 27, 29, 30)....	
	6
4(3)	Subpetiolar process a prominent posteriorly directed spine; color variable black to brown or bicolored	5
--	Subpetiolar process absent or present as a small anteriorly directed tooth; usually bicolored, red and black, but if all black, then mesonotum distinctly granulate	<i>melanocephalus</i>
5(4)	Mesonotum strongly convex in profile and posterior face of propodeum about as long as dorsal face (Fig. 44); color uniformly brownish to blackish	<i>pilosus</i>
--	Mesonotum weakly convex in profile and posterior face of propodeum distinctly shorter than dorsal face (Fig. 35); color uniformly reddish	<i>graciellae</i>
6(3)	Petiole node in dorsal view less than 1.2× longer than broad (Figs. 63, 66, 67).....	7
--	Petiole node in dorsal view at least 1.2× longer than broad (Figs. 62, 69)	10
7(6)	Head and body dull, coarsely granulopunctate	<i>rugulosus</i>
--	Head and body smooth and shiny	8
8(7)	Dorsal and lateral surfaces of petiole and postpetiole smooth and shiny, coarse punctures may be present but scattered; dorsolateral corners of head weakly developed, slightly rounded	9
--	Dorsal and lateral surfaces of petiole and postpetiole strongly granulate; dorsolateral corners of head well developed and angulate	<i>harrisi</i>
9(8)	Cephalic punctures in middle of frons fine, separated by 2 PD or more; HF 5.15× longer than thick	<i>carolinensis</i> (part)
--	Cephalic punctures coarser, 1.2-1.7 PD apart in middle of frons; HF 4.4× longer than thick	<i>kiowapache</i> (part)
10(6)	Head smooth and shiny between scattered fine piligerous punctures	11
--	Head distinctly sculptured and roughened, often appearing granulopunctate.....	13
11(10)	Inner basal margin of mandible evenly curved into masticatory margin, without tooth or sharp angle at juncture (Fig. 18); pronotal sculpture variable, but side of pronotum usually at least weakly reticulate-punctate rather than exhibiting a smooth shiny surface that contrasts with the sculptured mesosoma dorsum	12

- Inner basal margin of mandible straight, with distinct tooth or sharp angle at juncture with masticatory margin (Fig. 20); side of pronotum usually smooth and shiny, and contrasting with the rugulose-punctate sculpture that covers at least part of the mesosoma dorsum *opacithorax*
- 12(10) Dorsal face of propodeum distinctly depressed below level of mesonotum (Fig. 41); metafemur 6.4× longer than greatest thickness (Fig. 92) *nigrescens* (part)
- Dorsal face of propodeum not distinctly depressed (Fig. 32); metafemur 6.2× longer than greatest thickness (Fig. 88) *californicus*
- 13(10) Posterior face of propodeum slightly concave in profile and distinctly angulate at juncture with dorsal face angulate (angle may be indistinct in small specimens) (Fig. 47); petiole relatively short and high; surface of most of the metapleural gland bulla densely punctate and opaque, sometimes with a very small, thin shiny strip above the flange of the metapleural gland orifice *texanus*
- Posterior face of propodeum not concave in profile and rounded into juncture with dorsal face (Fig. 41); petiole height lower; sculpture on surface of metapleural bulla becoming obsolete, lower half or more is smooth (or weakly reticulate) and conspicuously shiny *nigrescens* (part)
- 14(1) Petiole with anteroventral tooth 15
- Petiole without anteroventral tooth 16
- 15(14) Petiole tooth well developed and with posteriorly directed spine; hind femur at least 4× longer than thick; subantennal lamella absent or poorly developed (Fig. 25) ... *swainsonii*
- Petiole tooth small, lacking posteriorly directed spine (Fig. 77); hind femur very short and robust, 3.4× longer than thick (Fig. 90); subantennal lamella distinct (Fig. 4) *goyahkla*
- 16(14) Basal (innermost) mandibular tooth not conspicuously enlarged relative to remaining teeth (Figs. 23-25) 17
- Basal mandibular tooth greatly enlarged relative to remaining teeth (Fig. 22) *moseri*
- 17(16) Petiole node no longer than broad or only slightly so (Fig. 71) 18
- Petiole node distinctly longer than broad (Figs. 68, 69, 70) 19
- 18(17) Broad lamella present below antennal fossa (Fig. 26); head shiny between scattered distinct punctures *leonardi*
- Without lamella below antennal fossa (Fig. 24, 25); head shiny, with only scattered minute and indistinct piligerous punctures *pauillus*
- 19(17) Antennal scape short and stout, not evenly tapered basad (Fig. 7, 8, 16) 20
- Antennal scape long and slender (about 3× as long as broad) (Fig. 11), gradually tapered basad *nyensis*
- 20(19) Subantennal lamella well developed (Fig. 8, 16, 26) 21
- Subantennal lamella absent or greatly reduced (Fig. 3, 7) 22
- 21(20) Mesosomal dorsum smooth and shiny (Fig. 54) *microps*
- Mesosomal dorsum distinctly sculptured (Fig. 61), slightly shiny *wilsoni*

- 22(20) Cephalic punctures in middle of frons fine, separated by 2 PD or more; HF 5.15× longer than thick *carolinensis* (part)
 -- Cephalic punctures coarse 1.2-1.7 PD apart in middle of frons; HF 4.43× longer than thick *kiowapache* (part)

Neivamyrmex agilis Borgmeier
 Figures 1a-b, 17, 31, 49

Eciton (Acamatus) cocula Mann, 1925: 77 (w). Nomen nudum.

Neivamyrmex agilis Borgmeier, 1953: 45 (w). **MEXICO**, Chihuahua, Río Santa María (MCZC). Borgmeier, 1955: 406-407 (w). Watkins, 1976: 17. Watkins, 1982: 211; pl. 8, fig. 8 (w). Watkins, 1985: 482 (w). MacKay & MacKay, 2002: 47.

DISTRIBUTION (Map 2)

UNITED STATES: Arizona, New Mexico; **MEXICO:** Chihuahua, Jalisco (Watkins, 1982).

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Cochise Co.: 0.5 mi. S. Paradise 5500' (LACM); 13.84 mi. E Coronado National Monument (31.36°N 110.51°W) (GCSC, LACM). *Santa Cruz Co.:* 1 mi. SE Peña Blanca Lake, 3950', under rock (ARSU, GCSC). *Gila Co.:* Hwy. 77, 12.1 mi. N Globe @ 0.8 mi. W Hwy 77 (33.55°N 110.68°W), 4920' (GCSC, LACM, RAJC). **NEW MEXICO, Grant Co.:** 3 mi. S. I-10 3.8 mi. E. Separ I-10, in *Pogonomyrmex rugosus* nest (ARSU, GCSC, MCZC).

DISCUSSION

A seldom collected species, *N. agilis* is known from only a handful of records. Until now known only from the area around Paradise Arizona, we take this opportunity to present new locality records for this species.

The male and queen of this species are so far unknown, but we believe that *N. andrei* is the likely male.

Neivamyrmex andrei (Emery)
 Figure 94, 124

Eciton andrei Emery, 1901: 53 (m). **MEXICO** (no specific locality) (MCSN).

Eciton (Acamatus) andrei: Emery, 1910: 25.

Eciton (Acamatus) osleri Wheeler, 1908: 4 15; pl. 26, fig. 8 (m). **UNITED STATES**, Arizona, Nogales (lost ?).

Neivamyrmex andrei: Borgmeier, 1953: 7, 19. Borgmeier, 1955: 451-453 (m). Watkins, 1976: 24 (m). Watkins, 1982: 213; (m). Watkins, 1985: 484. MacKay & MacKay, 2002: 47.

DISTRIBUTION (Map 1)

UNITED STATES: New Mexico and Arizona. **MEXICO:** Colima, Nayarit, Sinaloa and Vera Cruz (Watkins, 1982).

SPECIMENS EXAMINED

We have 39 United States records of this rather poorly known species.

DISCUSSION

In addition to the characters cited in the key, *N. andrei* may be separated from all other known United States species, except *N. swainsonii*, by the broad front coxae (in all our other species, they are distinctly longer than broad). As noted above, we believe that *N. agilis* will prove to be the female castes of this species.

***Neivamyrmex baylori* Watkins**

Figures 95

Neivamyrmex baylori Watkins, 1973: 430-433 (m). **USA**, Texas, McLennan County, Waco (USNM) *examined*. Watkins, 1976: 27 (m). Watkins, 1985: 485 (m).

DISTRIBUTION (Map 19)

UNITED STATES, Texas

SPECIMENS EXAMINED

UNITED STATES, TEXAS, *McLennan Co.*: Waco (USNM). *Uvalde Co.*: Rio Frio River, Haven Camp, (LACM).

DISCUSSION

This species is known from only three specimens, all collected in Texas. The worker and queen of this species is unknown, but is likely to be *N. pauxillus* or, less probably, *N. moseri*.

***Neivamyrmex californicus* (Mayr)**

Figures 2, 18, 32, 62, 75, 88

Eciton californicum Mayr, 1870: 969 (w). **USA**, California, San Francisco (NHMV). **Lectotype** designated by Ward, 1999: 76

Eciton (Labidus) californicum: Mayr, 1886b: 121 (w).

Eciton (Acamatus) californicum: Emery, 1894: 184 (w). Emery, 1900: 523 (w).

Eciton (Acamatus) californicum var. *obscura* Forel, 1914a: 265 (w). **USA**, California, Vista (MHNG).

Lectotype designated by Ward, 1999: 76

Eciton (Neivamyrmex) californicum: M. R. Smith 1942: 560 (w). Creighton, 1950: 70 (w).

Neivamyrmex californicus: Borgmeier 1953: 11 (w). Borgmeier, 1955: 517-519 (w). Watkins, 1976: 15 (w). Ward, 1999 (w).

DISTRIBUTION (Map 1)

UNITED STATES, California. **MEXICO**, Baja California.

SPECIMENS EXAMINED

UNITED STATES, CALIFORNIA, *Contra Costa Co.*: 9km ENE Danville, 490m (37°51'N 121°54'W) (UCDC); *El Dorado Co.*: 14km NW Shingle Springs, 340m (38°45'N 121°02'W) (UCDC, GCSC, LACM). *Los Angeles Co.*: Arcadia (USNM); La Verne (USNM, MCZC); Los Angeles (USNM). *Orange Co.*: Laguna Hills (LACM); Tonner Canyon (WPMC). *Riverside Co.*: Riverside,

“in house” (GCSC, KWCC, LACM); Lake Skinner (UCRC0. *Santa Barbara Co.*: T5N, R28W s.17, 500m, (JTLC). *San Diego Co.*: National City (USNM); Vista (USNM); Camp Pendleton (LACM); 5mi NE Poway, 600m (UCDC); Mt. Laguna, MSP Site, 6050 ft. (LACM); Mira Mar, Elliot Reserve (32.84°N 117.11°W) (JAKC). *Yolo Co.*: Davis (LACM, PENN).

MEXICO, BAJA CALIFORNIA: 28 km E Ensenada, 750m (31°53'N 116°18'W) (UCDC); San Carlos Canyon, 9.0 mi E Hwy 1,300 ft., mesic canyon bottom, sifted from litter (31°47.88'N 116°30.05'W) (ARSU).

DISCUSSION

The male form of this ant is unknown. This species appears to be primarily an ant of montane and foothill areas. Previously believed to occur only in California, recent extensive collection in Baja California has located this species there. All previous out of state records believed to apply to this species have proven to refer to the recently recognized shiny headed form of *N. nigrescens* (Ward 1999). Watkins (1972) described what he believed was the queen of *N. californicus*, however recent reexamination of the specimen in question (Ward, 1999) has led to the conclusion that it too is a representative of the shiny form of *N. nigrescens*.

Little is known about the feeding preferences of this species other than that it presumably attacks exclusively, or nearly so, other ant species. Ward (1999) lists the following as prey species of this ant: *Messor andrei*, *Solenopsis molesta*, *Pheidole californica* and *P. hyatti*. One of us (GCS) observed a portion of a raid on a *Solenopsis xyloni* colony; the raid was well underway when it was discovered. It was apparently a violent one with *S. xyloni* vigorously defending its nest. Whether or not the raid was successful from the standpoint of *N. californicus* is unknown but the ground was littered with dead and dying of both species.

Automontage images of *N. californicus* may be viewed at antweb.org.

The wingless phorid fly, *Xanionotum hystrix* Brues (Diptera: Phoridae), has been associated with a colony of *N. californicus* collected in San Diego County, California (J. H. Hunt, *pers. comm.*).

Neivamyrmex carolinensis (Emery)

Figures 3, 19, 33, 63, 76, 89, 96, 113, 125

Eciton (Acamatus) carolinense Emery, 1894: 184 (w). **USA**, North Carolina, Belmont (MCSN); syntypes in MCZC, AMNH; **examined**.

Eciton (Neivamyrmex) carolinense: M. R. Smith, 1942: 564 (w).

Neivamyrmex carolinensis: Borgmeier, 1953: 6 (w).

DISTRIBUTION (Map 1)

UNITED STATES: Virginia and North Carolina south to Florida, west to Tennessee and Louisiana.

SPECIMENS EXAMINED

UNITED STATES, ALABAMA, Tuscaloosa Co.: Bryce Lake, University of Alabama (MCZC); Hurricane Creek nr. Peterson (MCZC). **FLORIDA, Alachua Co.:** Gainesville (UMICH); Gainesville, San Felasco Hammock State Preserve, sandhill/xeric Oak Hammock, at base of dead Turkey Oak (GCSC, LACM). *Lake Co.:* Astatula, Jct S.R. 561 & 48, Sand Pine/Rosemary Scrub, at base of dead sand pine (GCSC, LACM). *Citrus Co.:* Withlacoochee State Forest, 1/2 mi S. of S. R. 44, in sand next to *Pheidole morrissi* colony (GCSC, LACM). *Marion Co.:* 3.5 mi E Dunnellon, Pine Oaks Estates, (CLMC). *Volusia Co.:* Orange City, Blus Spring St. Park, ex pitfall trap in Sand Pine/Oak Scrub (GCSC, LACM). **GEORGIA, Fulton Co.:** Atlanta, ex oak stump (MCZC). *Putnam*

Co.: Oconee National Forest (SEMC, WPMC). *Rabun Co.*: Clayton, 2000-3700' (MCZC). KENTUCKY, *Edmonton Co.*: Mammoth Cave Nat. Park, Bruce Hollow, ex long/stump litter (MCZC). MISSISSIPPI, *Hinds Co.*: Taylorsville (LACM). *Lowndes Co.*: Columbus (CASC). *Monroe Co.*: Aberdeen (CASC, CORN). *Oktibbeha Co.*: A & M College (MINN, PENN). ORTH CAROLINA: *Burk Co.*: 4 - XI- 1957 (Scott; MCZC). SOUTH CAROLINA, *Greenville Co.*: Greenville (LACM). *Oconee Co.*: Clemson College (MCZC). TENNESSEE, *Blount Co.*: Cades Cove (LACM). *Knox Co.*: University of Tennessee Farm (LACM).

DISCUSSION

Neivamyrmex carolinensis is a wide ranging eastern species. Long considered to extend into the central and western United States as far as Arizona, it is now known that the populations west of the Mississippi River belong to a hitherto unrecognized sibling species. That species is described below as *N. kiowapache*. We are unable to confirm the presence of this species in Nebraska and Ohio (M. R. Smith, 1942) nor have we seen any specimens from Louisiana.

This species is unusual among our species of *Neivamyrmex*, in that the presence of a distinct eye facet is variable, present in some individuals, absent in others. Generally, a facet is present in larger individuals, but even this is subject to variation. This feature is shared with its sister species, *N. kiowapache*.

Automontage images of this ant may be viewed at antweb.org

Neivamyrmex fuscipennis (M. R. Smith)

Figure 114

Eciton (Acamatus) spoliator: Wheeler, 1908: 416-417 (m). **Misidentification**

“*Acamatus fuscipennis* Cresson”: Wheeler, 1908: 417 (m). **Nomen nudum.**

Eciton (Neivamyrmex) fuscipennis M. R. Smith, 1942: 578 (m). USA: Texas (Belfrage) (USNM) **examined.**

Neivamyrmex fuscipennis: Borgmeier, 1953: 18. Borgmeier, 1955: 642. Watkins, 1975: 85-90.

Neivamyrmex macropterus Borgmeier, 1953: 40 (m). **MEXICO**, Durango, Lerdo (USNM). Borgmeier, 1955: 645-646 (m). Watkins, 1975: 85-90. **NEW SYNONYMY.**

DISTRIBUTION (Map 3)

UNITED STATES: Texas and Kansas, west to Arizona, south to **Mexico** (Morelos and San Luis Potosí).

MATERIAL EXAMINED

UNITED STATES, ARIZONA, *Cochise Co.*: SWRS. 5 mi. W. Portal, 5400' (LACM, UNAR, USNM); Herb Martyr Dam, Chiricahua Mtns. (UNAR.); near Portal (SEMC). *Santa Cruz Co.*: Madera Canyon, 4880' (LACM). KANSAS *Stevens Co.*: Hugoton (SEMC). TEXAS, *Jeff Davis Co.*: Ft. Davis Resort, 5800' (LACM). *Presidio Co.*: 40 mi. ESE Presidio, at UV light (UNAR). *Rusk Co.*: Henderson (TAMU).

MEXICO, MORELOS: 10 mi N Cuernavaca (UCDC).

DISCUSSION

As Creighton (1950) had pointed out, the authorship of this species has been confused. Wheeler (1908) recorded two male specimens from an unspecified locality in Texas as *Eciton (Acamatus) spoliator* Forel, 1899, a species originally described from Costa Rica. He provided a translation of

Forel's species and a figure that was clearly based on one of the Texas males. Wheeler further noted that the specimens bore an unpublished Cresson name, *Acamatus fuscipennis*.

M. R. Smith (1942) correctly recognized that the Texas specimens were not the same as Forel's species and redescribed the two males as *Eciton (Neivamyrmex) fuscipennis*, attributing the species authorship to Wheeler (1908). Subsequent authors have followed Smith's lead in awarding authorship to Wheeler. D. R. Smith (1979), however, determined that the correct author for *N. fuscipennis* should be M. R. Smith, 1942. Watkins (1975) concurred and selected one of the Texas males as lectotype.

Borgmeier (1953, 1955) noted the similarities between his new species, *N. macropterus*, described from Mexico, and *N. fuscipennis*, but cited relatively larger ocelli and wings as distinguishing features for *N. macropterus*. Watkins (1975) took up the matter and, after examining more than 50 males from 9 localities found that the differences in eye length and wing length cited by Borgmeier were unreliable. He did conclude that, in *N. fuscipennis* the distance between the lateral ocellus and the margin of the compound eye was slightly greater than in *N. macropterus*. He further noted that this difference could be determined in many specimens only by careful, precise measurements. His final determination was that the two species are so closely related that they could not be reliably separated, especially in specimens from intermediate localities.

According to Watkins (1985) in *N. fuscipennis* the "distance from the lateral ocellus to the compound eye was usually about one-half diameter of median ocellus" vs. "about one-fourth (or less)" in *N. macropterus*. We have found that when males are so positioned that the appropriate measurements of anterior ocellus and of the distance between the compound eye and the nearest lateral ocellus are uniform these differences between the two supposed taxa disappear. Accordingly we here treat *N. macropterus* as a synonym of *N. fuscipennis*.

Neivamyrmex goyahkla, new species

Figures 4, 34, 50, 64, 77, 90

DIAGNOSIS

Worker: Eye spot present; head distinctly longer than broad, sides weakly convex in frontal view and upper margin narrowly rounded onto vertex margin; front of head smooth and shiny between scattered minute punctures; antennal scape 3.5 x longer than broad; mesosomal dorsum smooth and shiny, with widely scattered small punctures; petiole longer than broad in dorsal view, sides approximately parallel; node evenly rounded in profile and dorsum smooth and shiny; subpetiolar tooth small but distinct; postpetiole broader than long, disc smooth and shiny. **Queen and male** unknown.

DESCRIPTION

Worker measurements (mm) ($n = 12$). HL 0.45-0.72 (0.64); HW 0.34-0.61 (0.54); SL .25-0.36 (0.33); SW 0.08-0.13 (0.095); PW 0.12-0.20 (0.196); PL 0.14-0.25 (0.24); Ppl 0.10-0.20 (0.19); Ppw 0.15-0.28 (0.25); HFL (0.48); HFW (0.14). **Indices.** CI 72-85 (85); FI 26-33 (31); SI 45-57 (51.5).

Head: distinctly longer than broad; sides weakly convex in frontal view; upper margin narrowly rounded onto vertex margin; preoccipital carina sharply angulate laterad. Small yellow eye spot present. Front of head smooth and shiny and with scattered minute punctures. Subantennal lamina well-developed. Mandible triangular, junction of upper and masticatory margins rounded, small peg-like tooth present on basal margin; outer surface with fine longitudinal rugulae. Antennal scape 3.5 x longer than broad, evenly tapering toward base.

Mesosoma: dorsum smooth and shiny, with widely scattered small punctures. Promesonotal suture indistinct to absent; metanotal suture distinct across dorsum. Dorsal face of propodeum about as long as declivitous face, shiny between scattered fine punctures; declivitous face straight to slightly concave in profile.

Petiole longer than broad in dorsal view, sides approximately parallel; node evenly rounded in profile; subpetiolar tooth small but distinct; dorsum smooth and shiny. Postpetiole broader than long, disc smooth and shiny.

Gaster smooth and shiny between scattered fine punctures.

Pilosity about as usual for the genus, consisting of sparse hairs of highly variable length, from short to long.

TYPE DATA

Holotype and numerous **paratypes**: U.S.A., Arizona, Santa Cruz Co., Ruby Road, 6.7 mi west of I-19, 6 April 1998 (R. A. Johnson & G. C. Snelling). Holotype and most paratypes in LACM; paratypes also in ARSU, BMNH, CASC, MCZC, UCDC, USNM.

ETYMOLOGY

This species is named for Goyahkla, the Bedonkohe Chiricahua Apache war leader more widely known by his Spanish name, Geronimo. It is most easily pronounced “Goyák lay”.

DISTRIBUTION (Map 6)

Presently known only from south-central Arizona.

DISCUSSION

In addition to the type series, we have examined a few specimens from Arizona, Cochise Co.: Chiricahua Mountains, 2 August 1954, collected by A. C. Cole, Jr. (LACM).

This small shiny yellow species is similar to *N. leonardi* and *N. nyensis*, but is easily separated from those species by the presence of a small but distinct subpetiolar tooth. It is further distinguished from *N. leonardi* by the mandibular structure.

The type series was discovered while overturning rocks in the late afternoon. A small number of workers were present under the rock, and a more detailed search of the area located a fairly strong column of ants trailing across the soil. Although they made use of cover as much as possible a good percentage of the column was exposed on the surface. The column was followed for approximately thirty feet before it was finally lost. It is unknown if this was a raiding or emigration column but since no brood was observed our assumption is that this was the beginning of a raid.

Neivamyrmex graciellae (Mann)

Figures 5a-b, 35, 51, 65, 78

Eciton gracellae Mann, 1926: 97 (w). **MEXICO**, JALISCO, Ototonilco (USNM) *examined*.

Neivamyrmex graciellae: Borgmeier, 1953: 10. *Emendation*. Borgmeier, 1955: 388-389 (w). Watkins & Coody, 1986: 257 (q).

DISTRIBUTION (Map 3)

UNITED STATES: Arizona. **MEXICO**: Jalisco, Oaxaca.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, *Santa Cruz Co.*, Florida Canyon, Santa Rita Mts. (LACM, GCSC).

MEXICO, JALISCO, Chamela Biological Station (USNM); Ototonilco (USNM). OAXACA, 13 mi NW Oaxaca, 5500 ft. (LACM).

DISCUSSION

This species has not been previously recorded from the United States. Its discovery in southern Arizona raises the possibility that this species, rather than *N. melanocephalus*, might be the worker caste of *N. mandibularis*. The question cannot now be resolved.

Neivamyrmex halidaii (Shuckard)

Labidus latreillii: Haliday, 1836: 328 (m). **Misidentification**

Labidus halidaii Shuckard, 1840: 200. **BRAZIL**, São Paulo (BMNH).

Eciton halidayi: Dalla Torre, 1893: 3. Erroneous spelling by Dalla Torre and most subsequent authors.

Labidus gravenhorstii Westwood, 1842: 76 (m). **BRAZIL**, Goiás, Rio Vendhina.

Labidus amplipennis F. Smith, 1859: 6 (m). **COLOMBIA**, Bogotá (BMNH).

Eciton (Acamatus) Le Moulti Santschi, 1912: 524 (m). **FRENCH GUYANA**, St. Laurent de Maroni (Basel)

Eciton (Acamatus) colombi Santschi, 1921: 94 (m). **COLOMBIA**, Bogotá (Basel)

Eciton (Labidus) frontalis Menozzi, 1924: 29 (m). **BRAZIL**,

Woitkowskia mexicana E. Enzmann, 1952: 445 (m). **MEXICO**, Chiapas, Tuxtla Gutierrez (type lost ?).

NEW SYNONYMY

Neivamyrmex halidaii: Borgmeier, 1953: 12, 15, 18 (m). Bolton, 1995: 289.

Neivamyrmex amplipennis: Borgmeier, 1953: 17.

Neivamyrmex halidaii lemoulti: Borgmeier, 1953: 14.

Neivamyrmex colombi: Borgmeier, 1953: 13.

Neivamyrmex frontalis: Borgmeier, 1953: 11.

Neivamyrmex halidayi: Borgmeier, 1955: 437-445 (m). Watkins, 1982: 212. Watkins, 1990:381.

DISTRIBUTION

MEXICO: Vera Cruz and Oaxaca to Chiapas (Watkins, 1982), south to **BOLIVIA** and northern **ARGENTINA**.

DISCUSSION

The genus *Woitkowskia* was described by Enzmann (1952) for two neotropical species. It was synonymized by Borgmeier (1955) with *Neivamyrmex* and its type species, *W. connectens* Enzmann, synonymized with *N. walkeri* (Westwood, 1842); the status of *W. mexicana* Enzmann, 1952, was left unresolved. As the name implies, *W. mexicana* was described from a single male from Tuxtla Gutierrez, Chiapas, Mexico; the present location of the type is unknown. Despite its verbosity the original description is mostly worthless and the accompanying figures are inept. It is not surprising that subsequent workers have largely avoided dealing with this taxon. Watkins, in his several papers on North American *Neivamyrmex* ignored this species altogether. Bolton (1995) merely noted that Enzmann's name was an unresolved junior secondary homonym of *N. mexicanus* (F. Smith, 1859).

Worthless as Enzmann's description and figure of *W. mexicana* appear to be, it is possible to match them to males of *N. halidaii*, a species that is common at the type locality of *W. mexicana*. Accordingly we have synonymized that name here because there appears to be no reason not to do so. Unless the type is some day located and proven not to be a synonym of *N. hallidaii*, this seems the best way to deal with Enzmann's name.

***Neivamyrmex harrisii* (Haldemann)**

Figures 6, 20, 36, 66, 79

Labidus harrisii Haldemann, 1852: 367 (m). **USA:** Texas, Fort Gates (no types known to exist).

Eciton (Labidus) harrisi: Mayr, 1886c: 441.

Eciton harrisi: Forel, 1899: 28 (m).

Eciton (Acamatus) harrisi: Emery, 1900: 515; fig. 18.

Eciton wheeleri Emery, 1901: 55, fig. 8 (w). **USA:** Texas, Hays Co. (MCSN).

Eciton (Acamatus) wheeleri: Wheeler, 1908: 412.

Eciton (Acamatus) wheeleri subsp. *dubia* Creighton, 1932: 75-77 (w, q). **U.S.A.**, Texas, 5 mi W Ft. Worth (AMNH?).

Eciton (Neivamyrmex) wheeleri: M. R. Smith, 1942: 561. Creighton, 1950: 76.

Eciton (Neivamyrmex) harrisii: M. R. Smith, 1942: 572. Creighton, 1950: 72.

Neivamyrmex wheeleri: Borgmeier, 1953: 6. 1955: 511-514; (q, w).

Neivamyrmex harrisii: Borgmeier, 1955: 522-524. Watkins, 1968: 275.

DISTRIBUTION (Map 13)

UNITED STATES: Oklahoma and Texas, west to Arizona; **MEXICO:** border states south at least to Colima in the east and Nayarit in the west.

SPECIMENS EXAMINED

We have studied 141 samples of this common species from the United States and Mexico.

DISCUSSION

M. R. Smith (1942) opined that *N. wheeleri* represented the female castes of *N. harrisii*. This suspected synonymy was confirmed by Watkins (1968).

Males of this common species are regularly collected at lights. They are superficially similar to those of *N. andrei* but the mandibular shape and the large ocelli will serve to separate them from that species.

***Neivamyrmex kiowapache*, new species**

Figures 7, 21, 37, 52, 67, 91, 93, 97-99, 126, 138

Neivamyrmex carolinensis: Borgmeier, 1955: 507-511. **Misidentification**, in part. Watkins, 1976: 16, 27.

Misidentification, in part. Watkins, 1985: 483, 485. **Misidentification**, in part. MacKay *et al.*, 1985: 611 **Misidentification** MacKay & MacKay, 2002: 43, 45, 48, (w, m). **Misidentification**

DIAGNOSIS

Worker: Eye lens present or replaced by eye spot; head slightly longer than broad; antennal scape barely exceeding level of eye spot; mesosomal dorsum subopaque to opaque; pronotal disc

coarsely punctate between weak longitudinal rugae; pronotal side smooth and shiny; petiole in dorsal view slightly longer than broad, dorsal node weakly sculptured and shiny; postpetiole about as long as broad in dorsal view, disc smooth and shiny.

Queen: Color pale yellow, Head about as broad as long; distinct yellow eyes spot present; preoccipital lobes rounded; clypeal margin straight but slightly concave in middle; Scape thickened distally, not reaching eye level; subantennal lamella absent. Dorsal surface of propodeum longer than declining face, smooth and shining with widely scattered coarse punctures.. Petiole approximately twice as broad as long, posterolateral corners of petiole well developed and angulate.

Male: Head less than 1.5mm wide measured across eyes; smooth and shiny with scattered small punctures; OOD at least 1.5 x OD. Mandible blade-shaped, approximately parallel-sided and tapering to blunt tip.

DESCRIPTION

Worker, measurements (mm) ($n = 12$): HW 0.45-0.81 (0.79); HL 0.55-0.83 (0.82); SL 0.28-0.51 (0.51); SW 0.08-0.16 (0.16); PW 0.18-0.25 (0.25); PL 0.165-0.28 (0.28); PpL 0.19-0.29 (0.28); PpW 0.21-0.29 (0.29); HFL 0.40-0.74 (0.71); HFW 0.11-0.21 (0.16). *Indices:* CI 87-100 (96); FI 21-27 (23); SI 51-62 (63).

Head: slightly longer than broad, sides weakly convex in frontal view and narrowing above; vertex corners rounded and preoccipital carina weakly developed at angle. Front of head shiny between scattered fine punctures; yellow eye spot present. Antennal scape barely exceeding level of eye spot, about 3.2 x longer than wide. Subantennal lamella prominent across median 0.33 of antennal fossa. Mandible triangular, upper margin acutely angulate at juncture with masticatory margin, latter with three or more small indistinct teeth, but tooth at juncture distinct.

Mesosoma: dorsum sub-opaque to opaque, pronotal disc coarsely punctate between weak longitudinal rugae; pronotal side smooth and shiny. Promesonotal suture indistinct; promesonotum slightly convex in profile, disc moderately shiny, with sparse coarse punctures, interspaces weakly to moderately sculptured. Propodeum slightly depressed below mesonotum, disc and sides granulate; dorsal face about as long as slightly concave declivitous face.

Petiole in dorsal view slightly longer than broad, dorsal face lightly granulate and shiny, sides weakly longitudinally striate, shiny; subpetiolar tooth minute. Postpetiole about as long as broad in dorsal view, smooth and shiny.

Gaster smooth and shiny, with abundant long semi-erect hairs.

Queen, measurements (mm) ($n = 8$): HW 1.21-1.26; HL 1.16-1.24; SL 0.47-0.54; SW 0.18-0.22; PW 0.61-0.68; ML 0.57-0.64. *Indices:* CI 105; SI 46.

Head a little broader than long, sides convex in frontal view and dorsolateral corners rounded; front of head smooth and shiny between numerous small punctures. Clypeal free margin mostly straight, but slightly concave in middle. Mandible blade-shaped, about half as long as head, with strong convexity at midpoint of inner margin, tapering to sharp apex. Scape thickened distally, not reaching level of eye-spot. Frontal carinae low and rounded; frons with deep median groove from base of clypeus to about level of eye-spot. Subantennal lamella absent.

Mesosoma. Pronotum rounded anteriorly in dorsal view; promesonotal suture indistinct; promesonotum in side view arched, but mesonotum slightly concave; metanotal suture distinct; all segments smooth and shiny. Dorsal face of propodeum longer than declivitous face, smooth and shiny between scattered coarse punctures.

Petiole smooth and shiny, about twice as wide as long; posterolateral corners well developed and angulate; subpetiolar process well-developed and triangular in profile.

Gaster smooth and shiny.

Pilosity of head consisting of scattered long erect hairs among more numerous shorter curved hairs; anterior margin of pronotum with scattered curled hairs among more numerous shorter erect hairs; gastral terga 1-4 with hairs along posterior margins, segment 5 with short hairs over entire surface.

Color uniformly pale yellow.

Male, measurements (mm) ($n = 2$): HW 1.1-1.3; HL 0.79-0.81; ML 0.15-0.17; SL 0.42-0.45; SW 0.18-0.22; EL 0.50-0.54 (0.54); EW 0.37-0.44; OD 0.16-0.18; OOD 0.26-0.29; IOD 0.34; OMD 0.07-0.12; PW 1.135. **Indices:** CI 150 SI 36

Head about twice as wide as long, dorsolateral corners rounded into preoccipital margin, not projecting; frons smooth and shiny; surface between lateral ocelli flat. Free margin of clypeus slightly concave. Frontal carinae sharp below, becoming rounded above, curving lateral to form moderate swelling above antennal fossae; frontal area with deep elongate groove. Mandible blade-shaped, approximately parallel-sided and tapering to blunt tip. Scape somewhat pyriform.

Mesosomal dorsum with dense fine punctures and widely scattered coarser punctures, only slightly shiny; sides shiny between scattered large punctures.

Petiole about twice as wide as long, posterolateral corners broadly rounded; densely punctate and slightly shiny.

Gaster: segments slightly shiny between dense fine punctures. Subgenital plate shovel-like, with strongly convex sides, lateral teeth large, median tooth broadly triangular. Paramere blade-shaped in profile, sides parallel before abruptly angling to sharp narrow tip, with broad shoulder at angle. Aedeagus in profile with apically rounded posterodorsal lobe and slightly longer out-turned sharply pointed posteroventral lobe. Volsella narrow basad, becoming broader at slightly angulate preapical curve; outer face without apical tubercles; numerous hairs along ventral margin and outer face.

Color: Head, mesosoma and appendages black; gaster reddish brown; wings clear brown.

TYPE MATERIAL

Holotype and numerous **paratypes**, U.S.A., Colorado, *Jefferson Co.*, Red Rock Park, 5 May 1999 (L. Davis). Holotype and most paratypes in MCZC; paratypes in BMNH, CASC, LACM, LDPC, UCDC, USNM.

ADDITIONAL SPECIMENS EXAMINED (not types)

UNITED STATES, ARIZONA, *Cochise Co.*: Cochise Stronghold, Dragoon Mts. (WPMC); 1.8 mi S Southwest Research Station, Chiricahua Mts. (ASUC, LACM). *Gila Co.*: Hwy. 288 @ Honey Creek Divide, Sierra Ancha (ASUC, LACM). *Navajo Co.*: Hwy. 60 @ Corduroy Creek (ASUC, LACM). *Santa Cruz Co.*: Madera Cyn. (LACM). *Yavapai Co.*: Yarnell (ASUC). **KANSAS**, *Pottawatomie Co.*: Little Gobi Desert (BPBM). *Riley Co.*: Kansas Hill (USNM); N of Tuttle Creek Dam (Bill Clark, LACM); . *Wallace Co.*: 10 mi N, 14 mi W Sharon Spring (LACM, Bill Clark). **NEW MEXICO**, *Mora Co.*: 12 km N Wagon Mound (TAMU). *Taos Co.*: 14 km S Tres Piedras (WPMC). **TEXAS**, *Sabine Co.*: 14.5 km E Hemphill (WPMC).

ETYMOLOGY

The name is derived from a combination of the names of two great Native American nations, the Kiowa of the midwestern states and the Apache of the southwestern states, a reflection of the broad distribution of this species.

DISTRIBUTION (Map 6)

UNITED STATES, Kansas and Colorado, south to Texas, west to Arizona; **MEXICO**, Chihuahua.

DISCUSSION

This is the western form that had been identified as *N. carolinensis* by previous authors. It differs from that species in the distinctly smaller size in all castes, but most notably the sexual forms. In addition to the smaller size, the males differ from those of *N. carolinensis* by the relatively shorter and broader, more strongly pyriform, antennal scape. The queen differs from that of *N. carolinensis* by its smaller size, the presence of a distinct yellow eye spot and a prominent subpetiolar process. These differences are not great, but they are consistent. That workers of *N. carolinensis* and *N. kiowapache* are very similar is without question. In view of this similarity we would be hesitant to describe the western form based solely on the worker caste. We are fortunate to have the sexual castes as well and the differences, particularly in size, are consistent and non-overlapping and non-convergent. The westernmost samples that we have seen of *N. carolinensis* (from Mississippi and Arkansas) and the easternmost samples of *N. kiowapache* (from Kansas and eastern Texas) demonstrate no tendency toward intergradation in size or other features. Therefore, for the present we recognize the western form, *N. kiowapache*, as distinct from the eastern ant, *N. carolinensis* in the absence of any evidence that they are conspecific.

Specimens from Nebraska and Louisiana were recorded by M. R. Smith (1942) as *N. carolinensis*, but we have been unable to locate these specimens and cannot comment with certainty as to their identity. Based solely on distribution, we assume that the Nebraska record will prove to be referable to *N. kiowapache*. The Louisiana record remains problematic until the specimens can be examined.

Rettenmeyer & Watkins (1978) noted the presence of multiple queens in a colony from Kansas identified as *N. carolinensis*. We have examined samples from this colony and find that they belong to *N. kiowapache*. In addition to the Kansas material cited in the paper, there were four samples from Georgia and South Carolina. We presume these samples to be true *N. carolinensis*, but were unable to examine the material during the course of this study. This phenomenon may be common, if not consistent, in both *N. carolinensis* and *N. kiowapache* judging from the number of occurrences reported.

Neivamyrmex leonardi (W. M. Wheeler)

Figures 27, 38, 53

Eciton (Acamatus) leonardi Wheeler, 1915: 392 (w). **USA**, California, Point Loma (MCZC) *examined*. *Eciton (Acamatus) peninsulare* Mann, 1926: 98 (w). **MEXICO**: Baja California [Sur], La Palma Davila (USNM) *examined*.

Eciton (Neivamyrmex) leonardi: M. R. Smith, 1942: 570 (w). Creighton, 1950: 72 (w).

Eciton (Neivamyrmex) peninsulare: Borgmeier, 1949: 101 (w).

Neivamyrmex leonardi: Borgmeier, 1955: 431-434 (w). Watkins, 1971: 101-103 (w). Wheeler & Wheeler, 1973: 38 (w). Watkins, 1976: 13, 18 (w). Cokendolpher & Francke, 1990: 11.

DISTRIBUTION (Map 6)

UNITED STATES: Oklahoma and Texas, west to California and Nevada; **MEXICO**, Baja California Sur and Tamaulipas south to Guerrero.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Pima Co.: Tucson, Prince Rd. (UNAR). *Santa Cruz Co.:* Nogales (LACM). **CALIFORNIA, Inyo Co.:** Saline Valley Rd., 1.7 mi. W Grapevine Canyon Rd. (36°30.7'N 117°33.3'W) (GCSC, CUIC, LACM, UCDC); 2 km ESE Furnace Creek Inn, Death Valley Natl. Pk. (36°26'N 116°50'W), 100m, ex *Solenopsis xyloni* middens (UCDC); 9-mile Canyon (35.85°N 117.90°W), 3400 ft. (LACM); 7 mi. S. Little Lake (LACM); 13.44 km SSE Lone Pine, ex *Messor pergandei* midden (LACM). *Los Angeles Co.:* Santa Monica Mtns., Stunt Ranch (34°06'N 118°39'W), 410m (LACM, UCDC). *Riverside Co.:* Deep Canyon, 1300 ft. (UCRC); Deep Cyn., 5200 ft. (UNAR). *San Bernardino Co.:* "Barstow Fossil Beds" (LACM); 4 mi. NNW Adelanto (LACM). *San Diego Co.:* Point Loma (USNM). **NEVADA, Churchill Co.:** Sand Springs Dune 1200m 39°17'N 118°25' W (UCDC). *Lyon Co.:* Weeks 1280m (39°18'N 119°15'W), 1280m (UCDC). **TEXAS, McLennan Co. (SEMC).** Bosque Co. (SEMC).

MEXICO, GUERRERO, 29 km NE Fila de Caballo (GCSC, WPMC).

DISCUSSION

This is a poorly known species. The synonymous form *N. peninsulare* was described from a few workers taken under a stone. Watkins (1971) also reported finding it under a stone in Texas and "...observed a few workers...in a weak nocturnal raiding column of *N. opacithorax*..." Our specimens from 9-mile Canyon were found in soft sand at a depth of about 45 cm. This was in Sagebrush Desert with some intermixed *Larrea*. This ant has also been collected from Creosote Bush Scrub-Joshua Tree Woodland. In the chaparral biome of Deep Canyon, Wheeler and Wheeler (1973) found a nest under a slightly buried stone.

Mann (1925) described the staphylinid beetle *Pulicomorpha coecum* from specimens collected with a colony of *N. leonardi* (as *Eciton peninsularis* Mann) in Baja California Sur, Mexico.

The queen and male forms are unknown; however based on range data we surmise that *N. minor* is probably the male form of *N. leonardi*.

Automontage images of *N. leonardi* may be viewed at antweb.org.

Neivamyrmex mandibularis (M. R. Smith) NEW STATUS

Figures 100, 101, 127

Eciton (Neivamyrmex) pilosus subsp. *mandibulare* M. R. Smith, 1942: 548 (m). U.S.A., Arizona, 30 mi E Quijotoa, Pima Co. (USNM) **examined**. Creighton, 1950: 68, 76.

Neivamyrmex pilosus subsp. *mandibularis*: Borgmeier, 1955: 375 (m).

DISTRIBUTION (Map 3)

UNITED STATES: Arizona and New Mexico; **MEXICO:** border states south to Chiapas and Colima.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Pima Co.: Santa Rita Mts., 4000 ft. (USNM); Forestry Cabin, Brown Canyon, Baboquivari Mts., 3500 ft. (LACM); Baboquivari Mts. (LACM). *Santa Cruz Co.:* Peña Blanca (LACM); Madera Canyon, Santa Rita Mts. (CASC). **NEW MEXICO, Catron Co.:** Whitewater Creek, 5 mi NE Glenwood (SEMC). *Grant Co.:* 100 km NW Silver City (WPMC).

MEXICO, CHIAPAS, Tuxtla Gutierrez, 1000 ft. (CUIC). **DURANGO,** Nombre de Dios (UCBC). **JALISCO,** Chamela, 3000 ft. (USNM). **OAXACA,** 1 mi SE Tamazulapám, 6200 ft.

(UCBC). SINALOA, Mazatlán (USNM); 5 mi N Mazatlán (UCBC). VERA CRUZ, Fortín de las Flores, 3000 ft. (CUIC); 8 mi S Elota (UCDC).

DISCUSSION

When M. R. Smith (1942) described this species as a subspecies of *N. pilosus* he did so primarily on similarities in the shape of the mandible. This difference is consistent throughout the range of this species, a range that lies almost entirely within the much more extensive range of *N. pilosus*. Were this the only difference between the two, there is no doubt that they would be regarded as conspecific. However, there is a difference, too, in the shape of the paramere. Although quite variable in shape, the paramere of *N. pilosus* (Figs. 128) is narrowly rounded at the apex; in *N. mandibularis* the paramere is blunt and broadly rounded. Additionally, the hairs of the compound eyes in *N. mandibularis* are generally longer and more flexuous than they are in most populations of *N. pilosus*, but in areas where both forms are present, they are more consistent in this difference.

Workers of *N. pilosus* are relatively large and are conspicuous when that species is present. No workers of *N. pilosus* have been found in southern Arizona, even though this is one of the most heavily collected areas for ants in the United States. While absence of proof is not proof of absence, we have allowed this consideration to influence our thinking. Additionally, workers of another species, *N. melanocephalus*, are available as a possible match for *N. mandibularis*. At present, we are reluctant to do more than suggest this match-up since recently examined material of *N. graciellae* (Mann, 1926), has raised the possibility that this might be the worker of *N. mandibularis*. That species was originally described from Ototonilco, Jalisco, Mexico, well within the range of *N. mandibularis*, and this species is another member of the *N. pilosus* group. For the present, then, we leave the question unresolved. But, in any case, we have concluded that *N. mandibularis* is best regarded as a species apart from *N. pilosus*.

Neivamyrmex melanocephalus (Emery)

Figures 28, 80

Eciton (Acamatus) melanocephalum Emery, 1895: 260 (w). **MEXICO**, Tepic (MHNG).

Eciton (Neivamyrmex) melanocephalum: M. R. Smith, 1942: 549 (w) (part). Creighton, 1950: 72 (part).

Neivamyrmex melanocephalus: Borgmeier, 1953: 19. Borgmeier, 1955: 385-387 (w).

Eciton (Acamatus) melanocephalum subsp. *xipe* Wheeler, 1914: 41; worker. **MEXICO**, Hidalgo, San Miguel (MCZC).

DISTRIBUTION (Map 7)

UNITED STATES: Arizona; **MEXICO**: south at least to Oaxaca and Morelos.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA: Santa Cruz Co.: Upper White Rock Campground, Peña Blanca Lake (31.39° N 111.08° W), 1200m (GCSC, LACM); Nogales, on sidewalk (USNM).

MEXICO, OAXACA: 14.5km S Ocotlán, 1500m (GCSC, WPMC). **MORELOS**: La Luz Tetecala (WPMC).

DISCUSSION

This rather large distinctive species is only rarely encountered in the United States and its principal range lies in Mexico and Guatemala. As discussed above, we believe that *N. mandibularis* is the likely male of *N. melanocephalus*, but it is also possible that *N. mandibularis* could be the opposite sex of *N. graciellae*.

One foraging raid of *N. melanocephalus* was observed. It occurred in full daylight and the workers were taking a variety of small arthropods (B. V. Brown, *pers. comm*).

***Neivamyrmex melshaemeri* (Haldemann, 1852)**

Figures 115, 128, 139

Labidus melshaemeri Haldemann, 1852: 368; pl. 9 fig. 7-9 (m). U.S.A, Texas, Fort Gates (type lost).

Eciton (Labidus) melshaemeri: Mayr, 1886c: 442. Emery, 1895: 261 (m). Emery, 1896: 33.

Eciton (Acamatus) melshaemeri: Emery, 1900: 516, 525 (m). Emery, 1910: 26.

Eciton melsheimeri: Forel, 1899: 28 (m).

Eciton (Acamatus) melshaemeri: Wheeler, 1908: 418 (m).

Eciton (Neivamyrmex) melshaemeri: M. R. Smith, 1942: 576 (m). M. R. Smith, 1951:780. Creighton, 1950: 73.

Neivamyrmex melsheimeri: Borgmeier, 1955: 647-649 (m). Watkins, 1972: 351 (m). Watkins, 1976: 23 (m); Watkins, 1982: 213 (m).

DISTRIBUTION (Map 7)

UNITED STATES: Louisiana and Oklahoma west to Texas; **MEXICO:** Tamaulipas and San Luis Potosí south to Chiapas and Yucatán; **SOUTH AMERICA.**

SPECIMENS EXAMINED

UNITED STATES, LOUISIANA, Beauregard Parish: DeRidder (LACM). **TEXAS, Bexar Co.:** San Antonio (CASC). **Brazos Co.:** College Station (TAMU, WPMC); 16 km W Bryan (WPMC). **Cameron Co.:** nr. Southmost Sabal Palm Grove Sanctuary (TAMU, WPMC); Brownsville (LACM, GCSC, UCBC, USNM). **Dimmit Co.:** Winter Haven (MINN). **Grayson Co.,** Sherman (TAMU). **Liberty Co.:** Devers (CUIC). **Matagorda Co.:** Blessing (TAMU). **Morris Co.:** Dangerfield (TAMU). **Tarrant Co.:** Fort Worth (LACM). **Travis Co.:** Austin (TAMU). **Val Verde Co.:** Juno (CUIC). **Victoria Co.:** Victoria (CUIC). **Wharton Co.:** Wharton (CUIC, LACM).

MEXICO, CHIAPAS: 12 mi N. Ocozocoautla (TAMU). **TAMAULIPAS:** Ciudad Victoria (WPMC); Ciudad Victoria, Canon La Libertad (TAMU).

DISCUSSION

This common small species can be confused with no other United States species. The long flexuous hairs on the body of this ant readily distinguish it from our other *Neivamyrmex*. Throughout its range from the southern United States to South America this ant is morphologically quite uniform.

***Neivamyrmex microps* Borgmeier, 1955**

Figures 8, 39, 54, 68, 81, 102, 103, 129, 140

Neivamyrmex microps Borgmeier, 1955: 635 (m). U.S.A., Arizona, Phoenix (USNM). Watkins, 1972: 352. Watkins, 1976: 25.

The worker caste has not been previously described.

DIAGNOSIS

Worker. Eye absent; antennal scape not extending to midlength of head; head with numerous suberect hairs, but no erect hairs; propodeal dorsum smooth and shiny, distinctly longer than declivitous face, latter smooth and shiny; petiole node longer than broad in dorsal view, sides slightly convex; postpetiole slightly wider than long, disc smooth and shiny, sides weakly sculptured.

DESCRIPTION

Worker, measurements (mm) ($n = 12$): HW 0.59; HL 0.73; SL 0.34; SW 0.11; PW 0.22; ML 0.36; PL 0.27; PpW 0.29; PpL 0.22; HFL 0.50; HFW 0.15. *Indices*: CI 70-85 FI 28-39; SI 39-51

Head distinctly longer than broad; smooth and shiny with only scattered small punctures. Eye absent. Dorsolateral corners slightly angulate, preoccipital carina weak. Scape not reaching middle of head length, 3 x as long as greatest breadth, broad distad, abruptly narrowed at base. Subantennal lamella well developed. Head without erect hairs, but with numerous suberect hairs. Mandible triangular, upper margin straight and distinctly angulate at juncture with masticatory margin; upper margin with distinct small distal tooth (Fig. 7).

Mesosomal dorsum smooth and shiny; promesonotal suture indistinct; metanotal groove distinct. Propodeal dorsum smooth and shiny, distinctly longer than declivitous face, latter smooth and shiny. Metafemur stout.

Petiole node longer than broad in dorsal view with sides slightly convex and narrowing anteriorly; evenly convex in lateral view; sides slightly granulate; subpetiolar tooth minute. Postpetiole slightly wider than long, dorsum smooth and shiny, sides lightly granulopunctate.

Gaster smooth and shiny on first tergum, second segment weakly sculptured and less shiny.

DISTRIBUTION (Map 4)

UNITED STATES: Known only from Arizona, but almost certainly extends into adjacent eastern California and south into **MEXICO**.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Maricopa Co.: Phoenix (USNM) (m); Scottsdale (GCSC, LAAG, LACM) (m); 4 Peaks Rd. (Mazatzal Mts.), 5 mi E Hwy. 87 (RAJC, GCSC, LACM) (w). *Pinal Co.:* Red Rock (34.30°N 110.19°W (ARSU) (m). *Pima Co.:* Tucson, in house (UNAR) (m). *Santa Cruz Co.:* Madera Canyon, 4000', Santa Rita Mts. (LACM) (m). *Yuma Co.:* Hoodoo Well, Kofa Mts. (GCSC) (m).

DISCUSSION

Neivamyrmex microps is one of a number of species, the males of which all have a distally bifurcate volsella, that possess minute tubercles on the outer face of the volsella (much as in Fig. 140). The number and distribution of these tubercles may be consistent and characteristic from species to species, but we have not investigated this matter in detail, nor have we examined all species with bifurcate volsellae. At this stage we can only stipulate that they are not present in all species with bifurcate volsellae. Among the United States species we can affirm their presence in males of *N. microps*, *N. minor*, *N. ndeh* and *N. swainsonii*. They are absent in males of *N. andrei* and *N. fuscipennis*. In the case of *N. microps* these tubercles are sufficiently numerous that three or four are visible within the apical crotch as minute teeth.

In the original description of this species Borgmeier incorrectly cited the collector of the type specimen as "R. H. Randall"; the correct name is R. H. Crandall. For many years known only from

the type specimen, this species has recently been collected again in a number of Arizona localities. Although we now know that *N. microps* has a fairly extensive range within Arizona, it will likely continue to be a rarely collected species. Current records indicate that this species inhabits a wide range of habitats, having been found in areas ranging from Creosote scrub to Oak woodland, with an elevational range between 1000 and 4000 feet.

Based on circumstantial evidence, we have associated the above described workers with this species. They were collected in Maricopa County, along 4 Peaks Road by R. A. Johnson, 27 March 1993. These workers belong to the correct species group and the known distribution makes this association probable. Workers may be confused with those of *N. leonardi*, but may be differentiated by the less well developed mandibular teeth, the longer, narrower postpetiole, and the less convex mesosomal profile.

Nothing is known of the biology of this species. However, label data indicate that the activity period for this species closely coincides with the summer/fall monsoon season in Arizona.

***Neivamyrmex minor* (Cresson)**

Figures 104, 105, 116, 130, 141

Labidus minor Cresson, 1872: 195 (m). U.S.A., Texas (ANSP).

Eciton (Labidus) minor: Mayr, 1886: 441 (m). Emery, 1895: 261 (m).

Eciton (Acamatus) minus: Wheeler, 1908: 418 (m).

Eciton (Neivamyrmex) minus: M. R. Smith, 1942: 544 (m). Creighton, 1950: 73 (m).

Neivamyrmex minor: Borgmeier, 1955: 630-632 (m). Watkins, 1976: 25 (m). Wheeler & Wheeler, 1986: 20. Cokendolpher & Francke, 1990: 11.

DISTRIBUTION (Map 8)

UNITED STATES: Texas to Kansas, west to southern Nevada and California; **MEXICO:** Baja California, Baja California Sur, Coahuila (Watkins, 1982).

SPECIMENS EXAMINED

We have 64 records from the United States.

DISCUSSION

Neivamyrmex minor is certainly one of the more widespread species. Occurring in a wide variety of habitats it is one of the most frequently encountered *Neivamyrmex* species, and is commonly collected at light. The female castes are currently unknown but, based on ranges, we posit that *N. leonardi* will prove to be the worker.

Although this species has been collected in variety of habitats, it has only rarely been collected in the desert areas of the west. Elevational amplitude ranges from near sea level to about 7000 feet. Automontage images of this ant are available at antweb.org.

***Neivamyrmex mojave* (M. R. Smith)**

Figures 117, 131, 142

Eciton (Neivamyrmex) mojave M. R. Smith, 1943: 196 (m). U.S.A., California, Mojave Desert (USNM) **examined**. Creighton, 1950: 73 (m).

Neivamyrmex mojave: Borgmeier, 1955: 633-635 (m). Watkins, 1976: 25; map 47 (m).

DISTRIBUTION (Map. 5)

UNITED STATES: Southern California; **MEXICO:** Baja California Sur.

SPECIMENS EXAMINED

UNITED STATES, CALIFORNIA, *Riverside Co.*: Riverside (LACM). *San Bernardino Co.*: Mojave Desert (USNM); 4 mi. NNW Adelanto 2900' (LACM).

MEXICO, BAJA CALIFORNIA SUR: 8.4 mi W on Ramal á Los Naranjo, at light (LACM).

DISCUSSION

This species has been previously known only from the type specimen, from an unknown locality in the Mojave Desert. The specimen from north of Adelanto was picked up dead on the ground.

Neivamyrmex mojave is evidently nearest to *N. microps* and superficially looks much like that ant. However it may be distinguished from that species by the non-toothed volsella, and differences in coloration. This species might also be mistaken for *N. minor* but may be readily distinguished from that species by the small size of the ocelli.

The recently described *N. nyensis* Watkins may be the worker form of this species.

Automontage images of this species are available at antweb.org

Neivamyrmex moseri Watkins

Figures 9, 22, 40, 55, 82

Neivamyrmex moseri Watkins, 1969: 529 (w). **U.S.A.**, Louisiana, Rapides Parish, Kisatchue National Forest (USNM) *examined*.

Neivamyrmex isodentatus MacKay, 1998: 333-335 (w). **U.S.A.**, Texas, Kleberg Co., Kleberg Airport (MCZC) *examined*. **NEW SYNONYMY.**

DISTRIBUTION (Map 4)

UNITED STATES: Louisiana and Texas.

SPECIMENS EXAMINED

In addition to the type material cited above, we have studied a small series from Texas, *Bell Co.*, Bowmer Ranch 18 June 1970 (J. F. Watkins II; W164; LACM, WPMC).

DISCUSSION

Neivamyrmex moseri is easily separated from all other described United States species by its unique mandibular structure: there are three large teeth that are usually approximately equal in size; much smaller intercalary denticles may be present. MacKay (1995) described *N. isodentatus* as a similar species that differed in details of mesosomal and petiolar sculpture, presence of a subantennal lamella, fewer short bristly hairs on the funiculus, and a subtle difference in the direction of the opening of the propodeal spiracle. None of these features is sufficiently distinctive to suggest a new species, since all are features that are typically variable in any species of *Neivamyrmex*. The types of *N. isodentatus* were compared with a few specimens from Bell County, Texas, identified by Watkins as *N. moseri*, but not with the types of that species. Had the *N. isodentatus* material been compared with *N. moseri* types, the conformity of the two would have been obvious. Both type series differ

from the Bell County specimens in the same manner and we conclude that *N. isodontatus* is a synonym of *N. moseri*.

With the limited material available we are forced to agree with Watkins that the Bell County specimens are also *N. moseri*, even though differing in a few subtle features that are variable and somewhat illusory, depending upon the angle of view. We should note further that the statement by Watkins (1969) that *N. moseri* workers lack a subantennal lamella is only partly correct; the lateral extension of the frontal carina that runs below the socket is present, but is not elevated to form a distinct lamella in most specimens examined. A low lamella is present in a few specimens, but not to quite the same degree as seen in the types of *N. isodontatus*.

Neivamyrmex ndeh, new species

Figures 118, 132, 143

DIAGNOSIS

Male: head and mesosoma blackish brown, gaster reddish brown; head 1.5× broader than long measured across eyes; smooth and shiny between scattered small punctures; mesosoma blackish brown, entire surface smooth and shining with numerous scattered small punctures, pilosity suberect and dense. **Queen** and **worker** unknown.

DESCRIPTION

Male, measurements (mm) ($n = 2$): HW 0.86-0.91 (0.91); HL 0.55-0.58 (0.58); SL 0.39-0.41 (0.41); SW 0.15-0.16 (0.15); EL 0.305-0.306 (0.305); EW 0.23-0.26 (0.23); OD 0.09-0.10 (0.09); OOD 0.15-0.175 (0.175); OMD 0.07-0.12 (0.12); OVD 0.20; PW 0.70 (0.70); ML 0.40 (0.40); PL 0.62-0.70 (0.70). **Indices:** CI 156-158 (158); SI 49-57 (57).

Head almost 1.6× as broad as long. Dorsal margin, in frontal view, concave and rounded at sides; preoccipital carina weak and not forming distinct collar. Free clypeal margin (ventral margin) slightly concave; frontal carina sharp between antennal fossae, but becoming rounded dorsad and curving laterad to form moderate swelling above antennal fossae. Mandible sickle-shaped and acute at apex, about 0.40 mm long. EL 1.3× EW. OOD about 1.75× OD. Scape extending to level of upper eye margin, about 3× longer than broad; subantennal lamella prominent.

Mesosoma smooth and shiny, with numerous scattered small punctures.

Petiole slightly longer than broad; posterolateral corners rounded; dorsal surface shiny, ventral surface less so.

First three segments of gaster smooth and shiny, following segments duller, more distinctly, finely punctate. Subgenital plate longer than broad, somewhat spatulate; apicolateral teeth prominent, median tooth small. Dorsal margin of paramere broadly triangular, margins densely clothed with long flexuous hairs. Volsella with apical fork, dorsal process large and sharp, ventral process blunt and much shorter; inner margin each segment with a minute denticle near fork; numerous long erect hairs along ventral margin. Aedeagus in profile with apically rounded posterodorsal lobe and slightly longer, out-turned sharply pointed posteroventral lobe.

Color: head and mesosoma blackish brown, first two gastral segments similar, following segments becoming reddish brown on posterior segments; wings clear brownish.

TYPE MATERIAL (Map 5)

Holotype: U. S. A., Arizona, *Santa Cruz Co.*, Yanks Canyon (31.42°N 111.17°W), 12-15 Aug. 1993 (B. V. Brown and D. Feener). **Paratype:** U. S. A., Arizona, *Cochise Co.*, Portal, 4800 ft., 4 Aug. 1959 (H. E. Evans). Both specimens in LACM.

ETYMOLOGY

This species is named for the Ndeh or Apache people of the southwestern United States and adjacent Mexico; the name pronounced approximately "in déh", accenting the second syllable.

DISCUSSION

This minute species, currently known only from the two specimens cited above, is close in size only to *N. baylori* and should be readily identifiable on that basis alone. The holotype was taken in a Malaise trap and the Portal specimen was presumably taken at black light. The worker caste of this distinct species is unknown but is certainly likely to be another minute species; possibly it is *N. goyahkla*, described above.

Neivamyrmex ndeh is superficially similar to *N. microps*, but is significantly smaller and with distinctive genitalic features: the crotch of the apical fork of the volsella has only two barely perceptible teeth that are well removed from each other (see discussion of *N. microps*).

Neivamyrmex nigrescens (Cresson, 1872)

Figures 10, 29, 41, 56, 69, 83, 92, 106, 107, 119, 133, 144

Labidus nigrescens Cresson, 1872: 194 (m). U.S.A., Texas (ANSP).

Eciton nigrescens: Dalla Torre, 1893: 5.

Eciton sumichrasti: Mayr, 1886a: 120. Mayr, 1886b: 440 (in part). Forel, 1899: 27 (in part). Wheeler, 1900: 563, fig. 1-3 (w, q). Wheeler & Long, 1901: 160, note 2. Mann, 1926: 99-100 (q).

Misidentification

Eciton (Acamatus) schmitti Emery, 1894: 183 (w). U.S.A. Missouri, Ripley Co., Doniphan (MCSN). Emery, 1895: 258 (w). Forel, 1899: 28. Wheeler & Long, 1901: 161 (m). Wheeler, 1908c: 410 (w, m). M. R. Smith, 1924: 84. M. R. Smith, 1927: 401-404. Borgmeier, 1936: 59. M. R. Smith, 1938: 160. G. Wheeler, 1942: 331.

Eciton (Labidus) nigrescens: Emery, 1895: 261.

Eciton (Acamatus) nigrescens: Emery, 1900: 517, 525. Wheeler, 1908c: 417; pl. 26 fig. 2 (m). Emery, 1910b: 27. M. R. Smith, 1938: 157 (m).

Eciton (Neivamyrmex) nigrescens: M. R. Smith, 1942: 551; fig. 4, 23 (w, q, m) (part). Borgmeier, 1948: 193. Creighton, 1950: 66, 69, 73-74; pl. 12 (w, q, m).

Eciton (Neivamyrmex) californicum: Creighton, 1950: 70 (part).

Neivamyrmex nigrescens: Borgmeier, 1955: 494-501 (w, q, m) (part). Watkins, 1972: 358-363 (w, q, m). Wheeler & Wheeler, 1973: 37, 38-40 (w, q, m). Watkins, 1976: 15, 22 (w, q, m). Cokendolpher & Francke, 1990: 12. Allred, 1982: 492. Wheeler & Wheeler, 1986: 20. Ward, 1999: 74-97.

Neivamyrmex californicus: Watkins, 1972: 363 (part); Watkins, 1985: 482 (part).

DISTRIBUTION (Map 9)

UNITED STATES: transcontinental across southern states, north to West Virginia, Tennessee, Colorado and Nebraska; **MEXICO:** Baja California, Nayarit, Oaxaca, Sonora (Watkins, 1982).

SPECIMENS EXAMINED

We have 133 records from the United States.

DISCUSSION

This common species is by far the most widespread species in the United States. As a result of this wide range it is also by far the most studied and best known of the *Neivamyrmex*. Not surprisingly, given such an extensive range, *N. nigrescens* also shows an extremely wide habitat range. Rarely encountered in desert environments it is nonetheless present, apparently largely confined to canyons and hillsides. Ward (1999) listed the elevational range from sea level to 1460m in California, but we have records up to 2200m in areas outside of California.

Automontage images of the worker caste may be viewed at antweb.org.

Colonies studied by Wheeler (1900) consisted of “thousands” of individuals, while Schneirla (1958) estimated 150,000 to 250,000 workers per nest.

Neivamyrmex nigrescens has a nomadic/statary cycle like Neotropical army ants such as *Eciton*. The nomadic phase of the cycle begins when pupae eclose to workers. The whole colony then moves along a trail, usually during night hours, capturing any insects they encounter and raiding the nests of other ant species encountered. Columns may be 90m long and are headed by scouts. The colony bivouacs before dawn, using natural cavities or nests of other species, which they have pillaged. The following night they again move and raid. This nomadic cycle lasts for about three weeks or until the larvae in the colony (which they transport each night) begin to pupate. The statary phase then begins and the ants nest in subterranean cavities, either under stones or in abandoned ant nests for about 18 days (Schneirla, 1958). Raids continue but are less extensive than during the nomadic phase.

New colonies of *N. nigrescens* are formed when “a daughter queen leaves the parental nest, accompanied by a number of workers. A mature colony is capable of producing a small number of females, some of which may be fertilized in the nest by their brothers, but this does not preclude mating outside the nest, or with males of other colonies. Since females are never winged, they can make no nuptial flight.” (Smith 1965). Recent very preliminary data for this species suggest that *N. nigrescens* may, at least at times, have more than one functional queen present in the colony. (D. Kronauer, pers. comm.)

Other ants form an important part of the diet of *N. nigrescens*. Mallis (1938) observed this species carrying larvae and pupae of *Tetramorium caespitum* (Linné), as well as click beetles, mayflies, water boatmen and crickets. Wheeler & Long (1901) found larvae of *Solenopsis geminata* (Fabr.) and three species of *Pheidole*, as well as dead carabid beetles, in nests they studied in Texas. Ward (1999) further notes that in California *Messor andrei* (Mayr), *Pheidole californica* Mayr, *P. hyatti* Emery, *Solenopsis molesta* (Say) and *Formica moki* Wheeler are also prey items of this species. In Arizona *N. nigrescens* has been observed regularly raiding *Pheidole obtusospinosa* Pergande (as *P. subdentata*) and *Pheidole desertorum* Wheeler. Neece & Bartell (1982) noted the presence of unidentified mites of the family Trachyaropodidae in colonies of *N. nigrescens*.

The blind snake, *Leptotyphlops dulcis*, is able to follow the pheromone trails of *N. nigrescens* to locate columns and feed on the ant brood (Watkins *et al.*, 1967). When the army ants attack the snake it forms a protective ball-like coil and smears a cloacal fluid on its body, which discourages further ant attacks (Watkins *et al.*, 1972).

Several species of scuttle flies (Diptera: Phoridae) are known to parasitize adults of *N. nigrescens*. These include species in the genera *Dacnophora* and *Cremersia* (B. V. Brown, pers. comm.), and *Xanionotum* (Rettenmeyer and Akre 1968). The diapiiid wasp, *Ecitovagus gibbus* Masner has been found as a parasitoid of *N. nigrescens* in southeastern Arizona (Masner 1977). Myrmecophilous Staphylinidae (Coleoptera) associated with this ant in areas other than California include: *Microdonia laticollis* Brues, *M. nitidiventris* Brues, *M. occipitalis* Casey, *Ecitoxenidia brevicornis* Seevers, *E. brevipes* Brues, *Dinocoryna carolinensis* Seevers, and *Ecitonidia wheeleri* Wasmann (Seevers 1965).

At least two species in the carabid beetle genus *Helluomorphoides* (*H. ferrugineus* Casey and *H. latitarsis* LeConte) are specialized predators on both the booty and brood of *N. nigrescens* in

southeastern Arizona: "The beetles were observed running in army ant columns or standing off to the sides of the columns, behind rocks or beneath clusters of leaf litter. During their predatory activities, beetles ran along the trails in both directions, 'plowing' through the continuous two-way ant traffic. When a beetle of either species contacted a worker ant bringing booty back to her bivouac, the ant usually dropped the booty. On some occasions, if the booty was a larval or pupal individual of another ant species, the beetle immediately ate it and continued on the trail. On other occasions the beetle picked up the dropped booty, left the raiding column, and proceeded to a nearby rock. There, the beetle quickly ate the larva or pupa, returned to the column, and resumed running along the trail" (Topoff, 1969). Beetles were observed to forcibly take booty from the ants. The beetles were also seen to feed on brood caches of the *Neivamyrmex* colony with which they became associated.

For further information on the biology and behavior of this species, see Ward (1999).

***Neivamyrmex nyensis* Watkins**

Figures 11, 23, 42, 57, 70, 84

Neivamyrmex nyensis Watkins, 1977: 421-423 (w). U.S.A., Nevada, Nye Co., 5 1/2 mi S, 3 mi E Beatty (USNM) **examined**. Wheeler & Wheeler, 1986: 20.

DISTRIBUTION (Map 4)

UNITED STATES: Southern Nevada, Arizona, California; **MEXICO:** Baja California.

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Coconino Co.: Havasu Canyon (UCDC, LACM). **CALIFORNIA, Imperial Co.:** 2.9 mi N Glamis (LACM). **Riverside Co.:** Chuckwalla Mts., Red Cloud Cyn. (LACM). **San Bernardino Co.:** Lucerne Valley (GCSC). **NEVADA, Nye Co.:** 5 1/2 mi S, 3 mi. E Beatty 3500 ft (LACM, USNM).

MEXICO, BAJA CALIFORNIA: 28 km E Ensenada (LACM, UCDC).

DISCUSSION

This small subterranean species is poorly known. Not surprisingly most of these collections were from under partially buried stones; the Glamis sample consists of a single specimen taken from a foraging worker of *Forelius maccooki* (Forel) and the Lucerne Valley record is based on a head capsule recovered from a refuse midden of *Solenopsis xyloni* McCook. The Red Cloud Canyon site is in a rocky streambed on the west side of the range, in Creosote/Cactus Scrub desert. The specimens were collected in late afternoon beneath a partially buried stone. There had been rain several days prior to the collection and the soil under the stone was slightly damp. The Havasu Canyon collection was made under similar circumstances.

Neivamyrmex nyensis may eventually prove to be the worker form of *N. mojave*.

Automontage images are available at antweb.org.

***Neivamyrmex opacithorax* (Emery)**

Figures 108, 109, 120, 134, 145

Eciton (Acamatus) californicum subsp. *opacithorax* Emery, 1894: 184 (w, in key). U.S.A., Missouri, Doniphan (MHNG). Emery, 1895b: 259. Pergande, 1895: 874. Forel, 1899: 28.

Eciton (Acamatus) opacithorax: Emery, 1900a: 524; Emery, 1910: 25. Wheeler & Long, 1901: 163, 173 (w, q). Wheeler, 1908b: 411 (m). M. R. Smith, 1924: 84. Mallis, 1941: 62.

Eciton (Acamatus) carolinense: Wheeler, 1921: 314 (q). **Misidentification**

Eciton (Neivamyrmex) opacithorax: M. R. Smith, 1932: 555 (w, q, m). M. R. Smith, 1951 [in Muesebeck, *et al.*]: 781. Buren, 1944: 180. Creighton, 1950: 74.

Eciton (Acamatus) opacithorax var. *castaneum* Borgmeier, 1939a: 416 (w). COSTA RICA, San Jose (MCSN).

Eciton (Acamatus) californicum: Mallis, 1941: 62 (w). **Misidentification**

Eciton (Neivamyrmex) californicum: M. R. Smith, 1942: 560 (w). **Misidentification**

Eciton (Neivamyrmex) opacithorax subsp. *castaneum*: Borgmeier, 1948: 191 (w, q m). **COSTA RICA**, San José.

Neivamyrmex opacithorax: Borgmeier, 1953: 6. Watkins, 1972: 349; Watkins, 1976: 16, 22. Watkins, 1985: 482, 484.

DISTRIBUTION (Map 10)

UNITED STATES: Virginia and Tennessee, south to Florida, west to California; **MEXICO** (Baja California, Jalisco); **GUATEMALA**; **COSTA RICA**.

SPECIMENS EXAMINED

We have 51 records from within the United States.

DISCUSSION

Although *N. opacithorax* is a widespread species it is not as commonly encountered as other members of the *N. nigrescens* group. Within the group it is readily recognized by the distinctively shaped mandible and the shiny head. It is presumably a raider on other ant species. Workers of this species were discovered during the processing of a number twig cuttings which contained a colony of *Pseudomyrmex championi* (Forel) in Guatemala. It is unknown if the *Neivamyrmex* were actively entering the colony while it was intact or if the raiding began as the twigs were cut and collected for processing (P. S. Ward, *pers. comm.*).

Automontage images of *N. opacithorax* may be viewed at antweb.org.

Neivamyrmex pauxillus (W.M. Wheeler)

Figures 12, 24, 43, 58, 71, 85

Eciton (Acamatus) pauxillum Wheeler, 1903: 93 (w). **U.S.A**, Texas, Austin, Paisano Pass (AMNH, MCZC).

Eciton (Neivamyrmex) pauxillum: M. R. Smith, 1942: 569

Neivamyrmex pauxillus: Borgmeier, 1953: 570-572. Watkins, 1982: 197-247. Watkins, 1985: 479-502.

DISTRIBUTION (Map 5)

UNITED STATES: Louisiana and Texas; **MEXICO**: Hidalgo (Watkins, 1982).

SPECIMENS EXAMINED

UNITED STATES, LOUISIANA, *Rapides Parish*: Kisatchue National Forest nr. Alexandria (LACM). **TEXAS**, *Bell Co.*: Bowmer Ranch (LACM, WPMC). *Brewster Co.*: Paisano Pass, nr. Alpine (MCZC). *Travis Co.*: Austin (AMNH, MCZC).

DISCUSSION

This is one of several small, nondescript yellow *Neivamyrmex* species. Because they are rarely encountered, little is known of their habits. Some success has been had locating these minute species using underground baiting, a practice that should be frequently employed. They will likely prove to be subterranean predators of either other ants or of termites.

Neivamyrmex pilosus (F. Smith)

Figures 13a-b, 44, 59, 72, 86, 1110, 111, 121, 135, 146, 150, 151

- Eciton pilosa* F. Smith, 1858: 151 (w). **BRAZIL**, Amazonas, Vila Nova (BMNH).
Eciton clavicornis Norton, 1868: 46 (w). **MEXICO**, Vera Cruz, Hacienda Potrero (types lost?).
Eciton pilosum: Mayr, 1865:77; 1886: 120. Dalla Torre, 1893:5.
Eciton (Labidus) subsulcatum Mayr, 1887: 440 (m). **U.S.A.**, Texas (NHMV).
Eciton mexicanus: Dalla Torre, 1893: 4. Forel, 1899: 27.
Eciton (Acamatus) pilosum: Emery, 1894a: 183. Emery, 1900a: 524; Emery, 1910: 25. Borgmeier, 1923, 48. Borgmeier, 1934: 94. Wheeler, G. C., 1943: 331 (larva).
Eciton (Labidus) mexicanum: Emery, 1895b: 260. Emery, 1896a: 33. **Misidentification**
Eciton pilosum: Forel, 1899: 27. Wheeler & Long, 1901: 165.
Eciton (Acamatus) mexicanum: Emery, 1900a: 515, 525. Emery, 1910: 26. Wheeler, 1908: 414. M. R. Smith, 1931: 16.
Eciton aztecum Forel, 1901: 49 (m). **GUATEMALA**, San José (MHNG).
Eciton (Acamatus) pilosum: Wheeler, 1908: 412. Wheeler, 1921: 313. M. R. Smith, 1924: 85; M. R. Smith, 1931: 295. Reichensperger, 1939: 297 (q).
Eciton (Acamatus) pilosum var. *angustius* Forel, 1909: 256 (w). **PARAGUAY**, San Bernardino (MHNG). Emery, 1910: 25. Wheeler, 1921: 312.
Eciton (Acamatus) mexicanum var. *azteca*: Emery, 1910: 26.
Eciton (Acamatus) pilosum var. *beebei* Wheeler, 1921: 312 (w, m). **GUYANA**, Kartabo (MCZC). **NEW SYNONYMY.**
Eciton (Acamatus) pilosum var. *aztecum*: Wheeler, 1921: 314.
Eciton (Labidus) spininodis subsp. *militarium* Santschi, 1929: 85 (w). **PANAMA**, Bocas del Toro, Changuinola (BASEL). Borgmeier, 1953: 14.
Eciton (Acamatus) porrectognathum Borgmeier, 1933b: 167 (m). **BRAZIL**, Rio de Janeiro, Angra dos Reis u. Itatiaia (?).
Eciton (Acamatus) pilosum var. *mexicanum*: Borgmeier, 1936: 59. Borgmeier, 1939a: 416. **Misidentification**
Eciton (Neivamyrmex) pilosum: M. R. Smith, 1942: 544. Creighton, 1950: 75.
Neivamyrmex pilosus porrectognathum: Borgmeier, 1953: 5. **BRAZIL**, Angra dos Reis and Itatiaia (IBVB).
Neivamyrmex pilosus mexicanus: Borgmeier, 1953: 17. **Misidentification**
Neivamyrmex pilosus beebei: Borgmeier, 1953: 19.
Neivamyrmex pilosus: Borgmeier, 1955: 361-373 (w, q, m).
Neivamyrmex pilosus subsp. *beebei*: Borgmeier, 1955: 373 (w, m).
Neivamyrmex pilosus subsp. *mexicanus*: Borgmeier, 1955:374 (w, q, m). Watkins, 1976: 16. Watkins, 1982: 197-247. Watkins, 1985: 479-502. **Misidentification**

DISTRIBUTION (Map. 2)

UNITED STATES: Arkansas and Mississippi west to southern Arizona; **MEXICO**: border states south to Chiapas; south to **BRAZIL** and **PARAGUAY**.

SPECIMENS EXAMINED

We have 56 records of this wide-ranging species in the United States.

DISCUSSION

The male type of *Labidus mexicanus*, described from Orizaba, Mexico by F. Smith (1859), has been examined. It is a specimen of *N. swainsonii* (Shuckard), not a form of *N. pilosus*. Accordingly, *L. mexicanus* is removed to the synonymy of that species.

We have examined both males and workers from throughout the extensive range of this species. We have found that the features distinguishing the several recognized subspecies form a continuum from north to south, with no clear demarcation for any of these features. Accordingly, all these are here placed in synonymy.

Watkins (1985) indicated on his map of the distribution of *N. pilosus mexicanus* that this ant had been collected from California. We have examined the specimens, purportedly collected at Exeter, Tulare County, and concur that they are *N. pilosus*. However, it is our opinion that these males are probably incorrectly labeled and we have not included California within the distribution of *N. pilosus*.

Automontage images of the worker caste (as *N. pilosus mexicanus*) are located at antweb.org.

Neivamyrmex rugulosus Borgmeier

Figures 14, 45, 60

Neivamyrmex rugulosus Borgmeier, 1953: 49 (w). **MEXICO**, Jalisco, Zapotlán) (AMNH).

Eciton (Acamatus) schmitti Pergande, 1895: 874. **Misidentification**

Eciton (Acamatus) sumichrasti Wheeler, 1908: 410. **Misidentification**

DISTRIBUTION (Map 4)

UNITED STATES: Arizona; **MEXICO:** Jalisco, Nayarit, Sonora (Watkins, 1982).

SPECIMENS EXAMINED

UNITED STATES, ARIZONA, Cochise Co.: 0.3 mi W Southwest Research Station, 5500', Chiricahua Mts. (LACM, MCZC); Cave Creek, Chiricahua Mts. (LACM, SEMC, USNM, WPMC); Southwest Research Station, 5400' (WPMC); 3.5 mi. NW Portal, mesquite foothills, 5450', raiding *Pheidole desertorum* (GCSC, LACM, RAJC).

DISCUSSION

This is a poorly known species, which has been collected in the United States only a handful of times. All of our records are from the Chiricahua Mountains in southeastern Arizona where it has been collected above the 5000-foot level. Although records are few in the United States it is probable that the species is more widespread than currently indicated, however this appears to be a primarily Mexican species that is at the extreme northern limit of its range in the United States. Little is known of the biology of this species, and the only prey records for it are other ant species: *Trachymyrmex arizonensis* (LaPolla *et al.*, 2002) and *Pheidole desertorum* (R. A. Johnson, *pers. comm.*).

LaPolla *et al.* (2002) mention that a male of *N. rugulosus* had been collected near Portal, Arizona. That male is in the LACM collections. We are unable to distinguish between this male and those of *N. harrisi*. Since they note that it was attracted to a head lamp, the association of this male with *N. rugulosus* appears to be accidental.

Neivamyrmex swainsonii (Shuckard)

Figures 15, 25, 30, 46, 73, 122, 136, 147, 149

Labidus swainsonii Shuckard, 1840: 201 (m). **BRAZIL** (BMNH). Westwood, 1842: 76. F. Smith, 1859: 8 (m).

Labidus mexicanus F. Smith, 1859: 7 (m). **MEXICO**, Orizaba (BMNH) (*examined*). **NEW SYNONYMY**.

Eciton (Acamatus) nitens: Pergande, 1895: 874. **Misidentification**

Eciton (Acamatus) swainsonii: Emery, 1900: 515, 525. Emery, 1910: 27. Santschi, 1916: 370. Santschi, 1931: 74. Gallardo, 1920: 379. Borgmeier, 1923: 50.

Eciton (Acamatus) arizonense Wheeler, 1908c: 414 (m). **U.S.A.**, Arizona, Nogales. (MCZC). Emery 1910:25. M. R. Smith, 1942: 581 (m)

Eciton (Acamatus) lieselaei: Gallardo, 1920: fig. 32. **Misidentification**

Eciton (Neivamyrmex) swainsoni: Borgmeier, 1948b: 462.

Eciton (Neivamyrmex) arizonense: Creighton, 1950: 69-70 (m).

Neivamyrmex swainsoni: Borgmeier, 1953: 16. Borgmeier, 1955: 454-458 (m). Watkins, 1972: 352 (m). Watkins, 1976: 24 (m). Cokendolpher & Francke, 1990: 13.

Eciton (Neivamyrmex) commutatum: M. R. Smith, 1942: 568 (*misidentification*).

Neivamyrmex swainsoni arizonensis: Borgmeier, 1953: 19 (m).

Neivamyrmex fallax Borgmeier, 1953: 48 (w). **U.S.A.**, Texas, Victoria (USNM). **NEW SYNONYMY**

DISTRIBUTION (Map 11)

UNITED STATES: Kansas, Louisiana and Texas, west to California; **MEXICO**: border states south to Chiapas and Yucatán; south to **ARGENTINA**.

SPECIMENS EXAMINED

We have 123 records for this species in the United States.

DISCUSSION

F. Smith's *Labidus mexicanus* was made a variety of *pilosus* by Borgmeier (1936), a synonym of *pilosus* by M. R. Smith (1942) and, finally, a subspecies of *pilosus* by Borgmeier (1953), where it has remained. We have examined the type of *L. mexicanus* and determined that none of the above decisions was correct. *Labidus mexicanus* F. Smith is, instead, a junior synonym of *N. swainsonii* (**New synonymy**).

Due to its large size and relative abundance *N. swainsonii* is easily one of North America's most conspicuous army ants. Surprisingly, for many years the worker form of this common and wide-ranging species was unknown. We have determined that *N. fallax* is the worker of *N. swainsonii*. The evidence for this association is scanty: it is based on a worker of *N. fallax* found attached to the leg of a male collected in Arizona. Although throughout the United States and Mexico the ranges of these two taxa overlap nicely, *N. fallax* is unknown south of Guatemala.

Differences do exist between the North and South American populations; however after having examining the type specimen from Brazil and several other specimens from Central and South America we are forced to conclude that we are dealing with a single wide ranging and slightly variable species.

Automontage images of the male caste may be viewed at antweb.org

Neivamyrmex texanus Watkins

Figures 47, 112, 123, 137, 148

Neivamyrmex texanus Watkins, 1972: 353 (w, q, m). **U.S.A.**, Texas, Travis Co., Austin (USNM).

DISTRIBUTION (Map 12)

UNITED STATES: Virginia to Florida, west to Colorado and Arizona; **MEXICO:** San Luis Potosí to Hidalgo and Jalisco.

SPECIMENS EXAMINED (U.S.A.)

In addition to numerous paratypes, we have 34 records from various states.

DISCUSSION

Small workers may be difficult to distinguish from those of *N. nigrescens*, but larger workers are fairly easy to distinguish with a little practice. Males may be readily recognized by the distinctive shape of the paramere.

This is a widespread ant, found in many different types of habitat. Although not commonly seen, *N. texanus* is a large (for *Neivamyrmex*) and conspicuous ant when it is actively foraging. Immigration columns are prominent and may often be seen from some distance away when crossing a suitable background. One observed near Tucson stretched well over 100 yards across the desert and could be readily seen as it meandered across the light colored sand. The blind snake, *Leptotyphlops dulcius*, was observed in the column. Occasionally, when an ant displayed an interest in the snake, it was quickly flicked off (*pers. obs.*, GCS).

Plsek *et al.* (1969) observed *Helluomorphoides texanus* (LeConte) in raiding columns of *N. texanus* and reported their observations on behavior of this species in the laboratory.

Automontage images of the worker are available at antweb.org.

Neivamyrmex wilsoni, new species

Figures 16, 26, 48, 61, 74, 87

DIAGNOSIS

Worker. Eye spot absent; front of head smooth and shiny, with scattered coarse punctures; subantennal lamella well developed; petiole longer than broad in dorsal view, sides anteriorly convergent; postpetiole distinctly wider than long, disc smooth and shiny, sides shiny and lightly sculptured. **Queen** and **male** unknown.

DESCRIPTION

Worker measurements (mm) ($n = 12$). HL 0.48-0.77 (0.77); HW 0.36-0.70 (0.70); SL 0.24-0.405 (0.405); SW 0.07-0.14 (0.14); PW 0.14-0.24 (0.24); PL 0.16-0.27 (0.27); PpL 0.12-0.23 (0.23); PpW 0.19-0.30 (0.30); HFL 0.34-0.62 (0.62); HFW 0.09-0.17 (0.17). **Indices:** CI 75-93 (90); FI 25-31 (28); SI 49-61 (52).

Head slightly longer than broad to distinctly longer than broad in minors, sides weakly convex; front of head smooth and shiny, with scattered coarse punctures; dorsolateral angle slightly developed, with strong preoccipital carina extending ventrad. Antennal scape about 2.9× longer than broad, evenly tapering toward base. Subantennal lamella well-developed. Mandible triangular, outer face weakly longitudinally striate; inner margin sharply angulate with masticatory margin, latter with small indistinct teeth.

Mesosoma contiguously punctate, slightly shiny. Promesonotal suture indistinct. Mesonotum smooth and shiny. Dorsum of propodeum opaque, in profile distinctly longer than slightly concave declivitous face.

Petiole longer than broad in dorsal view and with sides convergent anteriorly, in profile dorsum evenly arched and abruptly descending anteriorly, disc shiny between sparse fine punctures; side punctate and opaque; subpetiolar process usually absent, but sometimes with small anteriorly directed tooth. Postpetiole distinctly wider than long, disc smooth and shiny, sides shiny and lightly sculptured.

Gaster smooth and shiny between small widely scattered punctures.

Pilosity about as usual in *Neivamyrmex*: a combination of sparse short to long, suberect to erect simple hairs.

TYPE MATERIAL

Holotype and numerous **paratypes**, U.S.A., California, *San Diego Co.*, Elliot Reserve, Mira Mar (32.84° N 117.11° W), 28 March 1996 (A. Suarez). Holotype and most paratypes in LACM; paratypes also in BMNH, CASC, MCZC, and UCDC.

ADDITIONAL SPECIMENS

CALIFORNIA, *Orange Co.*: Starr Ranch, 520m (33°36'N 117°33'W) (P.S. Ward, #14325-3; UCDC), ex midden of *Solenopsis xyloni*. *Riverside Co.*: Lake Skinner, 462m (33°35'N 117°02'W) (A.V. Suarez #1378.7; UCDC), ex midden of *Forelius* sp. *San Bernardino Co.*: Caruthers Canyon (32.25°N 115.30°W), 1725m (P.S. Ward, #15175; UCDC), under stone.

ETYMOLOGY

We name this species in honor of Ed Wilson, a small recognition of his many achievements in ant systematics, sociobiology and ecology.

DISTRIBUTION (Map 2)

Presently known only from southern California.

DISCUSSION

This small species is most similar to *N. nyensis* and may be confused with that species. It may be separated by the shorter antennal scape (3.0× as long as wide vs. 4.0× as long as wide) and the opaque mesosomal dorsum. The only other local species with which *N. wilsoni* might be confused is *N. leonardi*, but in that species the mandibular teeth are better defined and the postpetiole is twice as wide as long. *N. wilsoni* is also a more hairy ant than other similar species. Large workers are further characterized by having the lower two-thirds or three-fourths of the head weakly longitudinally strigulose.

Known habitats include oak-pine-juniper woodland, chamise chaparral and coastal sage scrub. Automontage images of this species (as *Neivamyrmex* CA-01) are available at antweb.org.

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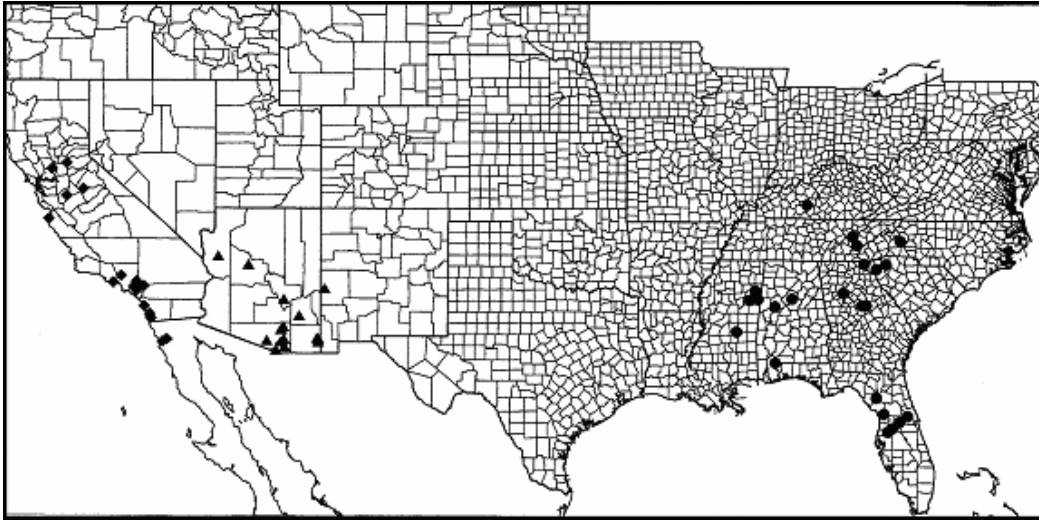
LITERATURE CITED

- Allred, D.** 1982. Ants of Utah. *The Great Basin Naturalist* **42**: 415-511.
- Bolton, B.** 1995. *A new general catalogue of the ants of the world*. Harvard University Press, Cambridge, MA, 504 pp.
- Borgmeier, T.** 1949. Formigas novas ou pouco conhecidas de Costa Rica. *Revista Brasileira de Biologia* **9**: 201-210.
- Borgmeier, T.** 1953. Vorarbeiten zu einer Revision der Neotropischen Wanderameisen. *Studia Entomologica* **2**: 1-51.
- Borgmeier, T.** 1955. Wanderameisen der Neotropischen Region. *Studia Entomologica* **3**: 1-720.
- Cokendolpher, J.C. & Francke, O.F.** 1990. The ants (Hymenoptera, Formicidae) of western Texas. Part II. Subfamilies Ecitoninae, Ponerinae, Pseudomyrmecinae, Dolichoderinae and Formicinae. *Special Publications, The Museum, Texas Tech University* **30**: 76 pp.
- Creighton, W.S.** 1932. A new female *Acamatus* from Texas. *Psyche* **39**: 73-78.
- Creighton, W.S.** 1950. The ants of North America. *Bulletin of the Museum of Comparative Zoology at Harvard College* **104**: 1-585.
- Cresson, E.T.** 1872. Hymenoptera Texana. *Transactions of the Entomological Society of America* **4**: 153-292.
- Dalla Torre, C.G. de.** 1893. *Catalogus Hymenopterorum, hucusque descriptorum systematicus et synonymicus* **7**: 289 pp. Lipsiae.
- Emery, C.** 1894. Studi sulle formiche della fauna Neotropica. *Bullettino della Società Entomologica Italiana* **26**: 137-241.
- Emery, C.** 1896. Studi sulle formiche della fauna Neotropica. *Bullettino della Società Entomologica Italiana* **28**: 33-107.
- Emery, C.** 1900. Nuovi studi sul genere *Eciton*. *Memorie della R. Accademia delle Scienze dell'Istituto di Bologna* (5) **8**: 173-188 (pp. 511-526 in reprint).
- Emery, C.** 1895. Beiträge zur Kenntniss der nordamerikanischen Ameisen-fauna (Schluss.). *Zoologische Jahrbücher. Abtheilung für Systematik, Geographie und Biologie der Tiere* **8**: 257-360.
- Emery, C.** 1901. Note sulle Doriline. *Bullettino della Società Entomologica Italiana* **33**: 43-56.
- Emery, C.** 1910. In Wytsman, P. *Genera Insectorum. Hymenoptera, Fam. Formicidae, subfam. Dorylinae*. Fasc. **102**: 34 pp. Bruxelles.
- Enzmann, E.V.** 1952. *Woitkowskia*, a new genus of army ants. *Proceedings of the Iowa Academy of Science* **59**: 442-447.
- Forel, A.** 1899. *Biologia Centrali-Americana; or, contributions to the knowledge of the fauna and flora of Mexico and Central America. Insecta: Hymenoptera. 3* (Formicidae): 169 pp. London.
- Forel, A.** 1914. Formicides d'Afrique et d'Amerique nouveaux ou peu connus. *Bulletin de la Société Vaudoise des Sciences Naturelles* **50**: 211-288.
- Gallardo, A.** 1920. Las hormigas de la República Argentina. Subfamilia dorylinas. *Anales del Museo Nacional de Historia Natural de Buenos Aires* **30**: 281-410.
- Gregg, R.E.** 1963. *The ants of Colorado*. University of Colorado Press, Boulder, CO, 792 pp.

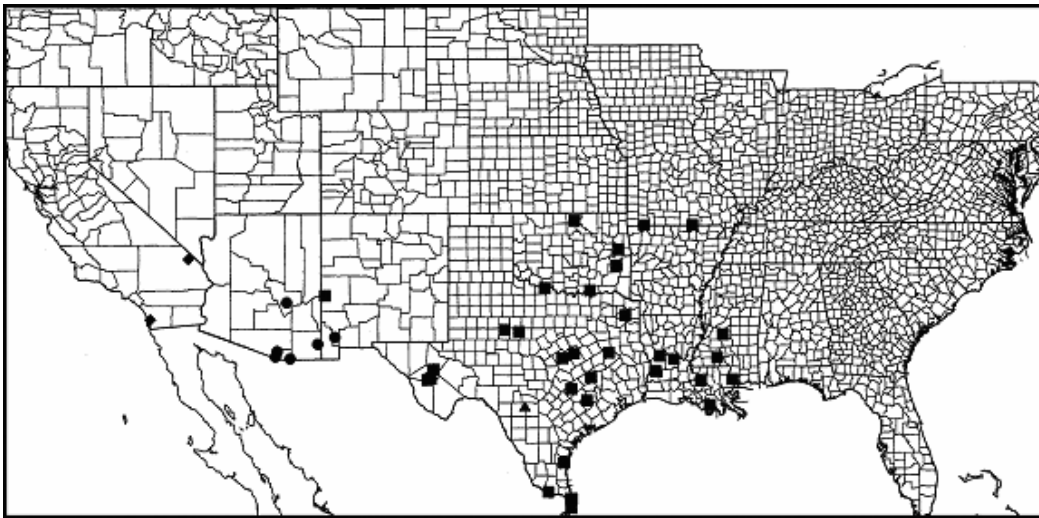
- Haldeman, S.S.** 1852. Appendix C.-Insects (pp. 366-378). In Stansbury, H. *An expedition to the Valley of the Great Salt Lake of Utah: including a description of its geography, natural history, and minerals, and an analysis of its waters.* 487 pp. London.
- Haliday, A.H.** 1836. Descriptions of the Hymenoptera. In: Curtis, J., Haliday, A. H., & Walker, F. Descriptions etc. of the insects collected by Captain P. P. Ring R. N., F. R. S., in the survey of the Straits of Magellan. *Transactions of the Linnean Society of London* **17**: 315-331.
- LaPolla, J.S., Mueller, U.G., Seid, M., & Cover, S.** 2002. Predation by the army ant *Neivamyrmex rugulosus* on the fungus-growing ant *Trachymyrmex arizonensis*. *Insectes Sociaux* **49**: 251-256.
- MacKay, W.P.** 1998. A new army ant from southern Texas. *The Southwestern Naturalist* **43**: 333-335.
- MacKay, W.P., Dominguez, J.F.P. & Sanchez, L.I.V.** 1985. The army ants of the State of Chihuahua, Mexico (Hymenoptera: Formicidae: Ecitoninae). *The Southwestern Naturalist* **30**: 611-612.
- MacKay, W. & MacKay, E.** 2002. *The ants of New Mexico (Hymenoptera: Formicidae)*. Edwin Mellen Press, Lewiston, New York, 398 pp.
- Mallis, A.** 1938. Army ants in California. *Scientific Monthly* **47**: 220-226.
- Mallis, A.** 1941. A list of the ants of California with notes on their habits and distribution. *Bulletin of the Southern California Academy of Science* **40**: 61-100.
- Mann, W.M.** 1925. New beetle guests of army ants. *Journal of the Washington Academy of Sciences* **15**: 73-77.
- Mann, W.M.** 1926. Some new neotropical ants. *Psyche* **33**: 97-107.
- Mayr, G.** 1870. Neue Formiciden. *Verhandlungen der K.K. Zoologisch-Botanische Gesellschaft in Wien* **20**: 939-996.
- Mayr, G.** 1886a. Ueber *Eciton-Labidus*. Ein myrmecologischer Beitrag. *Wiener Entomologische Zeitung* **5**: 33-36.
- Mayr, G.** 1886b. Ueber *Eciton-Labidus* (schluss). *Wiener Entomologische Zeitung* **5**: 115-122.
- Mayr, G.** 1886c. Die Formiciden ver Vereinigten Staaten von Nord-Amerika. *Verhandlungen der k.k. Zoologisch-Botanischen Gesellschaft in Wien* **36**: 419-464.
- Mayr, G.** 1887. Südamerikanische Formiciden. *Verhandlungen der k.k. Zoologisch-Botanischen Gesellschaft in Wien* **37**: 511-632.
- Menozzi, C.** 1924. Una specie inedita di *Eciton* Latr. del sottogenere *Labidus* Jr. *Bollettino della Società Entomologica Italiana* **56**: 29-31.
- Neece, K.C. & Bartell, D.P.** 1982. A faunistic survey of the organisms associated with ants of western Texas. *Graduate Studies of Texas Tech University* **25**: 36 pp.
- Norton, E.** 1868. Notes on Mexican ants. *American Naturalist* **2**: 57-72.
- Pergande, T.** 1895. Formicidae of Lower California, Mexico. *Proceedings of the California Academy of Sciences* (ser. 2) **4**: 161-165.
- Rettenmeyer, C.W. & Watkins J.F.** 1978. Polygyny and monogyny in army ants (Hymenoptera: Formicidae). *Journal of the Kansas Entomological Society* **51**: 581-591.
- Santschi, F.** 1912. Quelques fourmis de l'Amérique australe. *Revue Suisse de Zoologie* **20**: 519-534.
- Santschi, F.** 1921. Ponerinae, Dorylinae et quelques autres formicides néotropiques. *Bulletin de la Société Vaudoise des Sciences Naturelles* **54**: 81-103.
- Schneirla, T.C.** 1956. The army ants. *Smithsonian Report for the Year 1955*: 379-406.
- Schneirla, T.C.** 1958. The behavior and biology of certain Nearctic army ants. Last part of the functional season in Arizona. *Insectes Sociaux* **5**: 215-255.
- Schneirla, T.C.** 1971. *Army ants*. W. H. Freeman & Co., San Francisco, 349 pp.
- Shuckard, W.E.** 1840. Monograph of the Dorylidae, a family of the Hymenoptera Heterogyna. *Annals of Natural History; or Magazine of Zoology, Botany and Geology* **5**: 188-201.

- Smith, D.R.** 1979. Formicoidea (pp. 1323-1467). In Krombein, K. V., Hurd, P. D. Jr., Smith, D. R., & Burks, B. D. (eds.) *Catalog of Hymenoptera in America North of Mexico*. 2 Apocrita (Aculeata):1199-2209. Washington, D. C.
- Smith, F.** 1858. *Catalogue of Hymenopterous Insects in the Collection of the British Museum*. 6 Formicidae. British Museum, London, 216 pp.
- Smith, F.** 1859. *Catalogue of Hymenopterous Insects in the Collection of the British Museum*. 7 Dorylidae and Thynnidae. British Museum, London, 76 pp.
- Smith, M.R.** 1927. A contribution to the biology and distribution of one of the legionary ants, *Eciton schmitti* Emery. *Annals of the Entomological Society of America* **28**: 401-404.
- Smith, M.R.** 1942. The legionary ants of the United States belonging to *Eciton* subgenus *Neivamyrmex* Borgmeier. *American Midland Naturalist* **27**: 537-590.
- Smith, M.R.** 1943. A new male legionary ant from the Mojave Desert, California. *Lloydia* **6**: 196-197.
- Topoff, H.R.** 1969. A unique predatory association between carabid beetles of the genus *Helluomorphoides* and colonies of the army ant *Neivamyrmex nigrescens*. *Psyche* **76**: 375-381.
- Ward, P.S.** 1999. Deceptive similarity in army ants of the genus *Neivamyrmex* (Hymenoptera: Formicidae): taxonomy, distribution and biology of *N. californicus* (Mayr) and *N. nigrescens* (Cresson). *Journal of Hymenoptera Research* **8**: 74-97.
- Watkins, J.F., II.** 1969. A new species of *Neivamyrmex* from Louisiana (Hymenoptera: Formicidae). *Journal of the Kansas Entomological Society* **41**: 528-531.
- Watkins, J.F., II.** 1971. A taxonomic review of *Neivamyrmex moseri*, *N. pauxillus* and *N. leonardi*, including new distribution records and original descriptions of queens of the first two species. *Journal of the Kansas Entomological Society* **44**: 93-103.
- Watkins, J.F., II.** 1972. The taxonomy of *Neivamyrmex texanus* n. sp., *N. nigrescens* and *N. californicus* (Formicidae: Dorylinae), with distribution map and keys to the species of *Neivamyrmex* of the United States. *Journal of the Kansas Entomological Society* **45**: 347-372.
- Watkins, J.F., II.** 1973. *Neivamyrmex baylora* n. sp. from Waco, Texas, U.S.A. (Hymenoptera: Formicidae). *Journal of the Kansas Entomological Society* **46**: 430-433.
- Watkins, J.F., II.** 1975. The relationship of *Neivamyrmex fuscipennis* to *N. macropterus* (Dorylinae: Formicidae). *Southwestern Naturalist* **20**: 85-90.
- Watkins, J.F., II.** 1976. *The identification and distribution of New World army ants*: Baylor University Press, Waco, Texas, 102 pp.
- Watkins, J.F., II.** 1977. *Neivamyrmex nyensis*, n. sp. (Formicidae: Dorylinae) from Nye County, Nevada, U. S. A. *The Southwestern Naturalist* **22**: 421-425.
- Watkins, J.F., II.** 1982. The army ants of Mexico (Hymenoptera: Formicidae: Ecitoninae). *Journal of the Kansas Entomological Society* **55**: 197-247.
- Watkins, J.F., II.** 1985. The identification and distribution of the army ants of the United States of America (Hymenoptera, Formicidae, Ecitoninae). *Journal of the Kansas Entomological Society* **58**: 479-502.
- Watkins, J.F., II.** 1990. The army ants (Formicidae: Ecitoninae) of the Chamela Biological Station in Jalisco, Mexico. *Folia Entomológica Mexicana* **77**: 379-393.
- Watkins, J.F., II. & Coody, C. J.** 1986. The taxonomy of *Neivamyrmex graciellae* (Mann) including an original description of the queen and field observations. *Southwestern Naturalist* **31**: 256-259.
- Watkins, J.F., II., Gehlbach, G.R. & Baldrige, R.S.** 1967. Ability of the blind snake, *Leptotyphlops dulcis*, to follow pheromone trails of army ants, *Neivamyrmex nigrescens* and *N. opacithorax*. *Southwestern Naturalist* **12**: 455-462.

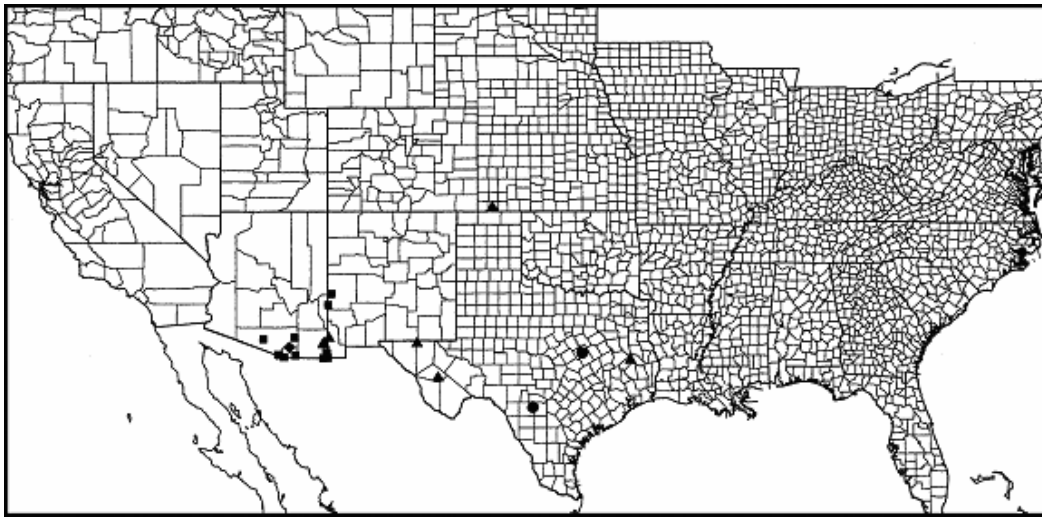
- Watkins, J.F., II., Gehlbach, G.R. & Plisek, R.W.** 1972. Behavior of blind snake (*Leptotyphlops dulcis*) in response to army ant (*Neivamyrmex nigrescens*) raiding columns. *Texas Journal of Science* **23**: 556-557.
- Westwood, J.O.** 1842. Monograph of the hymenopterous group, Dorylides (No. 5, pp. 73-80). *Arcana Entomologica; or illustrations of new, rare, and interesting insects* **1**:192 pp. London.
- Wheeler, G.C. & Wheeler, J.N.** 1973. *The ants of Deep Canyon*. University of California, Riverside, California, 162 pp.
- Wheeler, G.C. & Wheeler, J.N.** 1986. *The ants of Nevada*. Natural History Museum of Los Angeles County, Los Angeles, California, 138 pp.
- Wheeler, W.M.** 1900. The female of *Eciton sumichrasti* Norton, with some notes on the habits of Texan Ecitons. *American Naturalist* **34**: 563-574.
- Wheeler, W.M.** 1908. The ants of Texas, New Mexico and Arizona. Part I. *Bulletin of the American Museum of Natural History* **24**: 399-485.
- Wheeler, W.M.** 1915. Some additions to the North American ant-fauna. *Bulletin of the American Museum of Natural History* **34**: 389-421.
- Wheeler, W.M. & Long, W.H.** 1901. The males of some Texan Ecitons. *American Naturalist* **35**: 157-173.



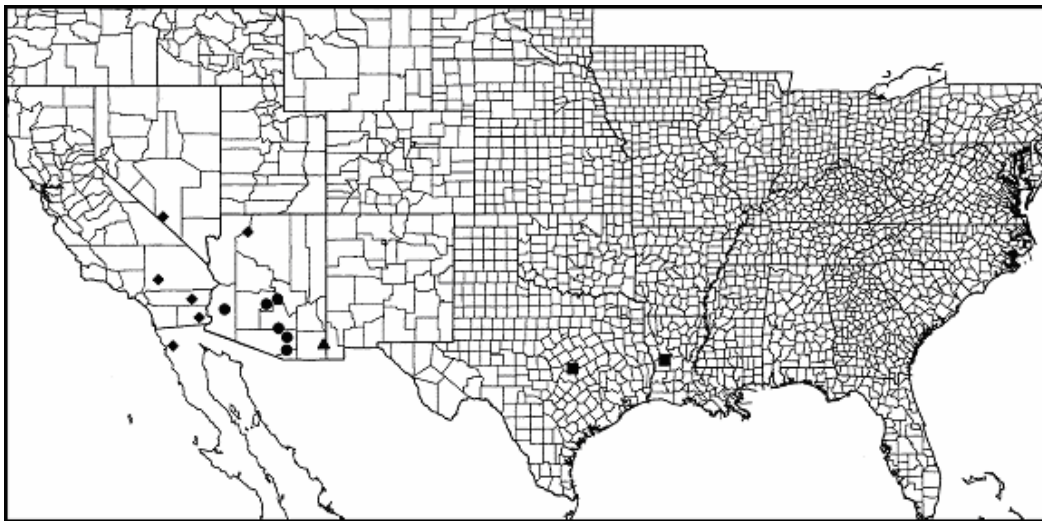
Map 1. Distribution of: *N. andrei* (▲); *N. californicus* (◆); *N. carolinensis* (●).



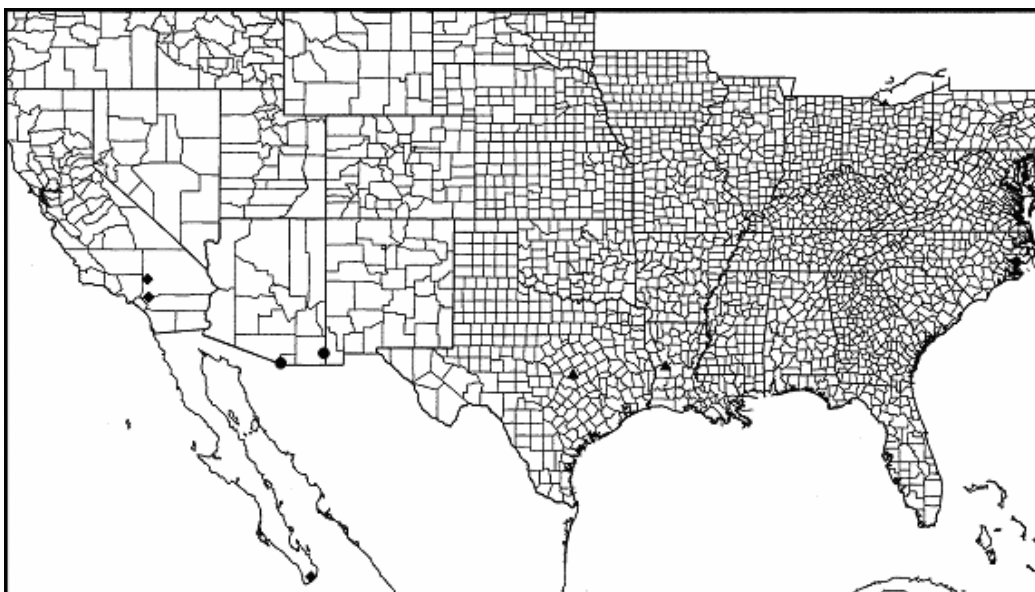
Map 2. Distribution of: *N. agilis* (●); *N. pilosus* (■); *N. wilsoni* (◆).



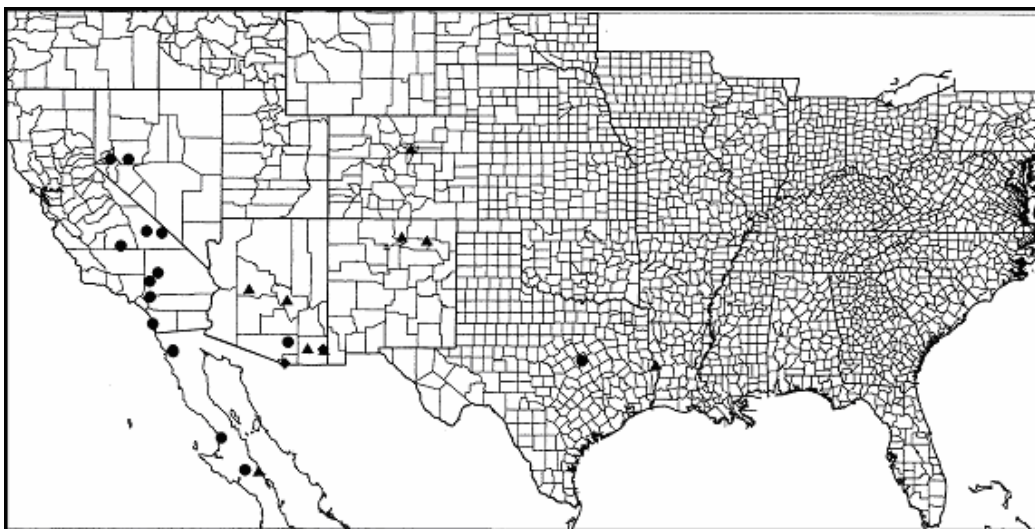
Map 3. Distribution of: *N. baylori* (●); *N. fuscipennis* (▲); *N. graciellae* (◆); *N. mandibularis* (■).



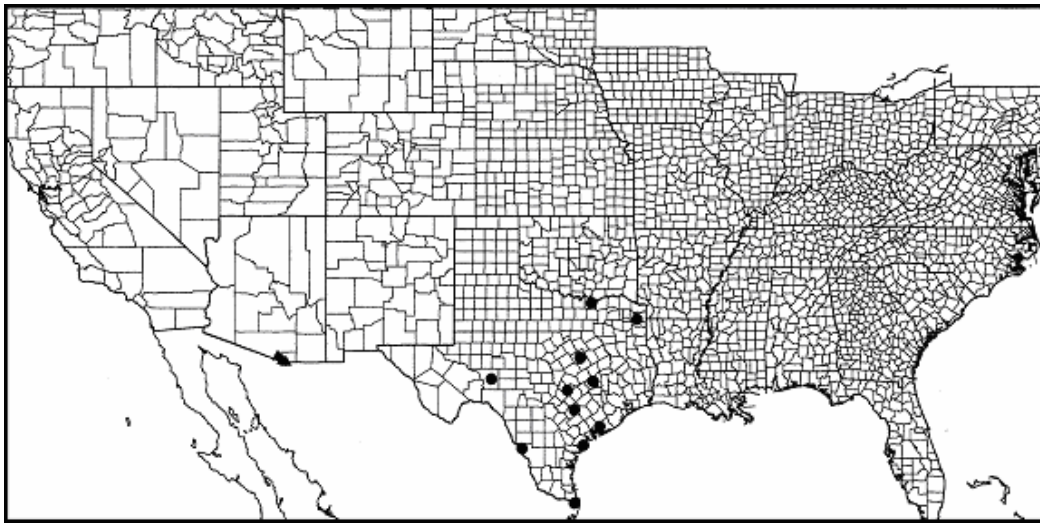
Map 4. Distribution of: *N. microps* (●); *N. moseri* (■); *N. nyensis* (◆); *N. rugulosus* (▲).



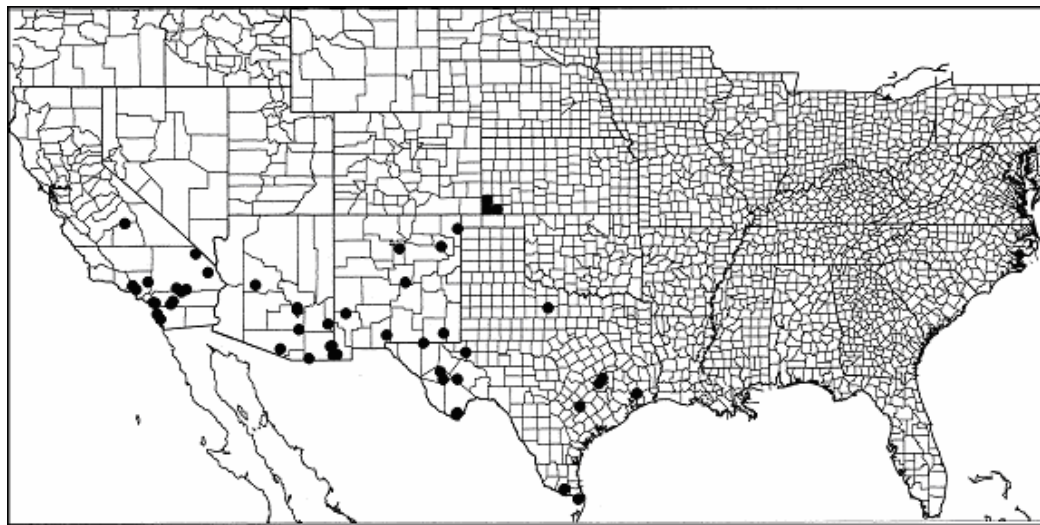
Map 5. Distribution of: *N. mojave* (◆); *N. ndeh* (●); *N. pauxillus* (▲).



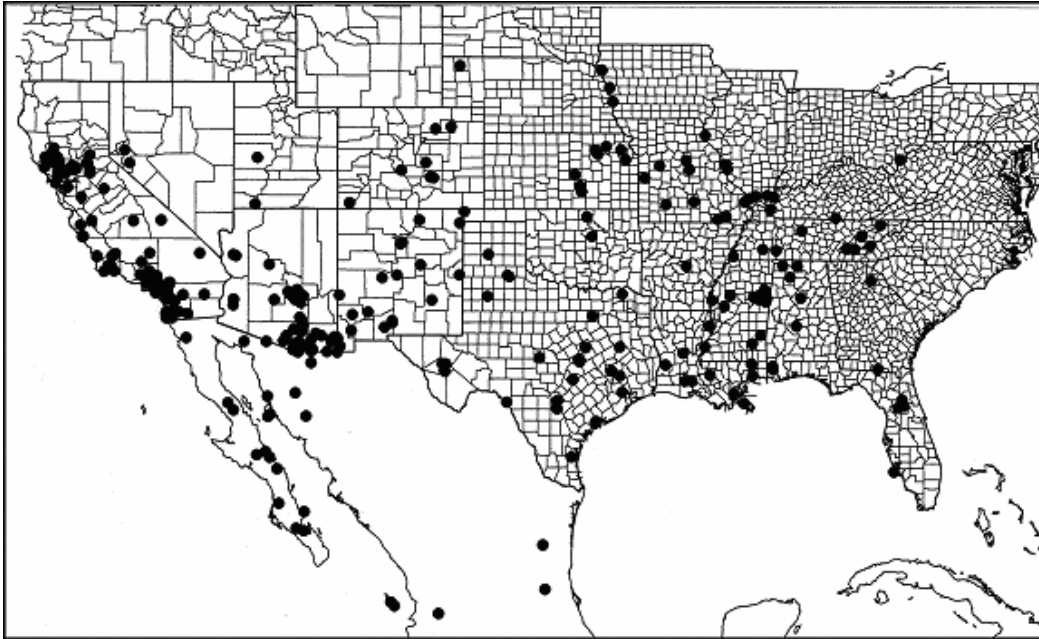
Map 6. Distribution of: *N. kiowapache* (▲); *N. leonardi* (●); *N. goyahkla* (◆).



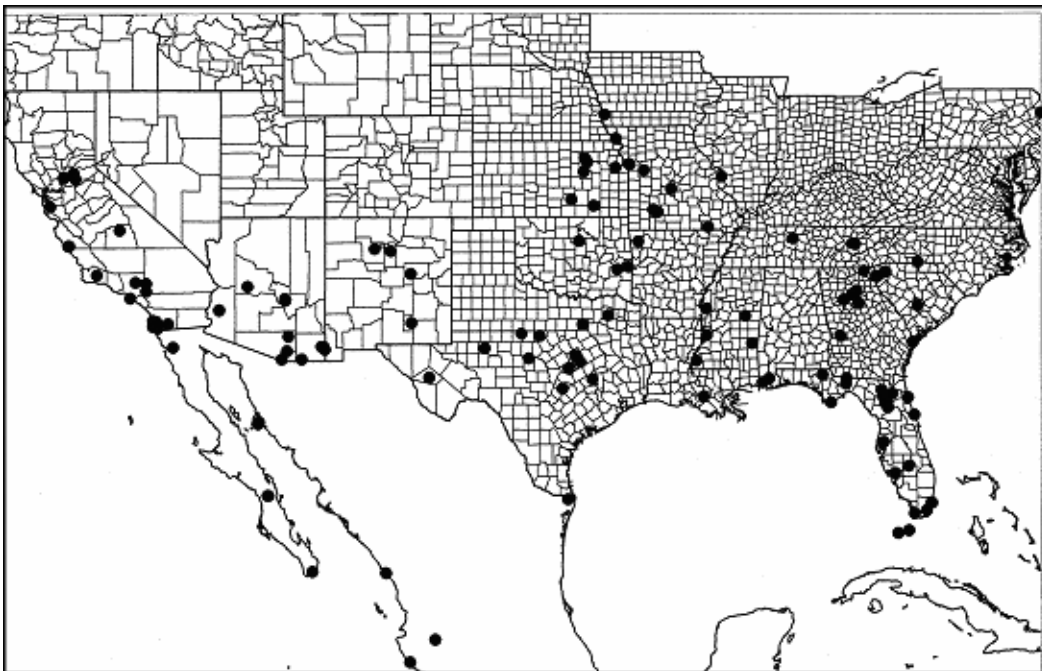
Map 7. Distribution of: *N. melanocephalus* (▲); *N. melshaemeri* (●).



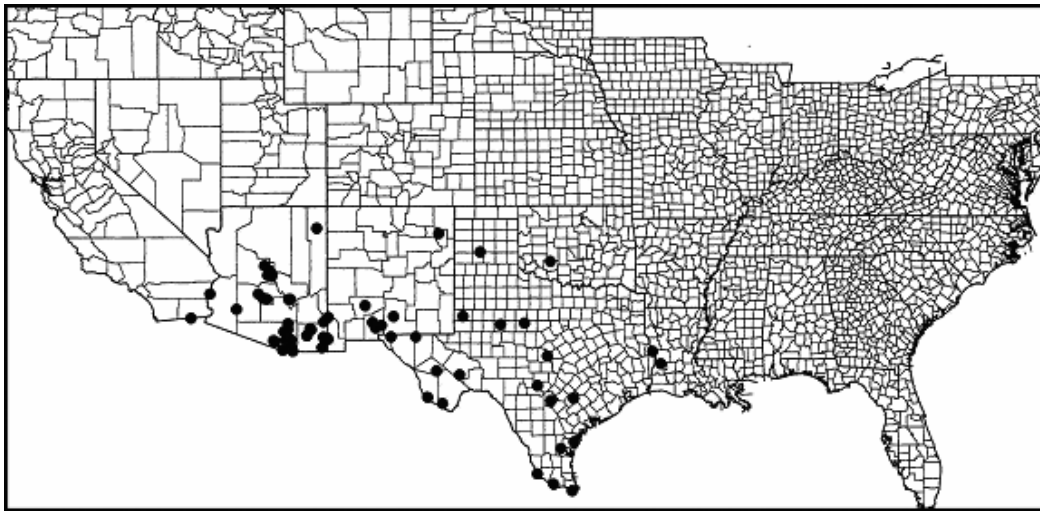
Map 8. Distribution of *N. minor*.



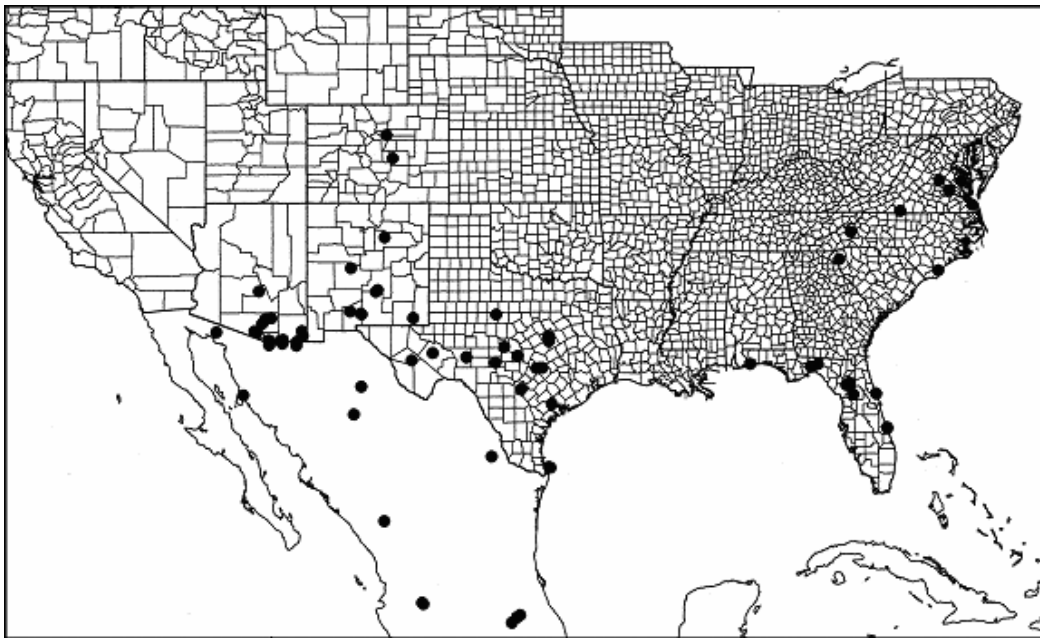
Map 9. Distribution of *N. nigrescens*.



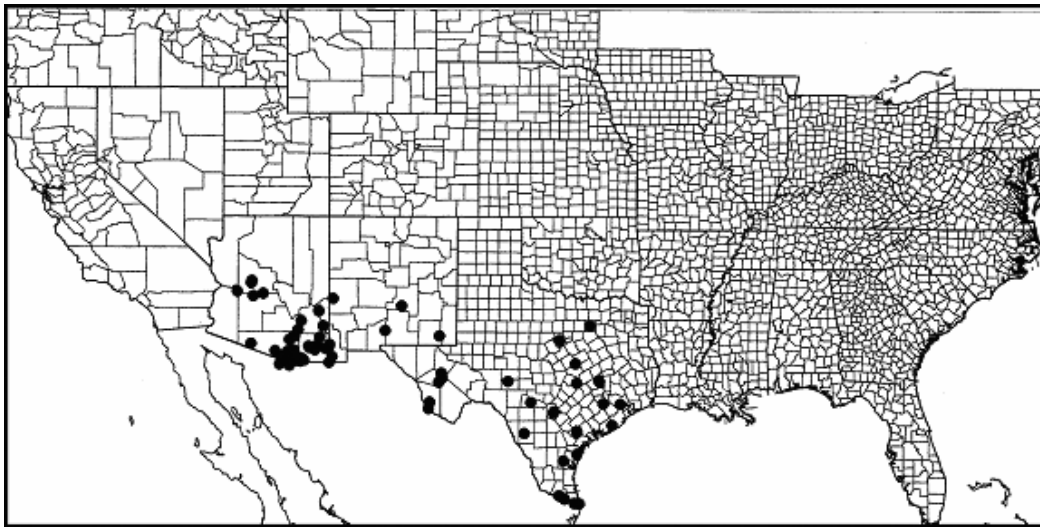
Map 10. Distribution of *N. opacithorax*.



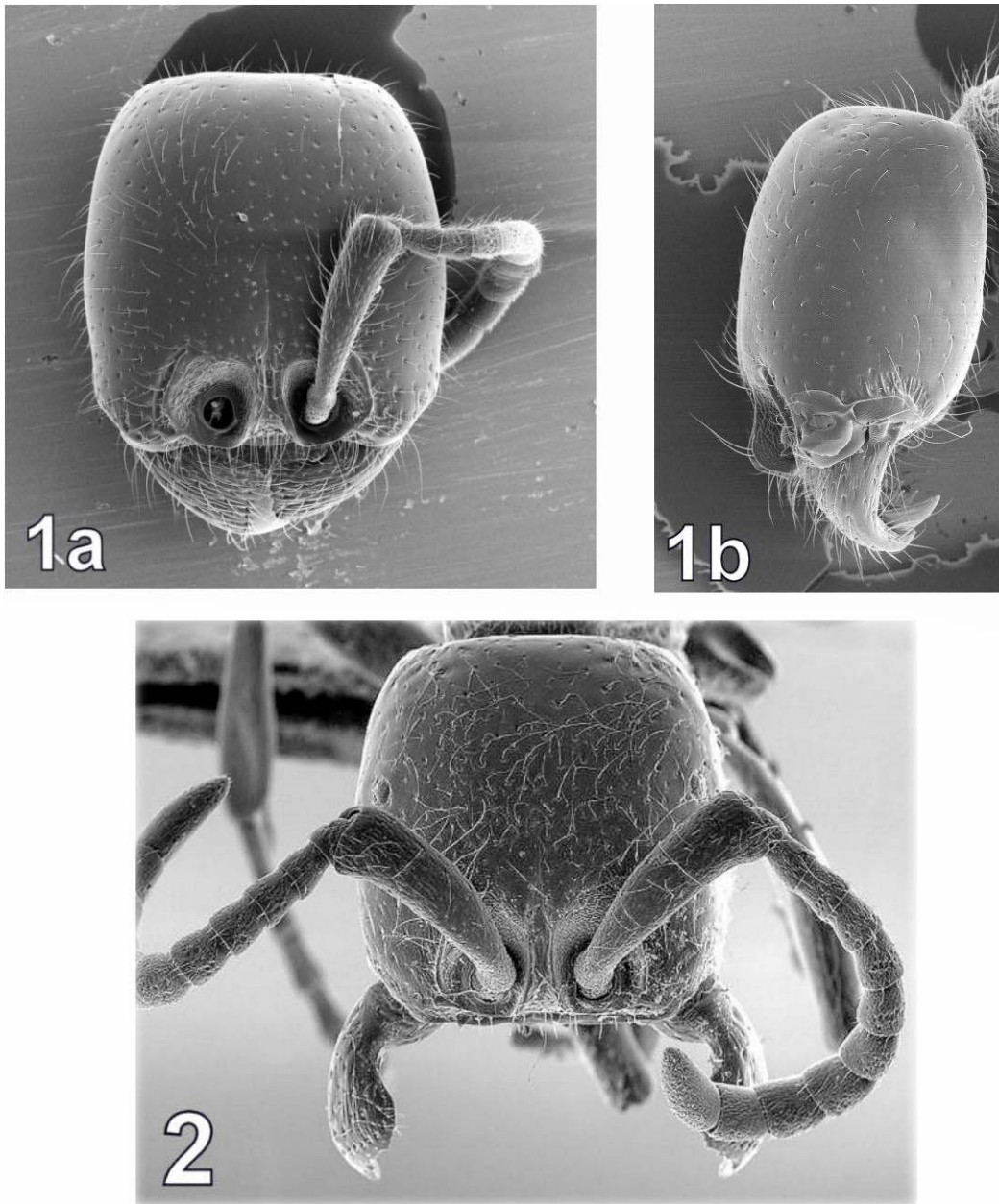
Map 11. Distribution of *N. swainsonii*.



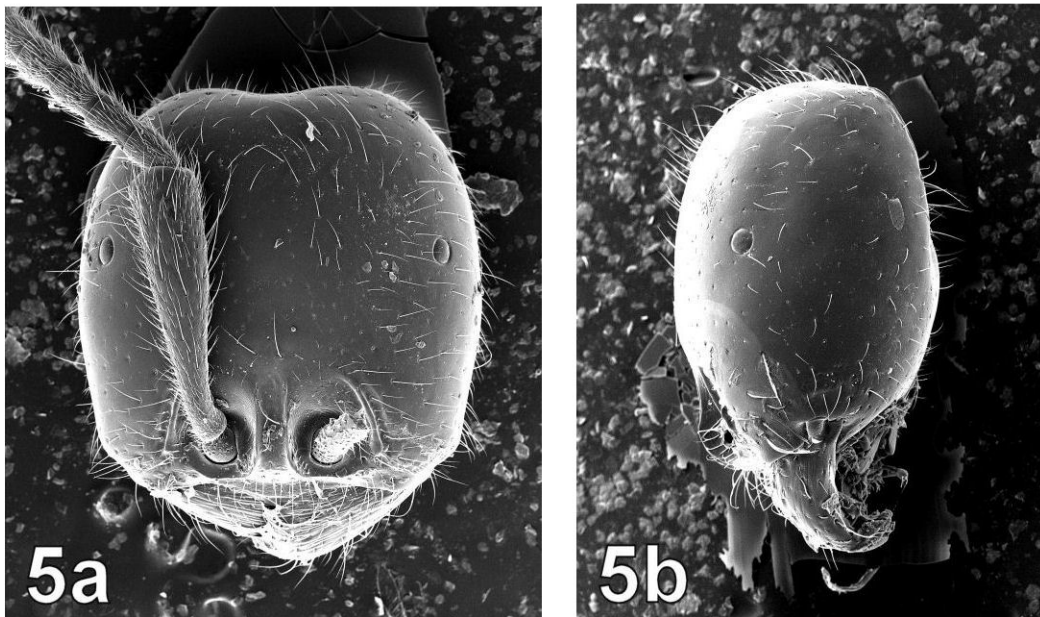
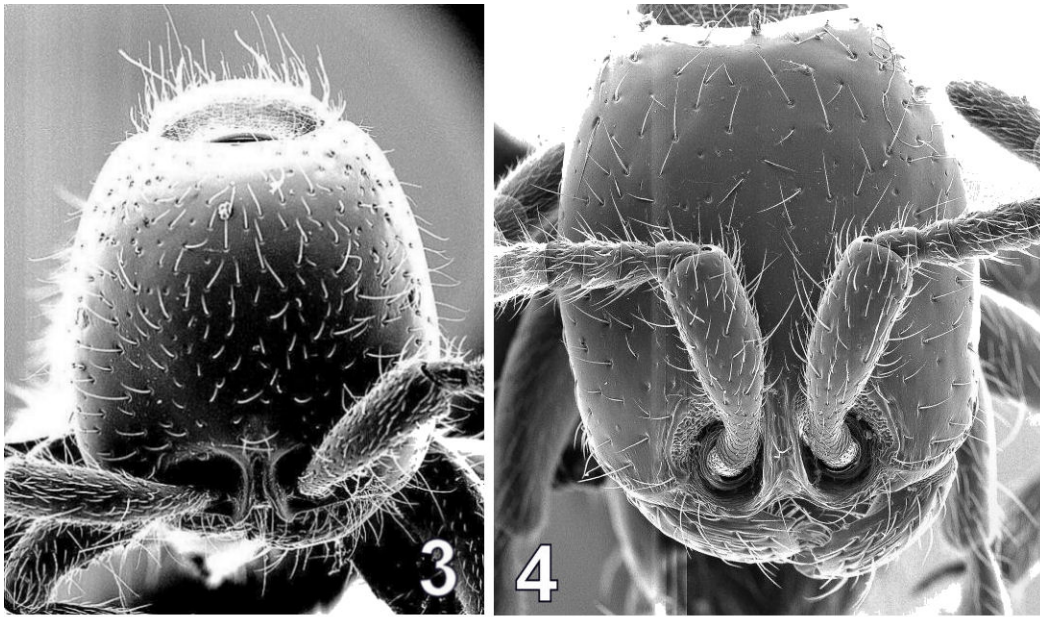
Map 12. Distribution of *N. texanus*.



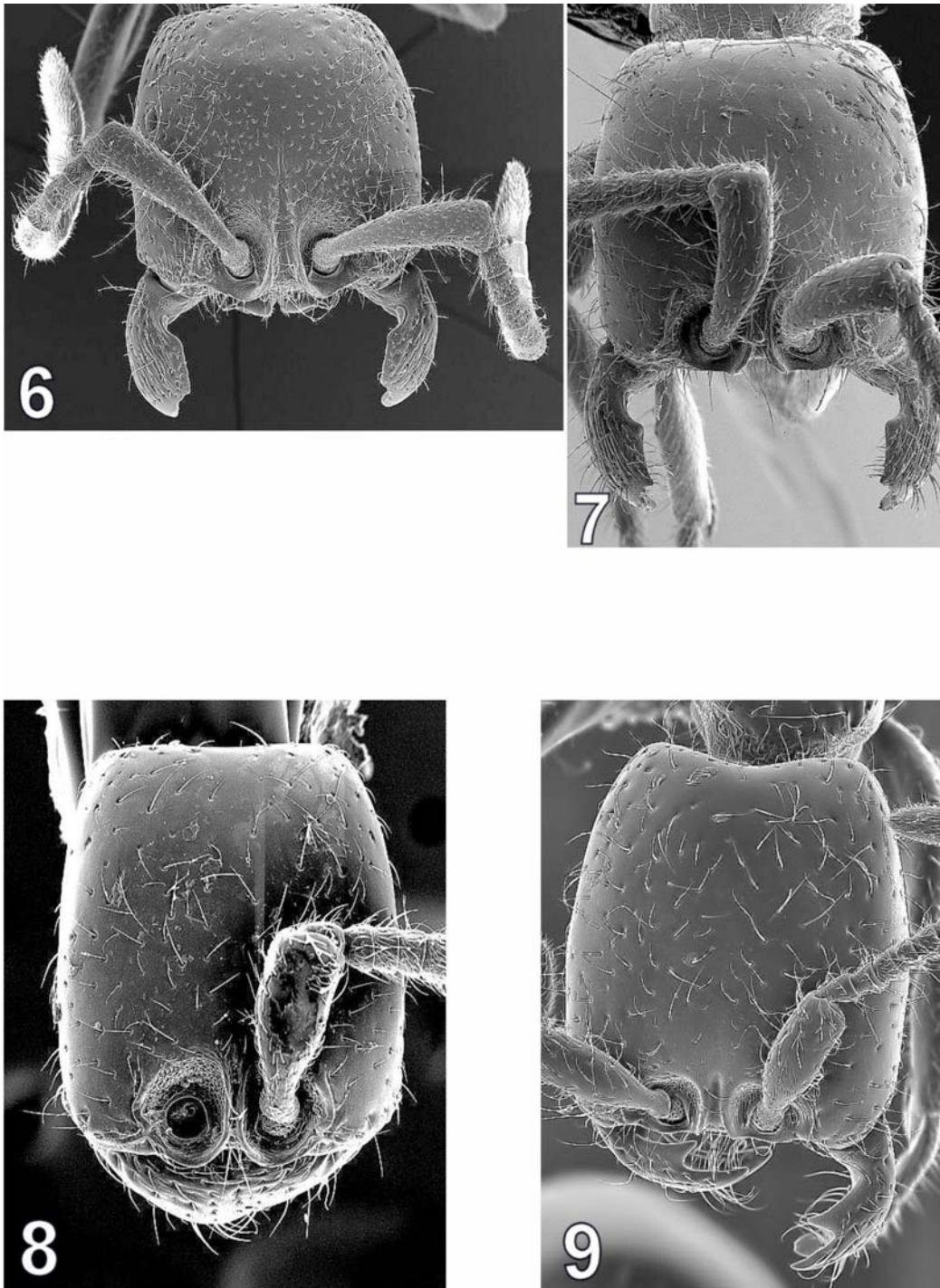
Map 13. Distribution of *N. harrisi*.



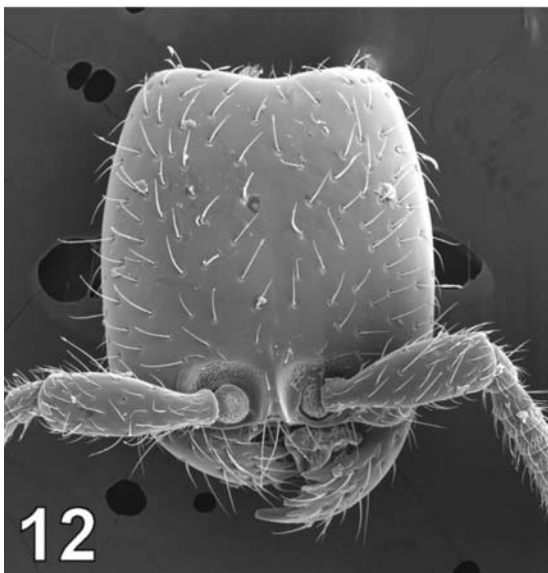
Figures 1-2. Frontal view of head of: 1a-b, *N. agilis*; 2, *N. californicus*.



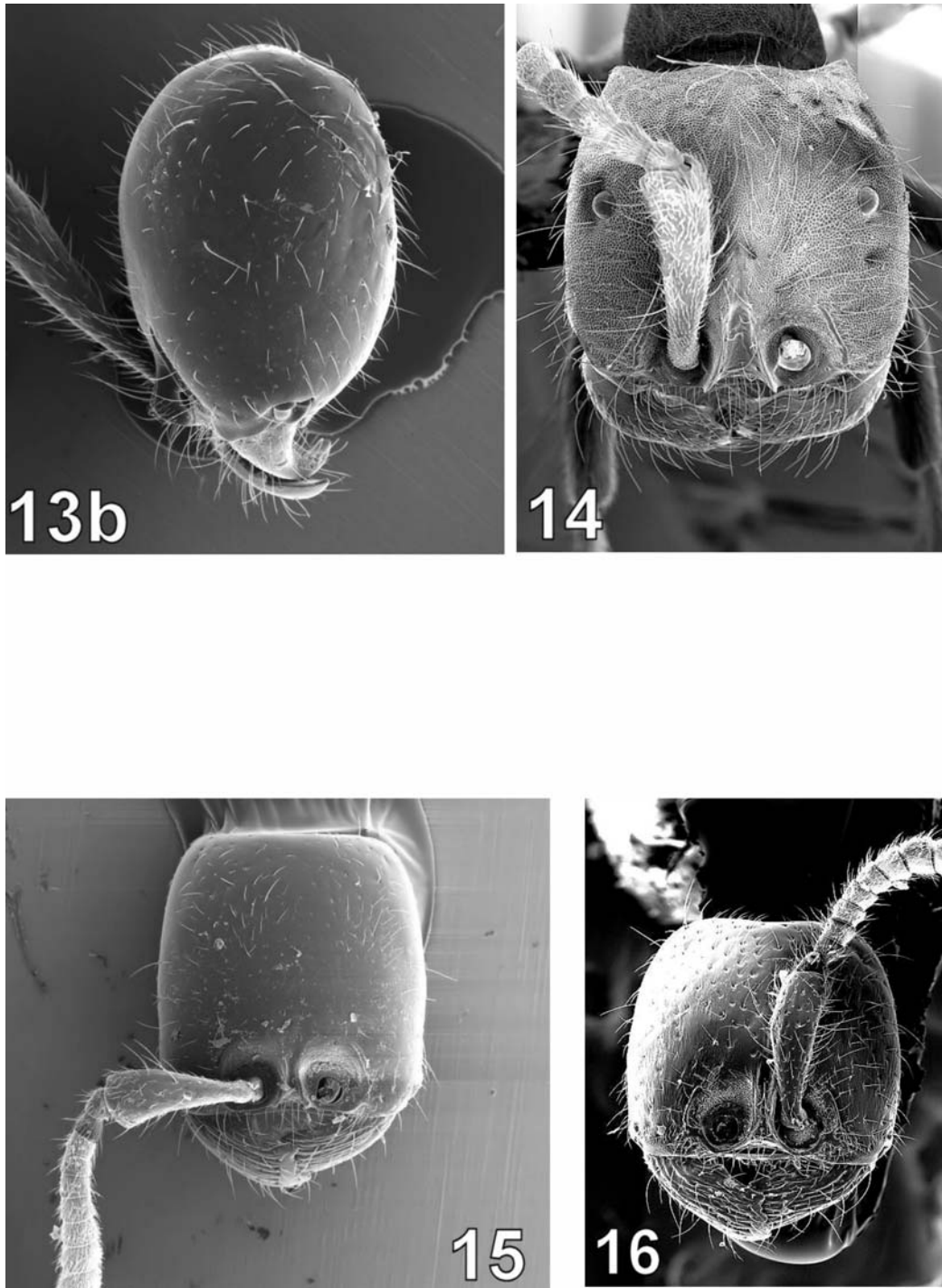
Figures 3-5. Frontal view of head of: 3, *N. carolinensis*; 4, *N. goyahkla*; 5a,b *N. graciellae*



Figures 6-9. Frontal view of head of: 6, *N. harrisi*; 7, *N. kiowapache*; 8, *N. microps*; 9, *N. moseri*.

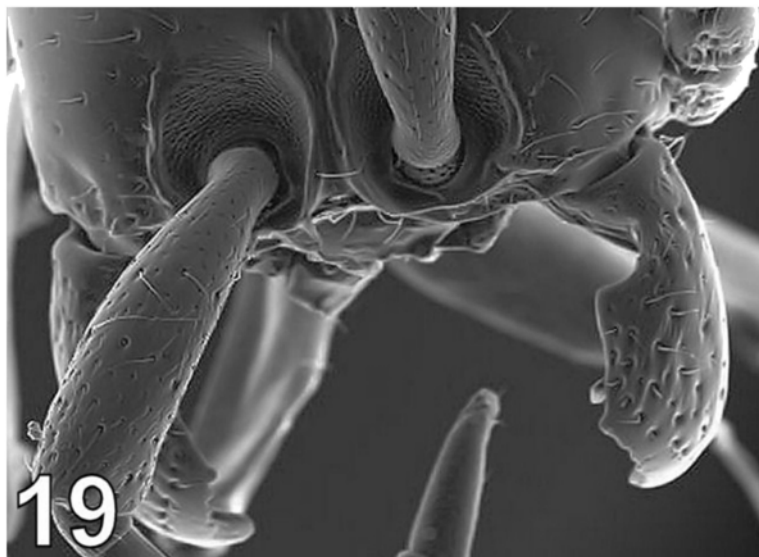
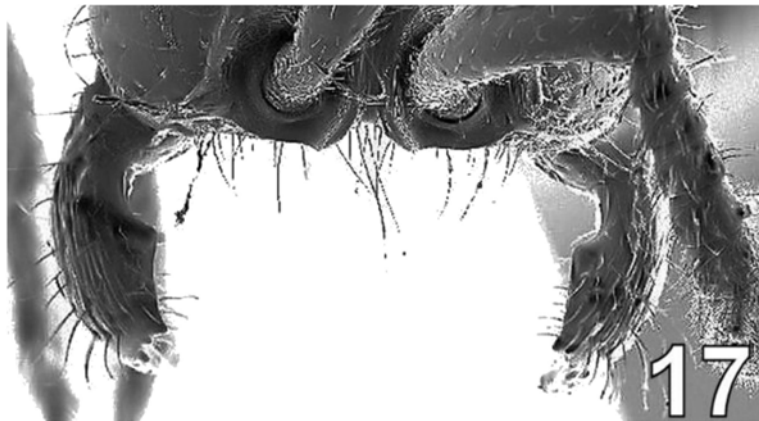


Figures 10-13a. Frontal view of head of: 10, *N. nigrescens*; 11, *N. nyensis*; 12, *N. pauxillus*; 13a, *N. pilosus*.

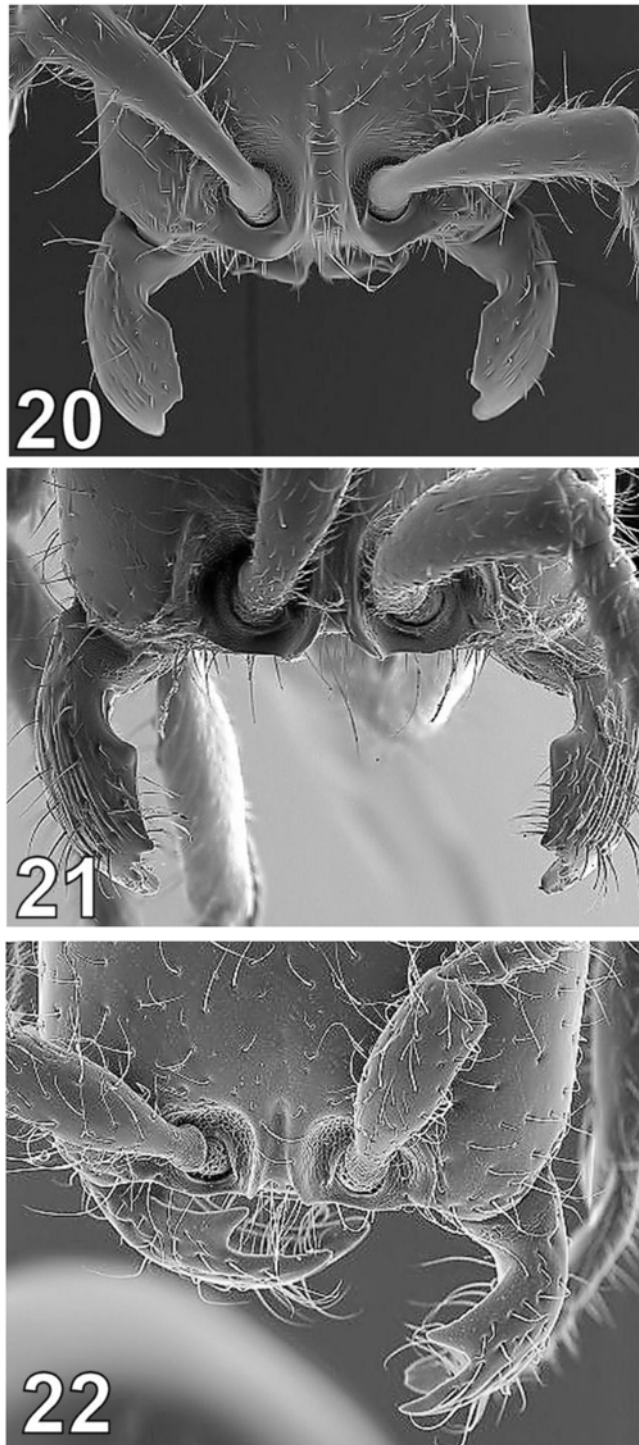


Figures 13b. Side view of head: 13b, *N. pilosus*.

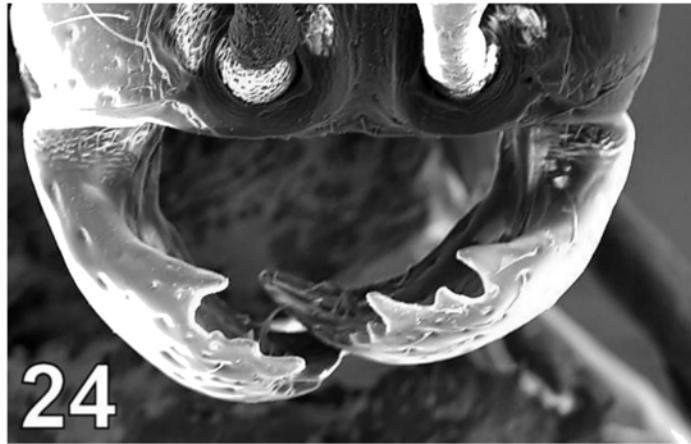
Figures 14-16. Frontal view of head of: 14, *N. rugulosus*; 15, *N. swainsonii*; 16 *N. wilsoni*.



Figures 17-19. Mandibles and subantennal lamella of: 17, *N. agilis*; 18, *N. californicus*; 19, *N. carolinensis*.



Figures 20-22. Mandibles and subantennal lamella of: 20, *N. harrisi*; 21, *N. kiowapache*; 22, *N. moseri*.



Figures 23-25. Mandibles of: 23, *N. nyensis*; 24, *N. pauxillus*; 25, *N. swainsonii*.

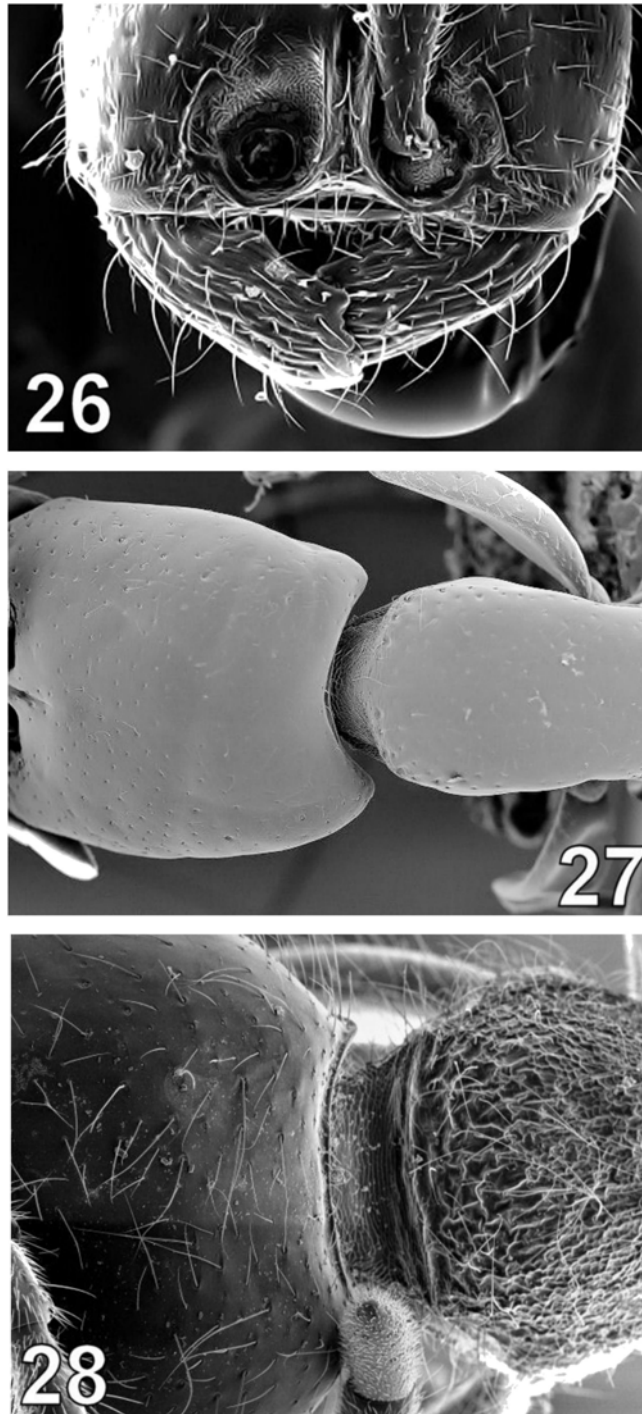
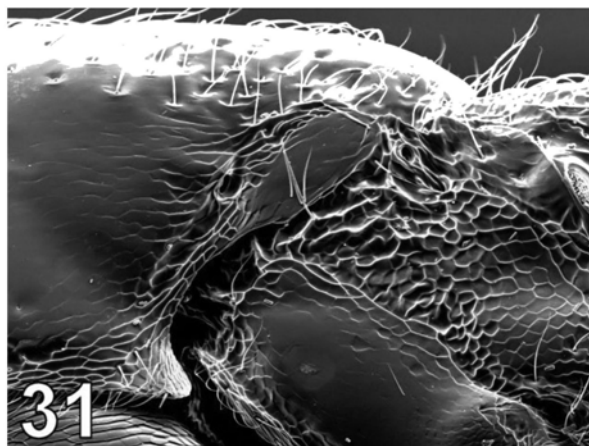
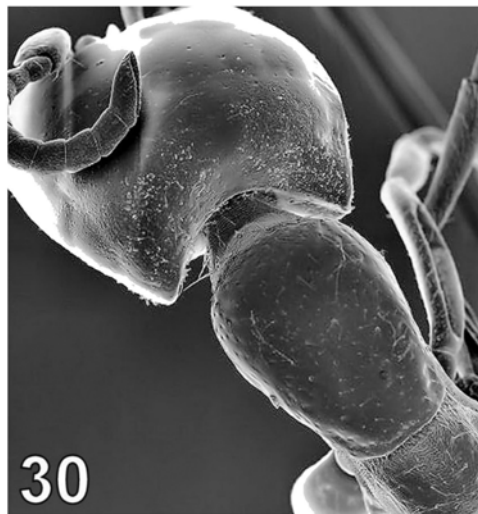
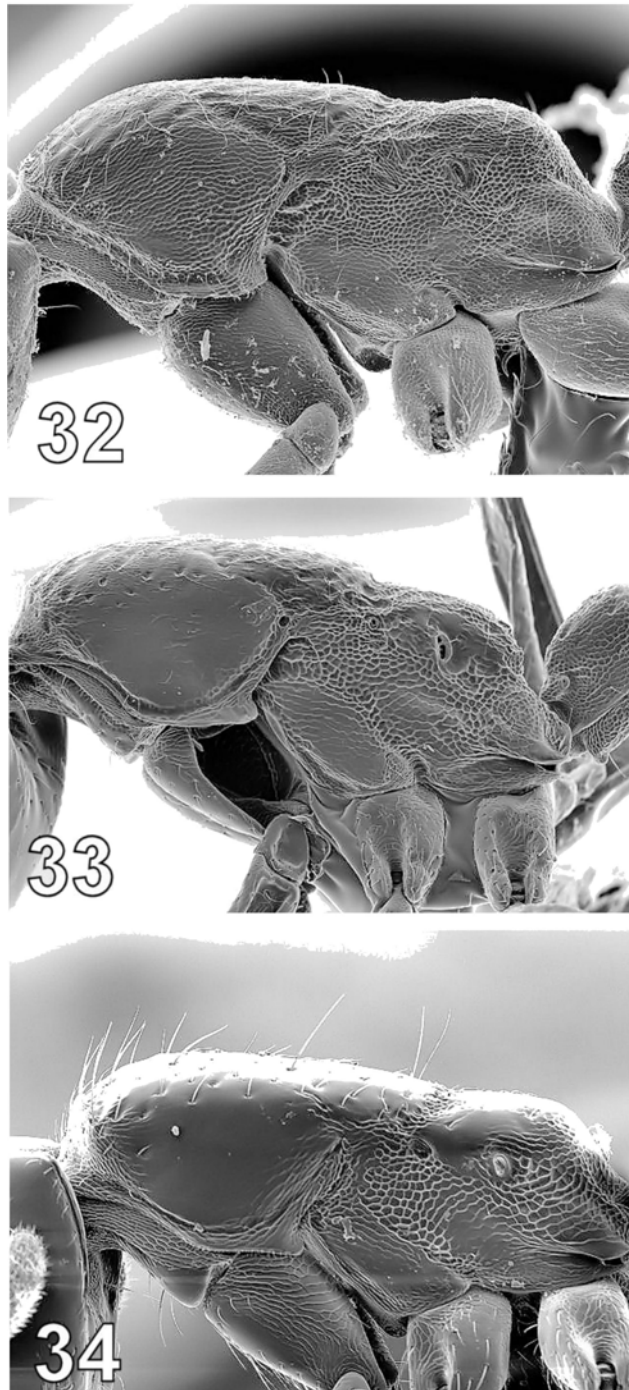


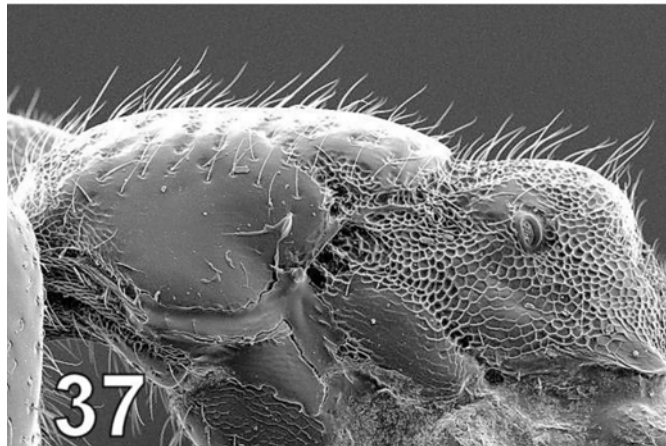
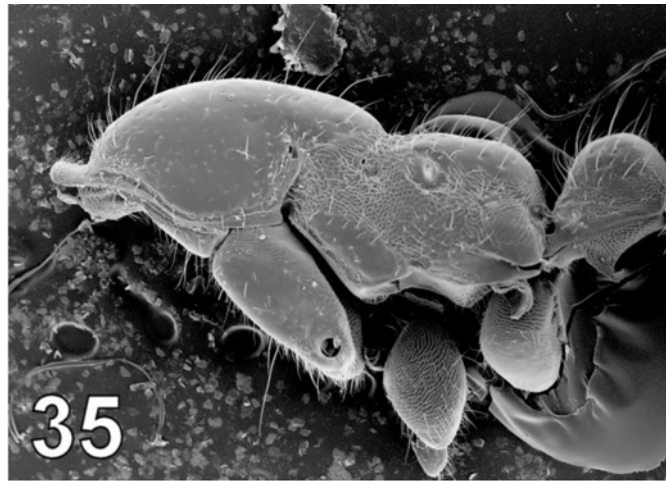
Figure 26. Mandible of *N. wilsoni*. **Figures 27-28:** Dorsal view of head and pronotum of: 27, *N. leonardi*; 28, *N. melanocephalus*.



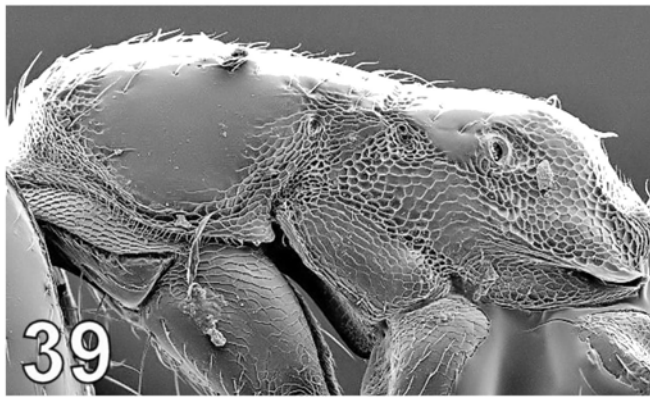
Figures 29-30. Dorsal view of head and pronotum of: 29, *N. nigrescens*; 30, *N. swainsonii*.
Figure 31. Lateral view of mesosoma of: 31, *N. agilis*.



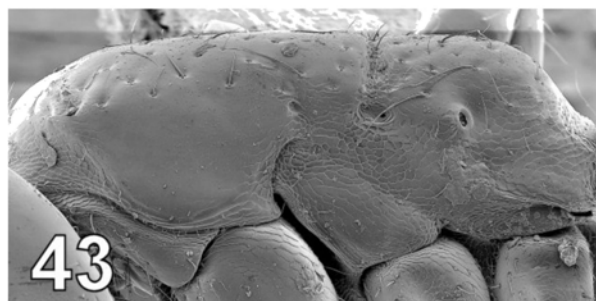
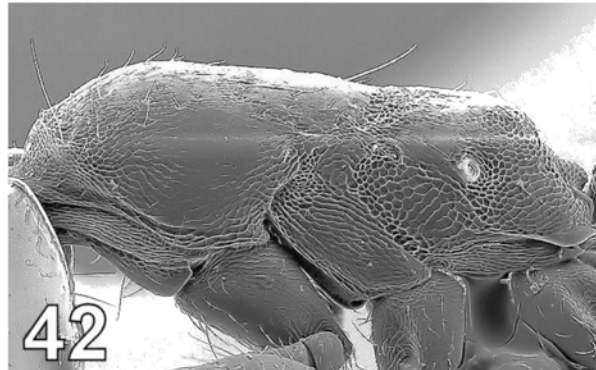
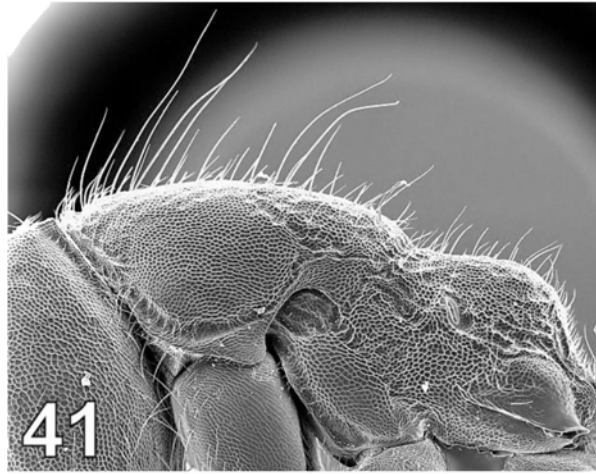
Figures 32-34. Lateral view of mesosoma of: 32, *N. californicus*; 33, *N. carolinensis*; 34, *N. goyahkla*.



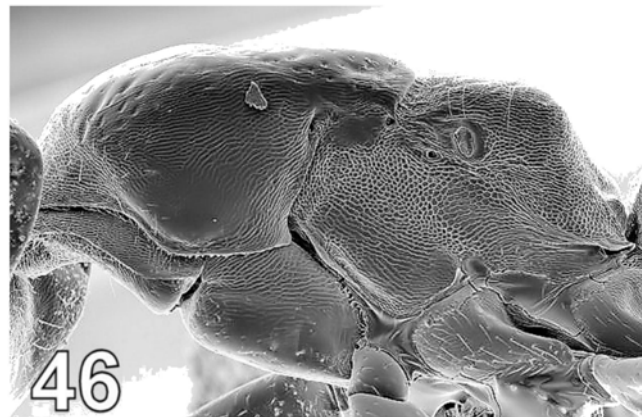
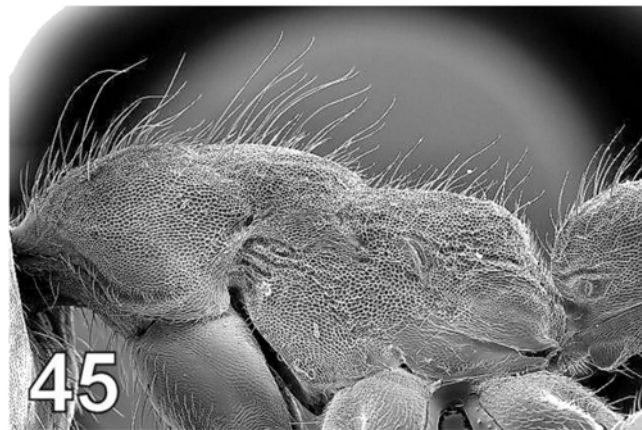
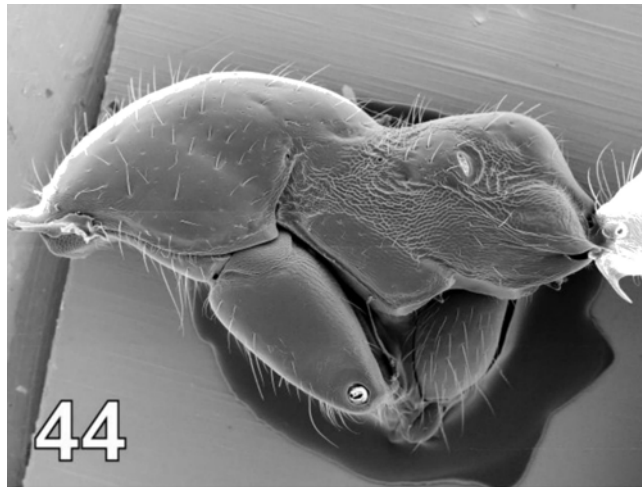
Figures 35-37. Lateral view of mesosoma of: 35, *N. graciellae*; 36, *N. harrisi*; 37, *N. kiowapache*.



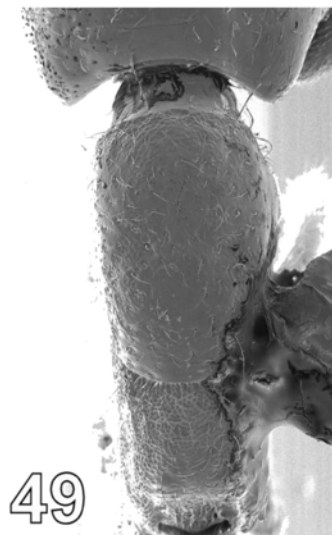
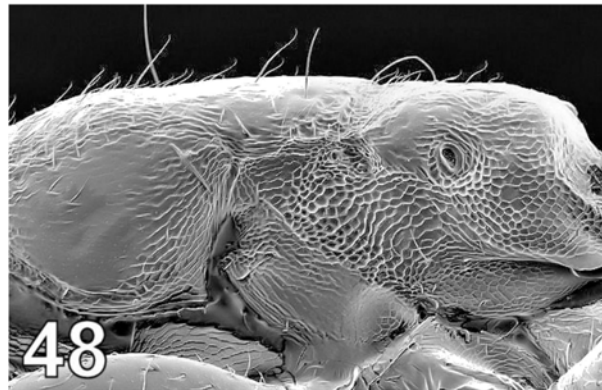
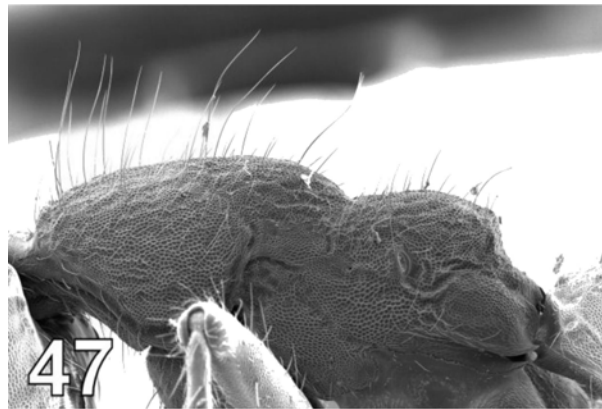
Figures 38-40. Lateral view of mesosoma of: 38, *N. leonardi*; 39, *N. microps*; 40, *N. moseri*.



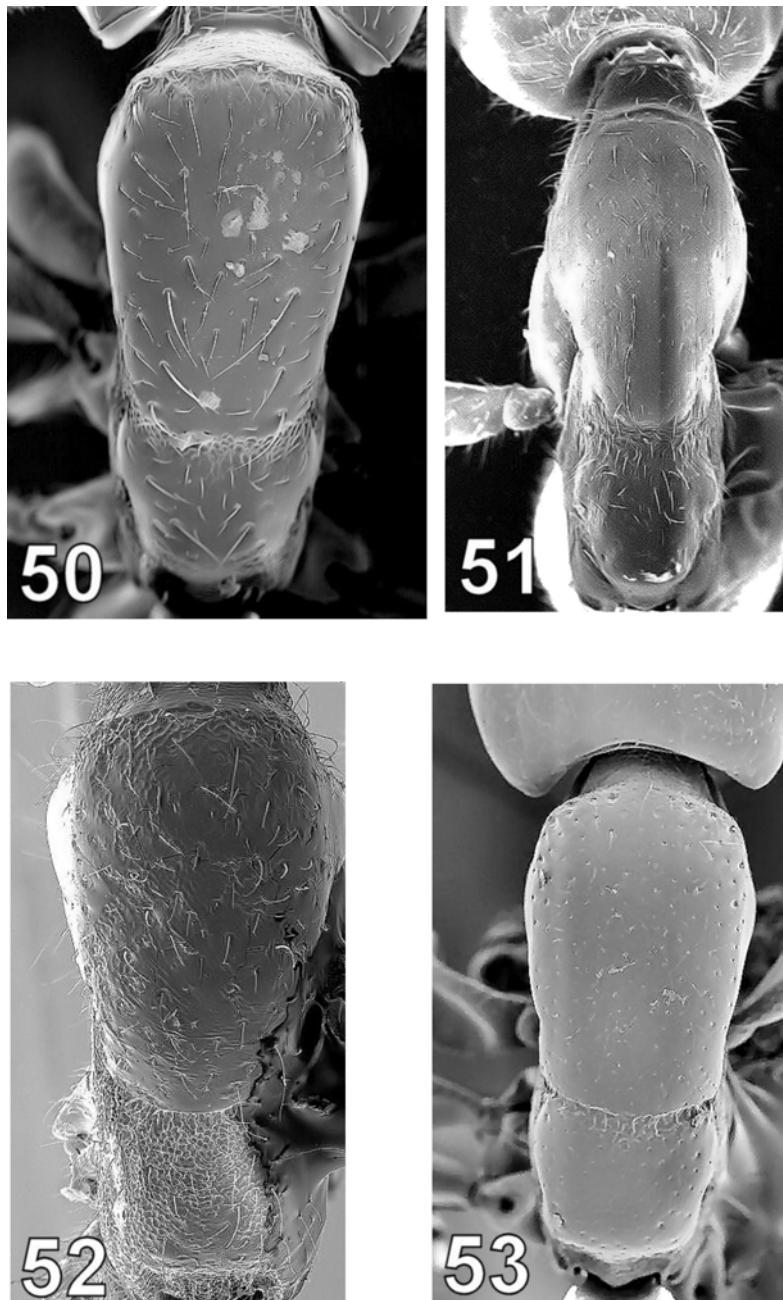
Figures 41-43. Lateral view of mesosoma of: 41, *N. nigrescens*; 42, *N. nyensis*; 43, *N. pauxillus*.



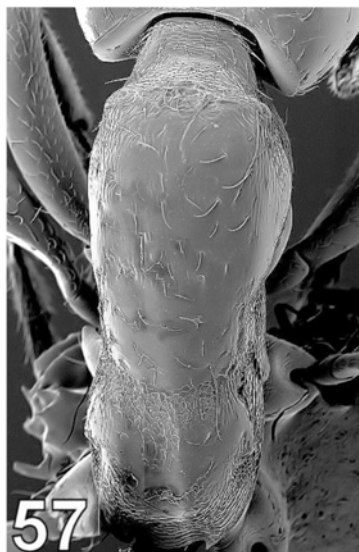
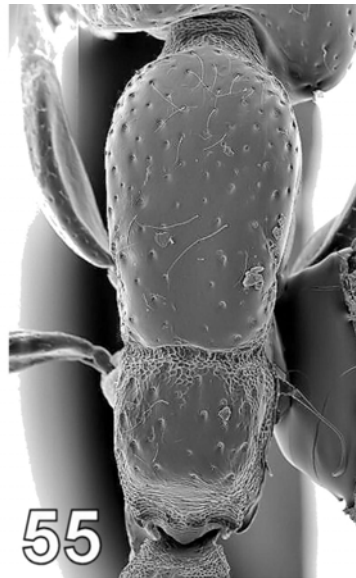
Figures 44-46. Lateral view of mesosoma of: 44, *N. pilosus*; 45, *N. rugulosus*; 46, *N. swainsonii*.



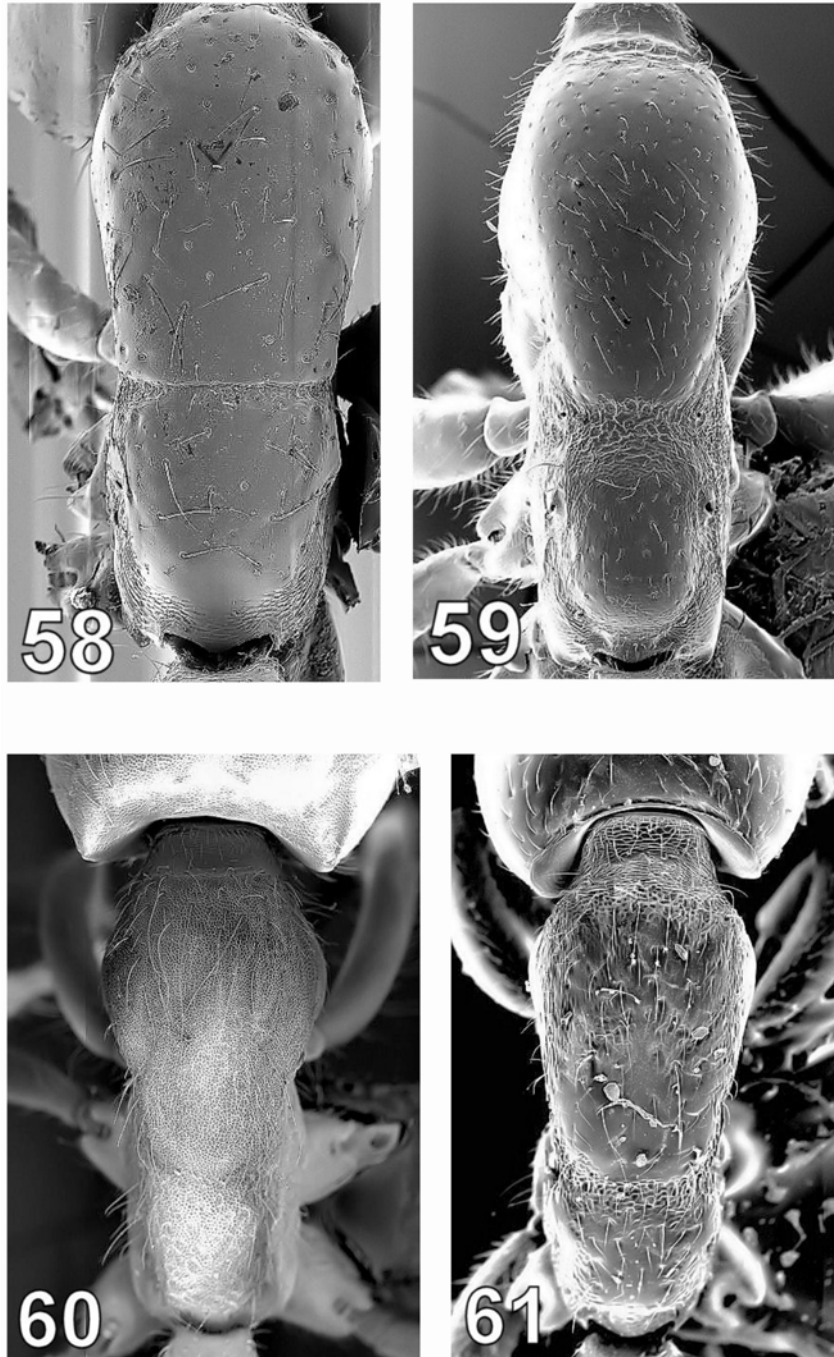
Figures 47-48. Dorsal view of mesosoma of: 47, *N. texanus*; 48, *N. wilsoni*.
Figure 49, Dorsal view of mesosoma of *N. agilis*.



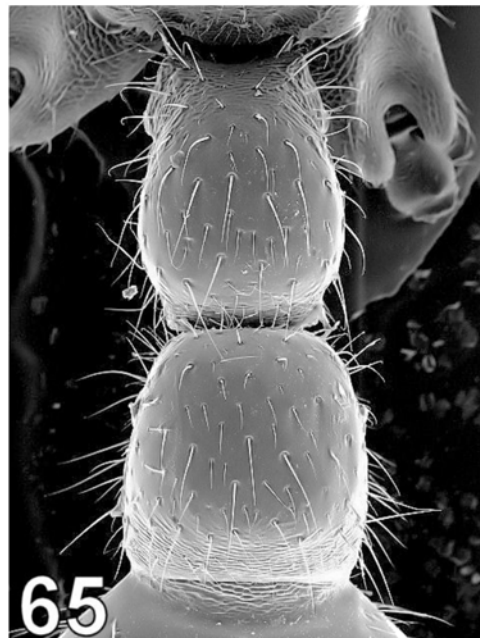
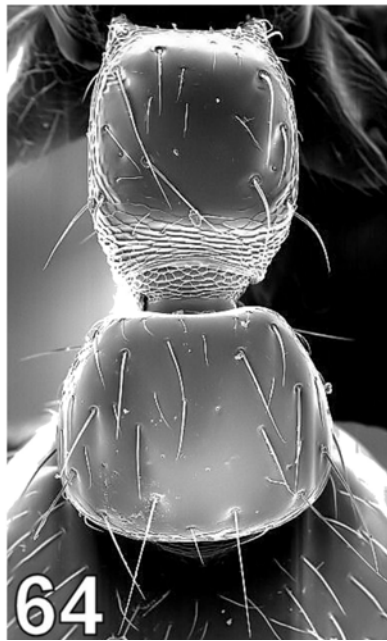
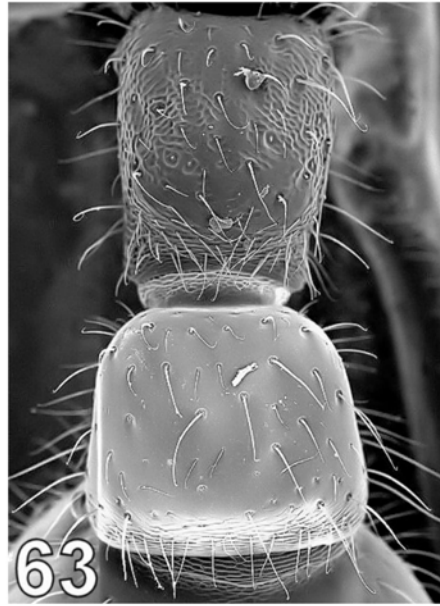
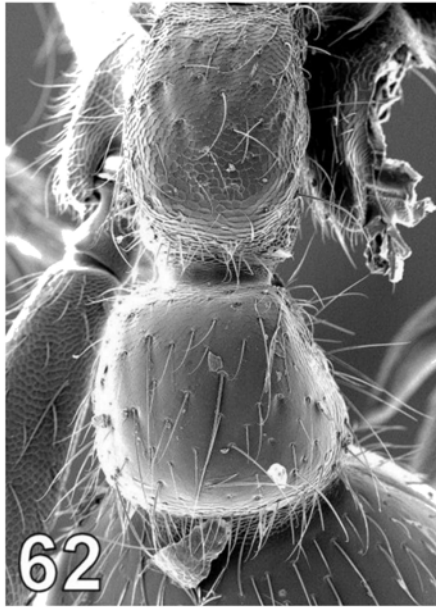
Figures 50-53. Dorsal view of mesosoma of: 50, *N. goyahkla*; 51, *N. graciellae*; 52, *N. kiowapache*; 53, *N. leonardi*.



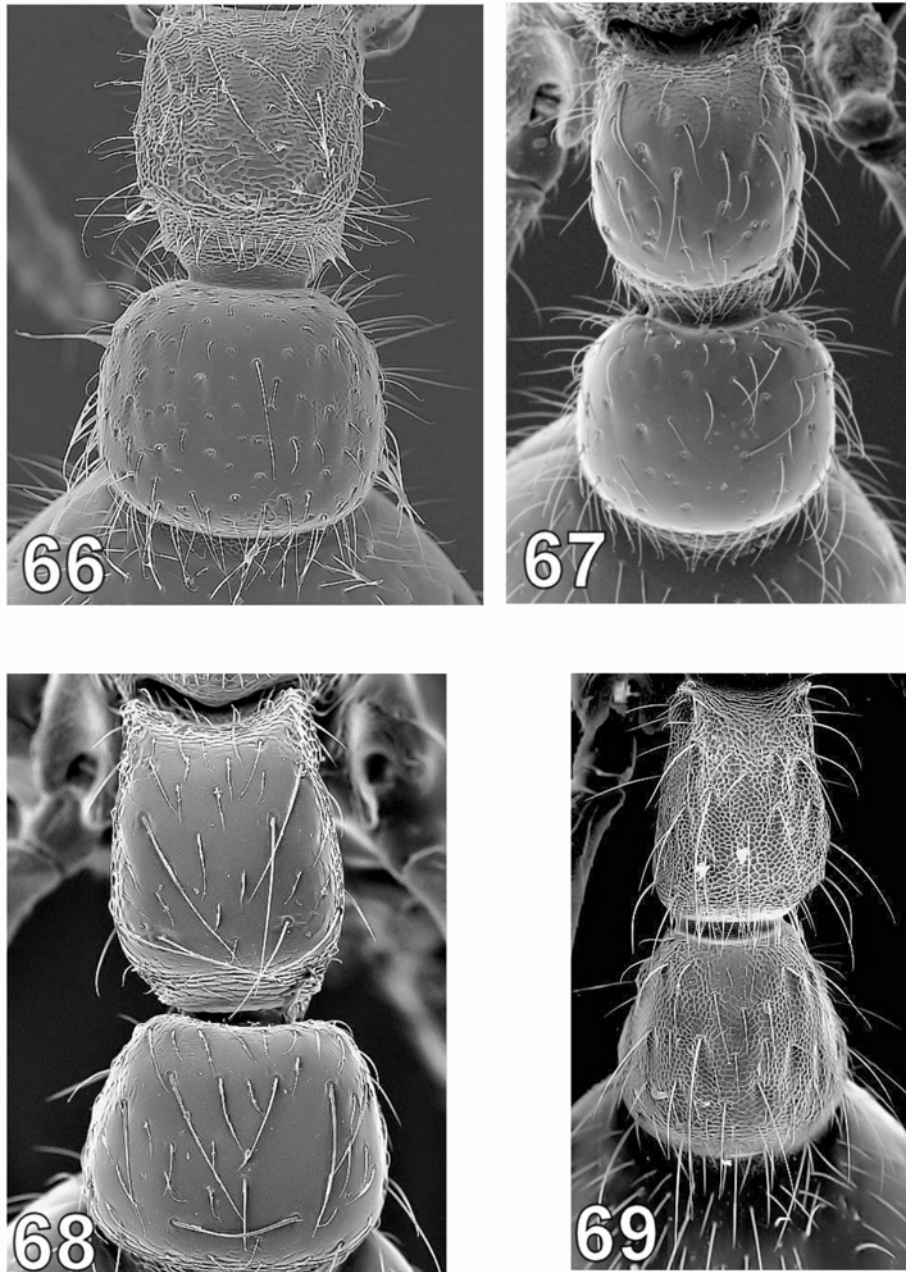
Figures 54-57. Dorsal view of mesosoma of: 54, *N. microps*; 55, *N. moseri*; 56, *N. nigrescens*; 57, *N. nyensis*.



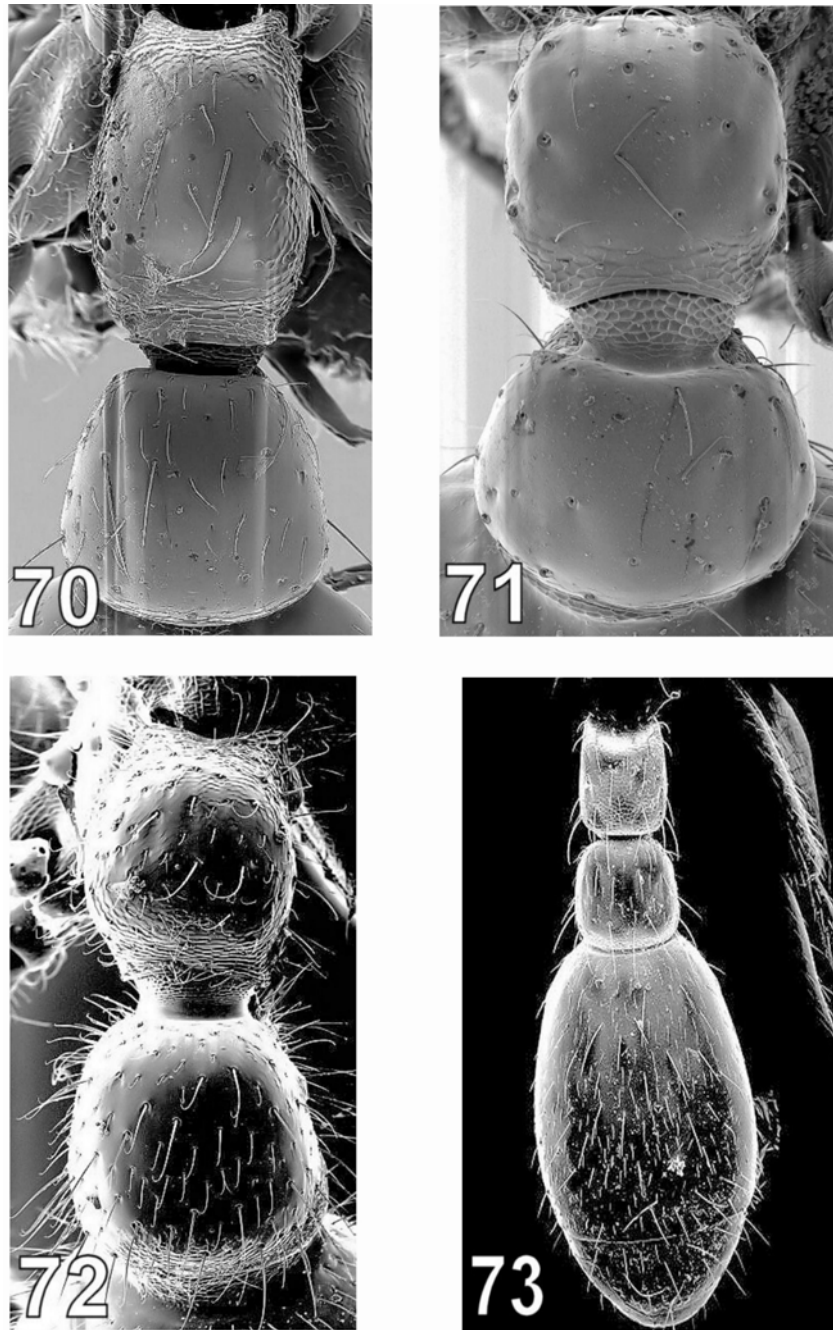
Figures 58-61. Dorsal view of mesosoma of: 58, *N. pauxillus*; 59, *N. pilosus*; 60, *N. rugulosus*; 61, *N. wilsoni*.



Figures 62-65. Dorsal view of petiole and postpetiole of: 62, *N. californicus*; 63, *N. carolinensis*; 64, *N. goyahkla*; 65, *N. graciellae*.



Figures 66-69. Dorsal view of petiole and postpetiole of: 66, *N. harrisi*; 67, *N. kiowapache*; 68, *N. microps*; 69, *N. nigrescens*.



Figures 70-73. Dorsal view of petiole and postpetiole of: 70, *N. nyensis*; 71, *N. pauxillus*; 72, *N. pilosus*; 73, *N. swainsonii*.

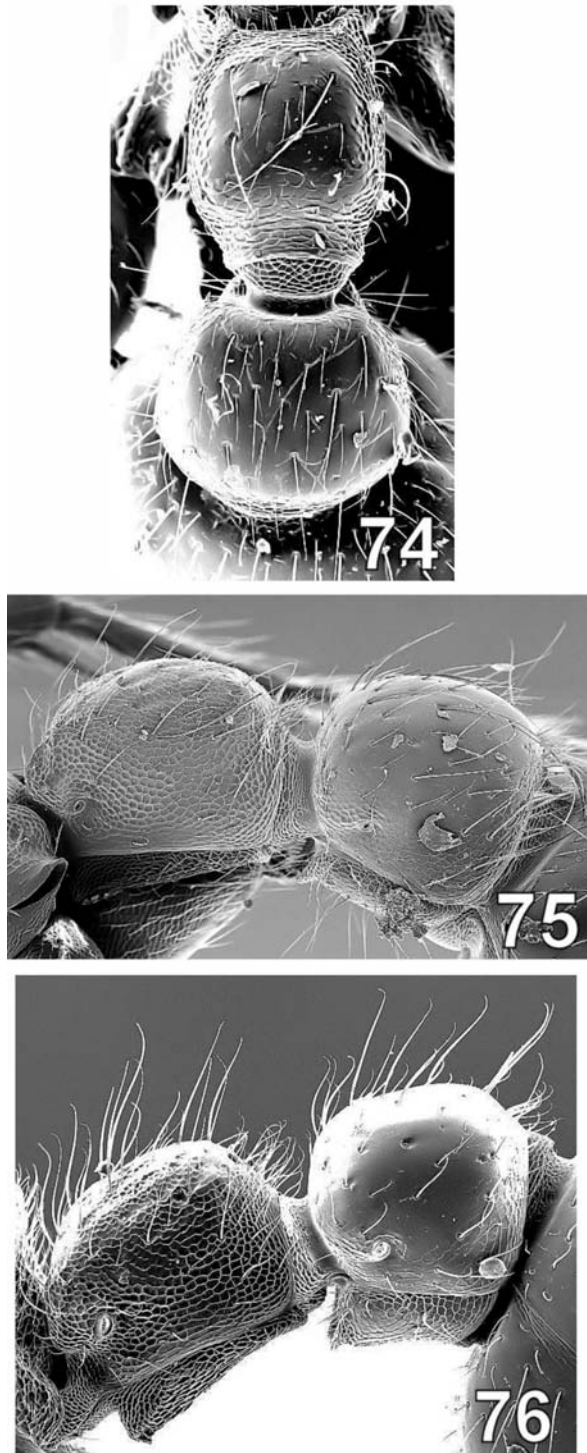
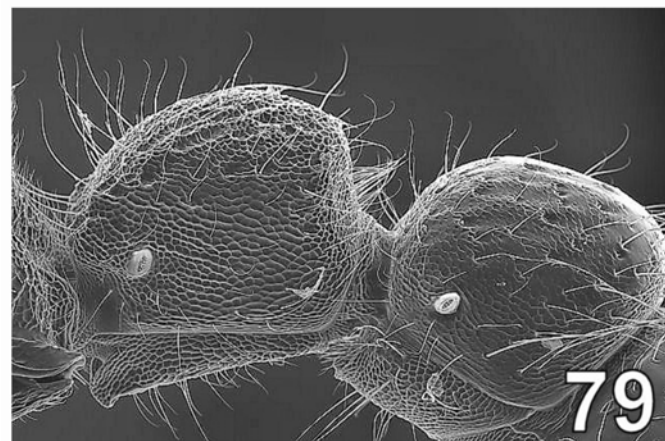
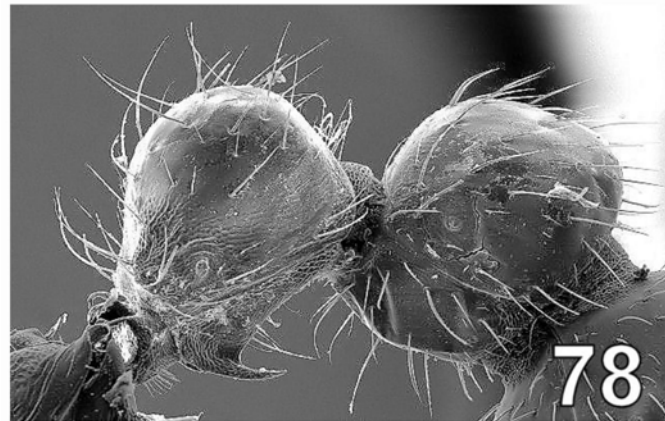
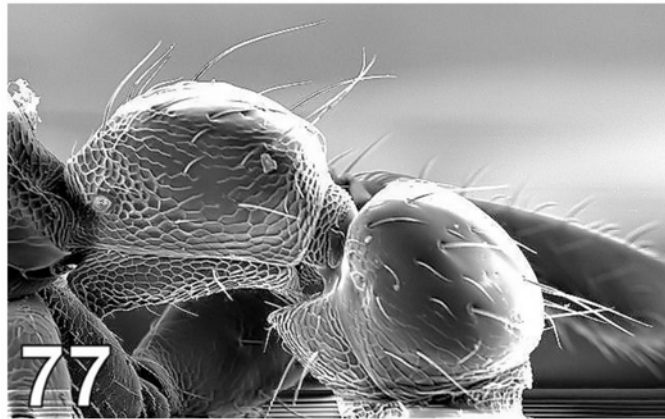
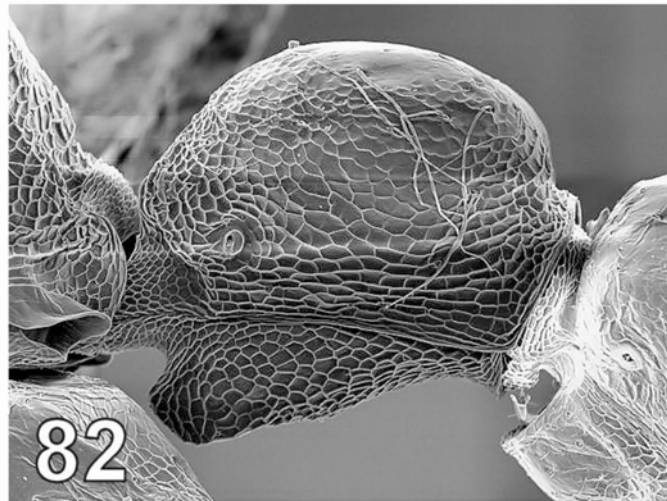
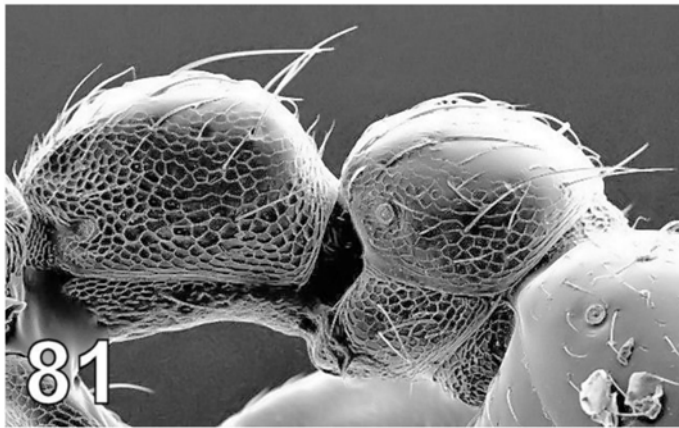
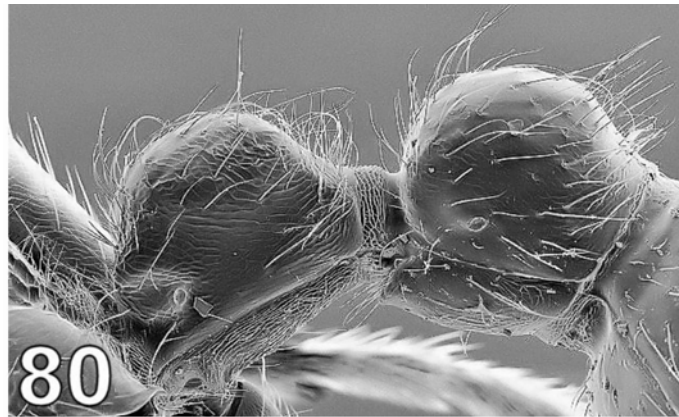


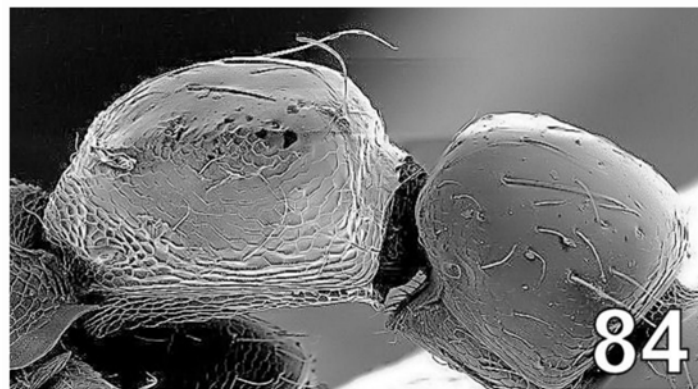
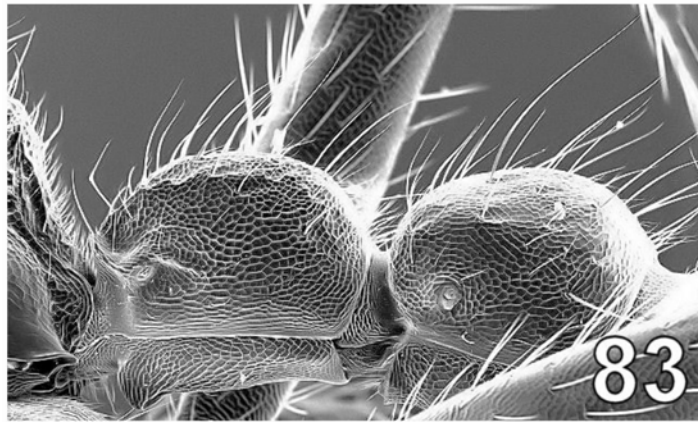
Figure 74. Dorsal view of petiole and postpetiole of *N. wilsoni*. **Figures 75-76,** Lateral view of petiole of: 75, *N. californicus*; 76, *N. carolinensis*.



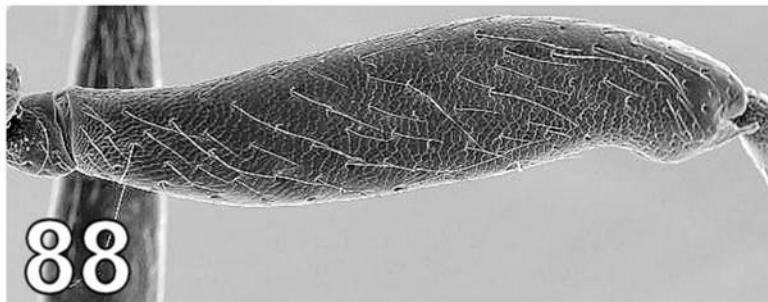
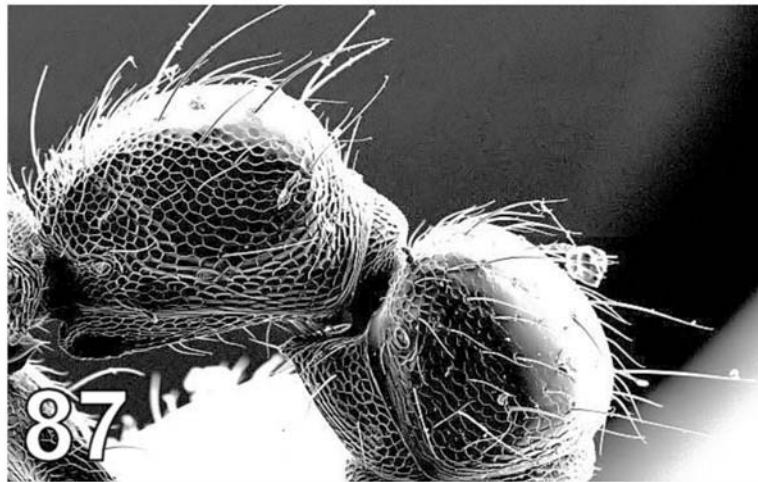
Figures 77-79. Lateral view of petiole of: 77, *N. goyahkla*; 78, *N. graciellae*; 79, *N. harrisi*.



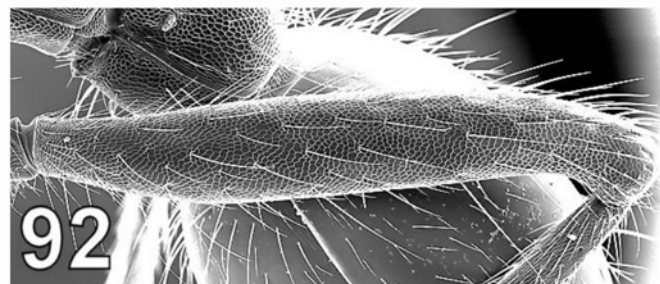
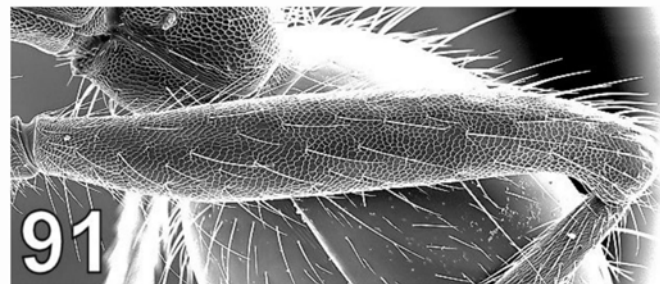
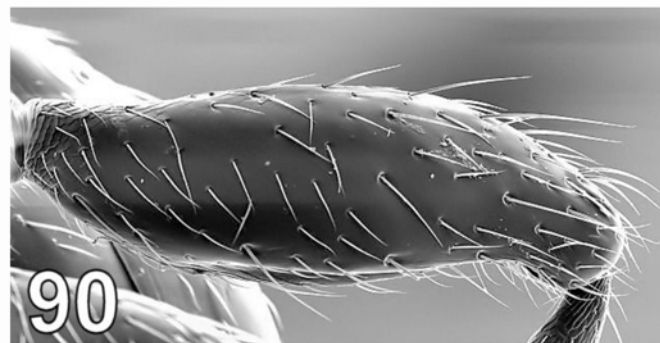
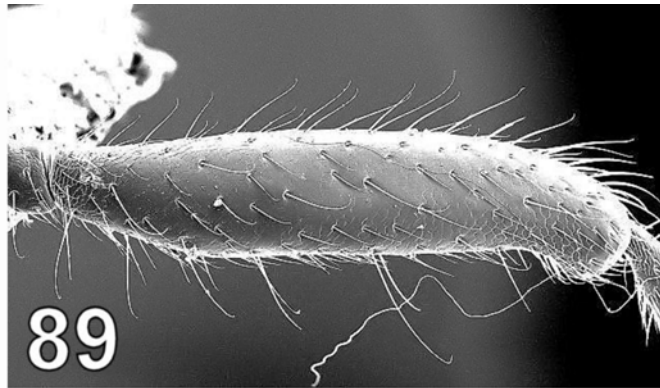
Figures 80-82. Lateral view of petiole of: 80, *N. melancephalus*; 81, *N. microps*; 82, *N. moseri*.



Figures 83-85. Lateral view of petiole of: 83, *N. nigrescens*; 84, *N. nyensis*; 85, *N. paucillus*.



Figures 86-87. Lateral view of petiole of: 86, *N. pilosus*; 87, *N. wilsonii*.
Figure 88. Hind femur of *N. californicus*.



Figures 89-92. Hind femora of: 89, *N. carolinensis*; 90, *N. goyahkla*; 91, *N. kiowapache*; 92, *N. nigrescens*.

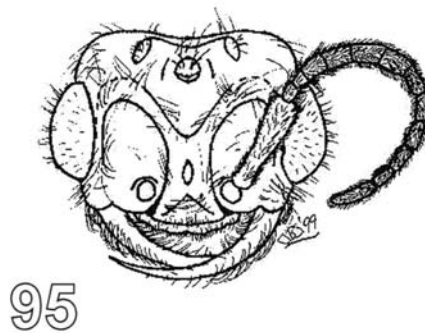
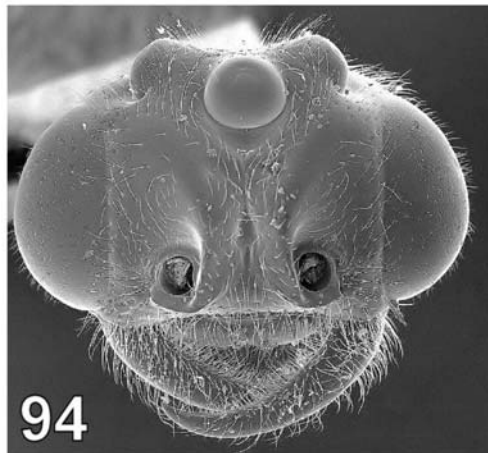
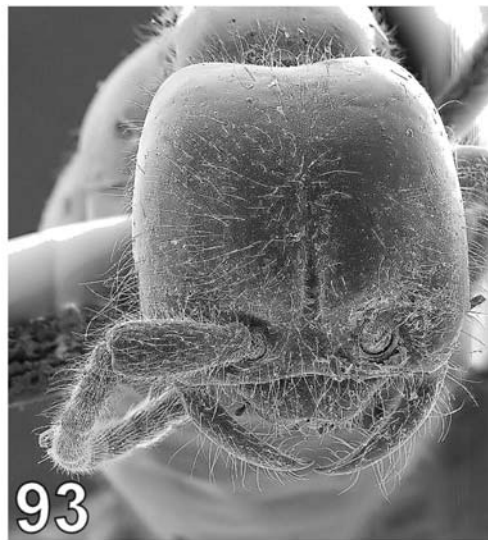
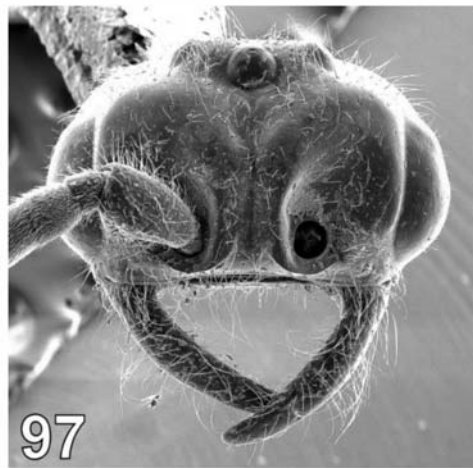
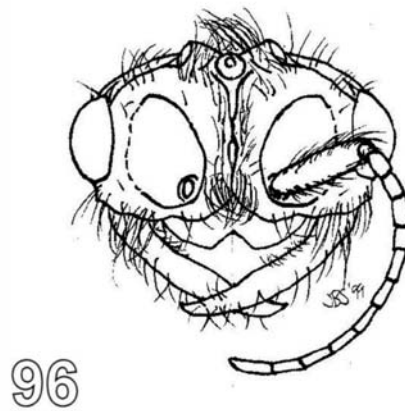


Figure 93. Frontal view of head of queen *N. kiowapache*. **Figures 94-95.** Frontal view of head of males: 94, *N. andrei*; 95, *N. baylora*. **Figure 95** by James Snelling.



Figures 96-97. frontal view of head of male: 96, *N. carolinensis*; 97, *N. kiowapache*. **Figure 98,** lateral view of head of male *N. kiowapache*. **Figure 96** by James Snelling.

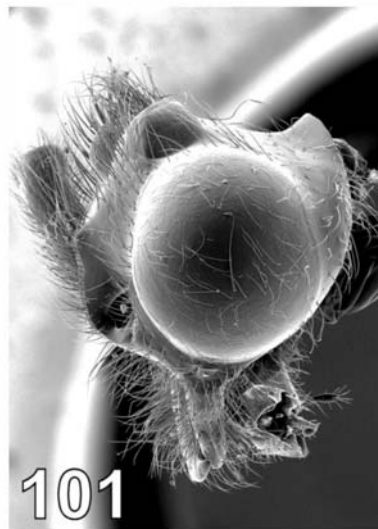
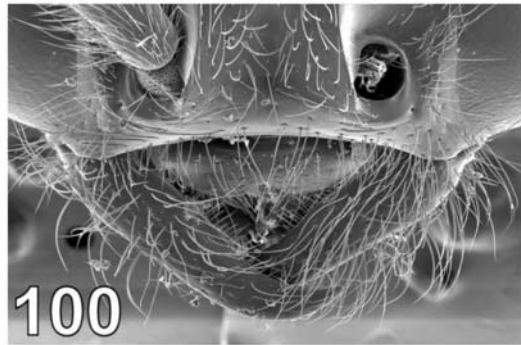
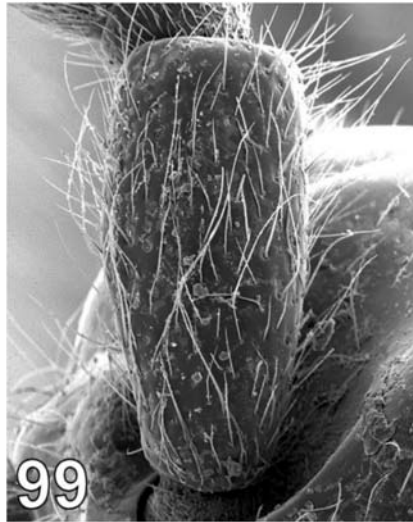
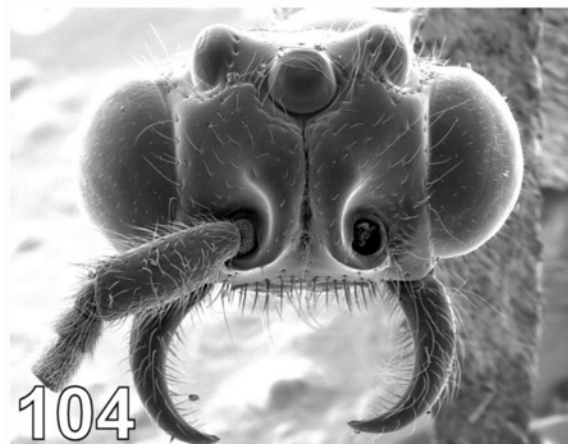
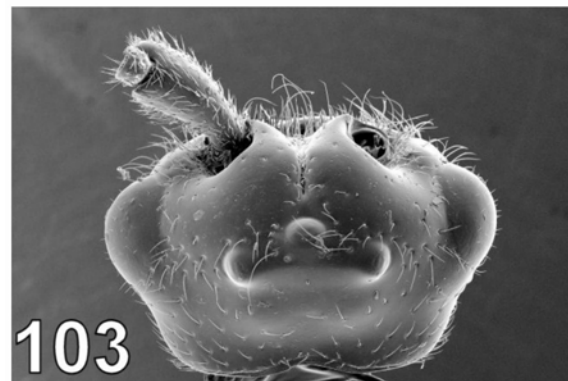
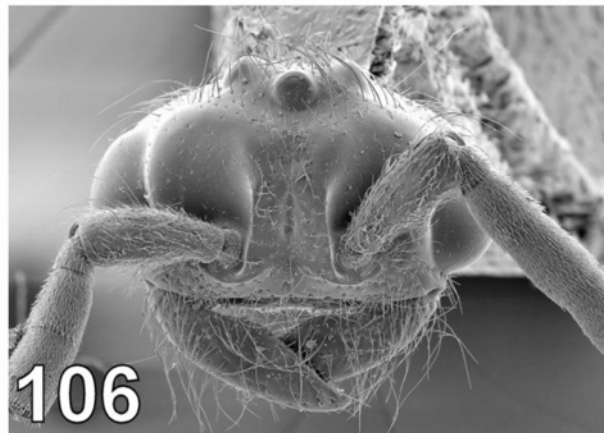
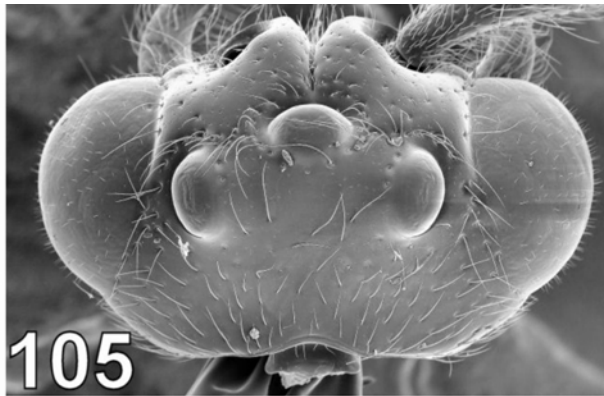


Fig. 99. Antenna of male *N. kiowapache*.

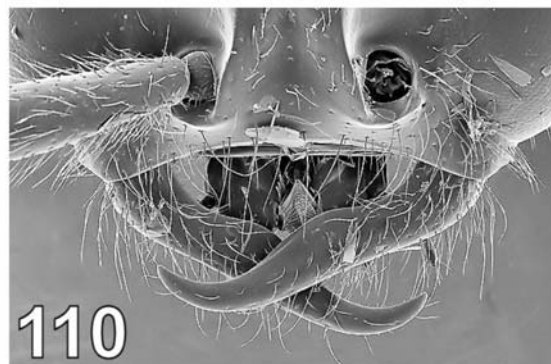
Figures 100-101: *N. mandibularis*: 100, mandibles; 101, lateral view of head.



Figures 102-104. Head of males of: 102-103. *N. microps*; 104, *N. minor*.



Figures 105-107. Head of males of: 105, *N. minor*; 106-107, *N. nigrescens*.



Figures 108-110. Head of males of: 108-109, *N. opacithorax*; 110, *N. pilosus*.

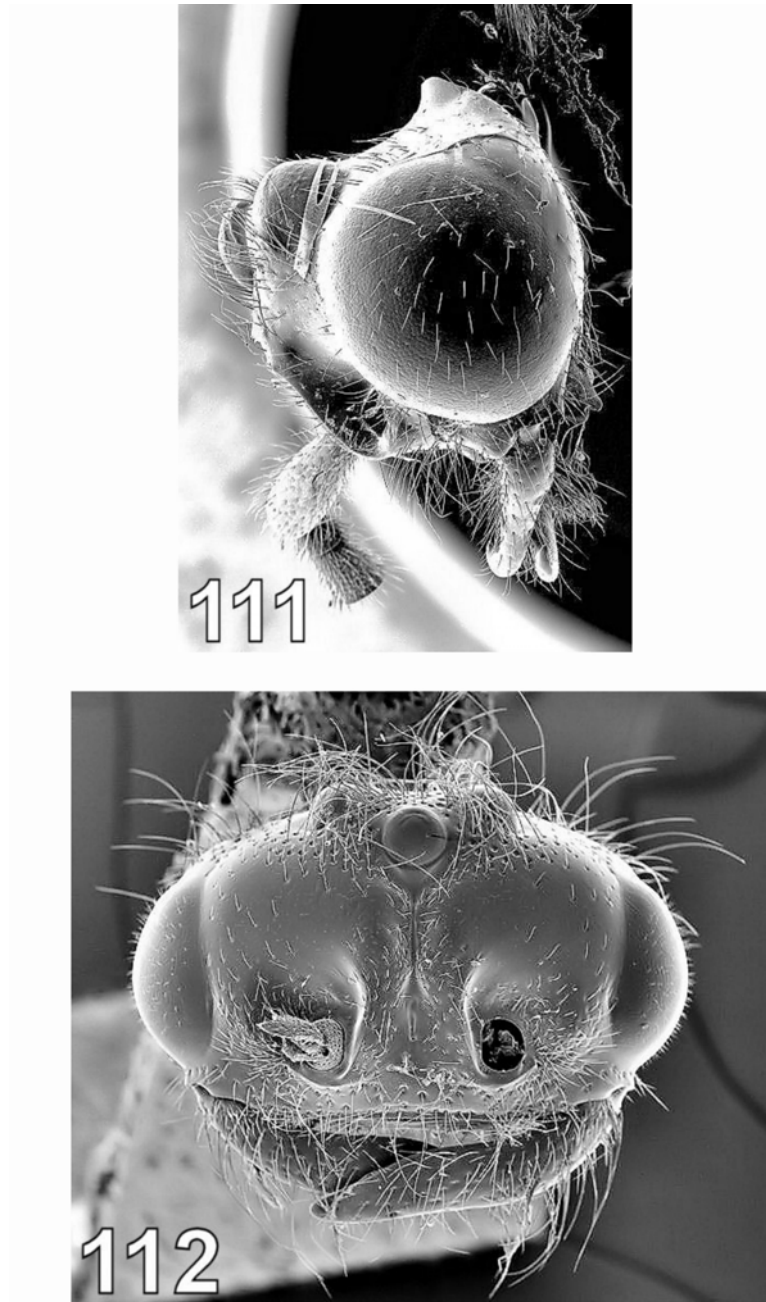
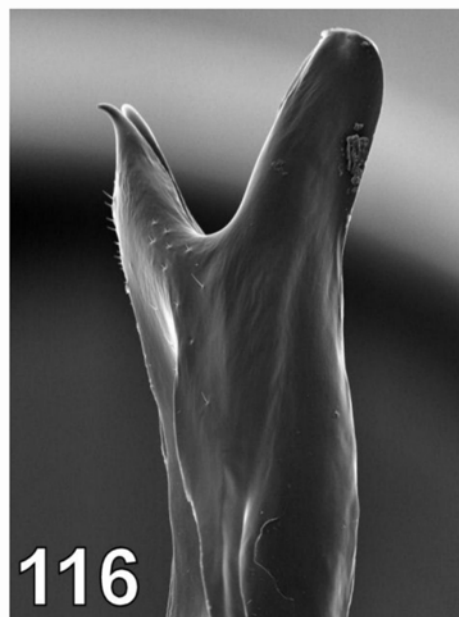
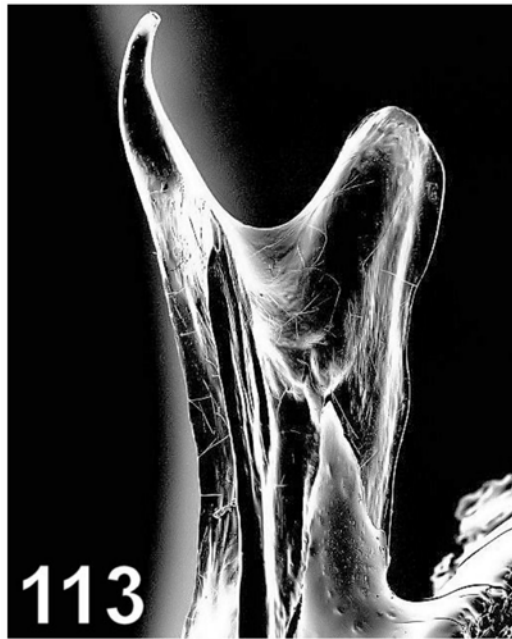


Figure 111-112. Head of male: 111, *N. pilosus*; 112, *N. texanus*.



Figures 113-116. Aedeagus of : 113, *N. carolinensis*; 114, *N. fuscipennis*; 115, *N. melshaemeri*; 116, *N. minor*.



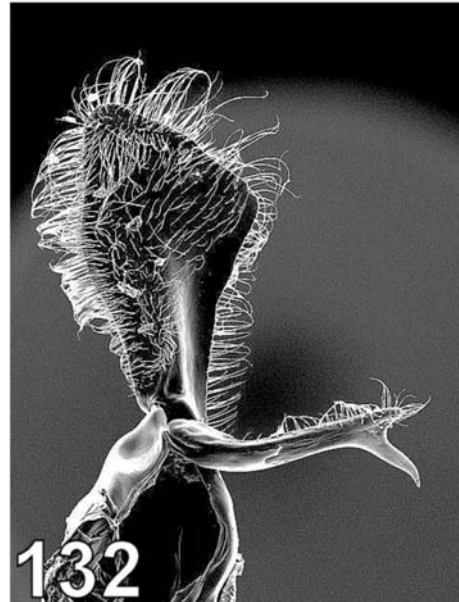
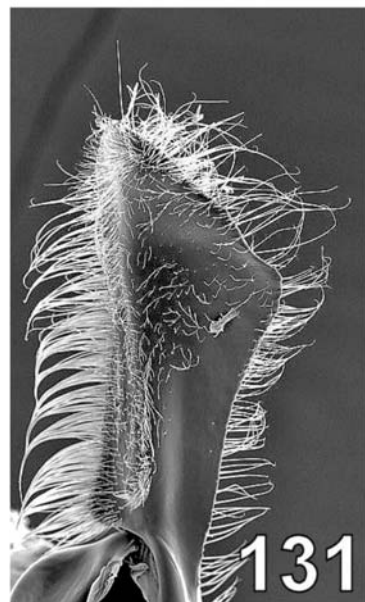
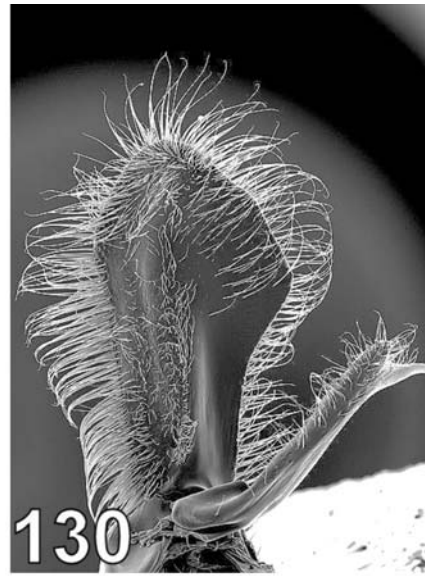
Figures 117-120. Aedeagus of: 117, *N. mojave*; 118 *N. ndeh*; 119, *N. nigrescens*; 120, *N. opacithorax*.



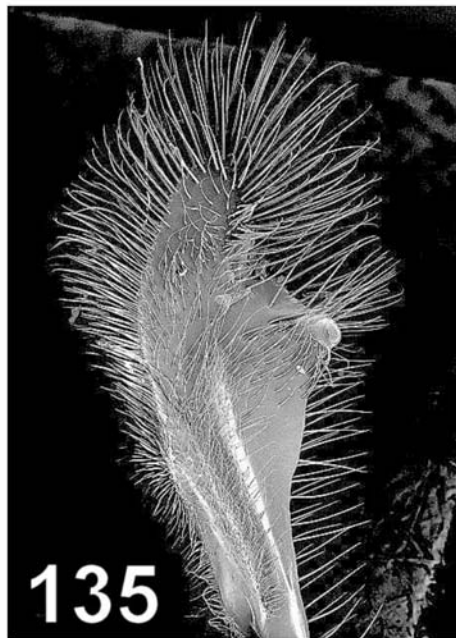
Figures 121-123. Aedeagus of: 121, *N. pilosus*; 122, *N. swainsonii*; 123, *N. texanus*.
Figure 124. Paramere of: 124, *N. andrei*.



Figures 125-128. Paramere of: 125, *N. carolinensis*; 126, *N. kiowapache*; 127, *N. mandibularis*; 128, *N. melshaemeri*.



Figures 129-132. Paramere of: 129, *N. microps*; 130, *N. minor*; 131, *N. mojave*; 132, *N. ndeh*.



Figures 133-136. Paramere of: 133, *N. nigrescens* (after Ward 1999); 134, *N. opacithorax* (after Ward 1999); 135, *N. pilosus*; 136, *N. swainsonii*.

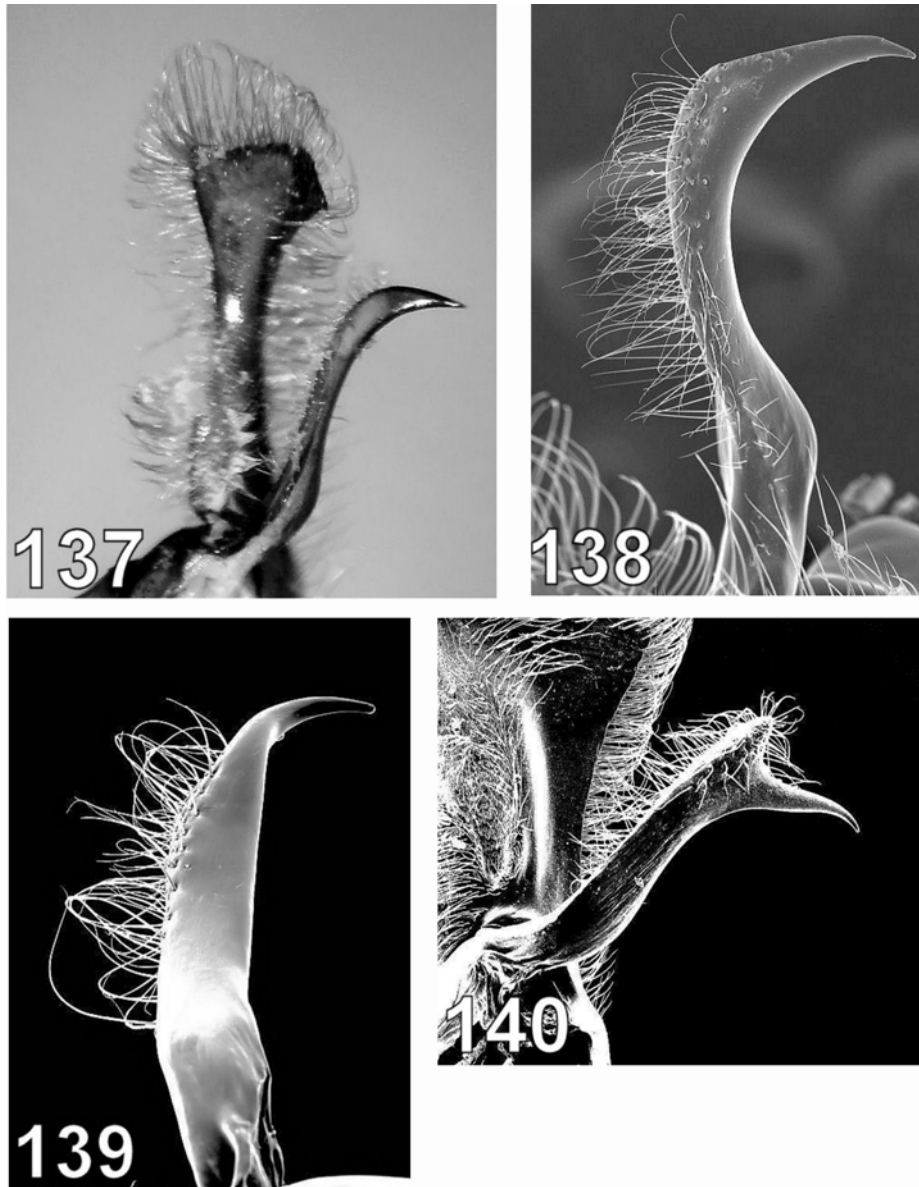
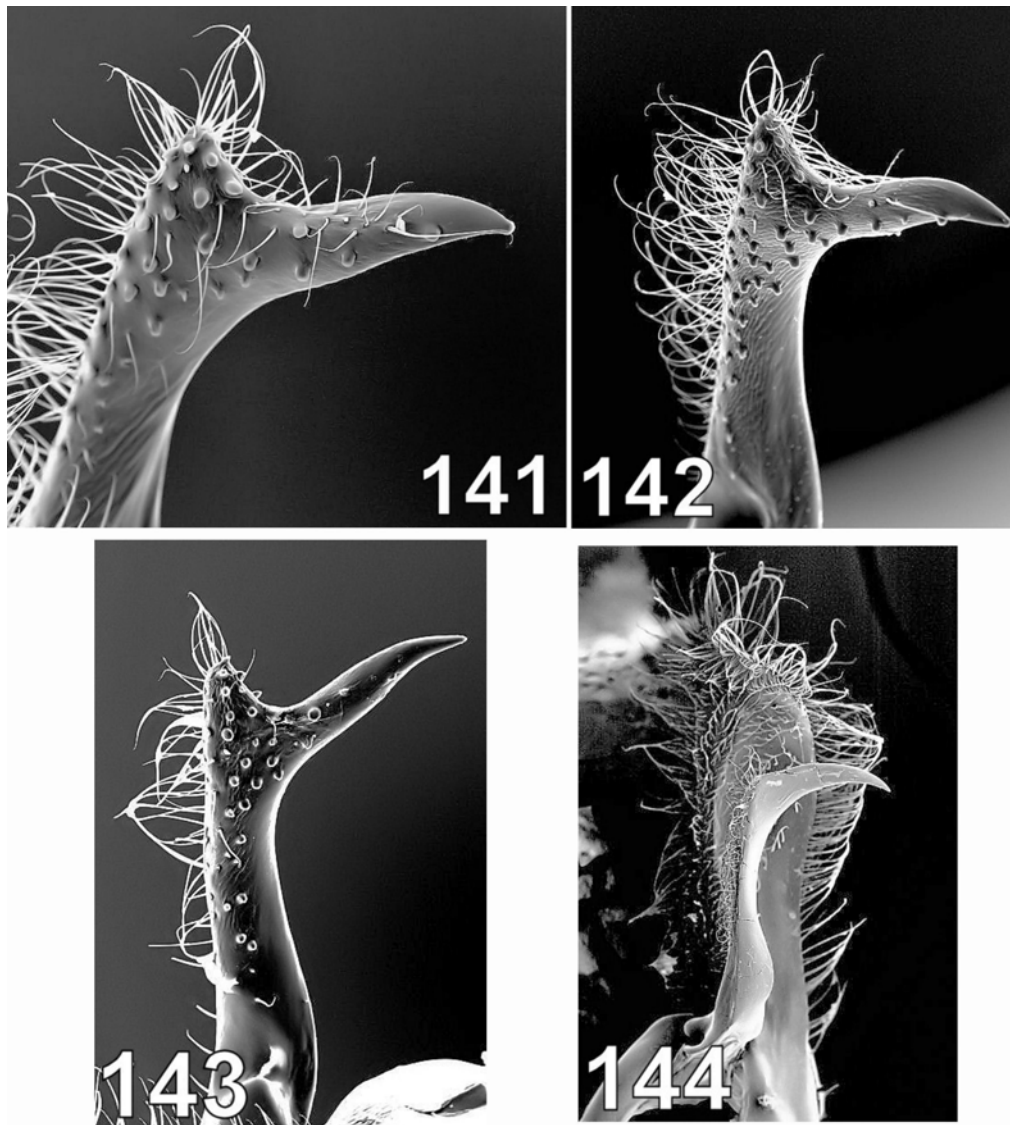
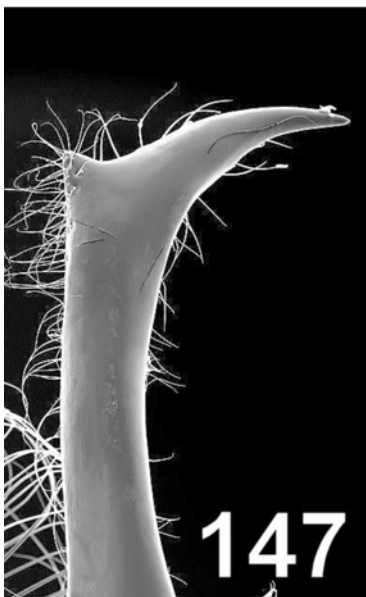
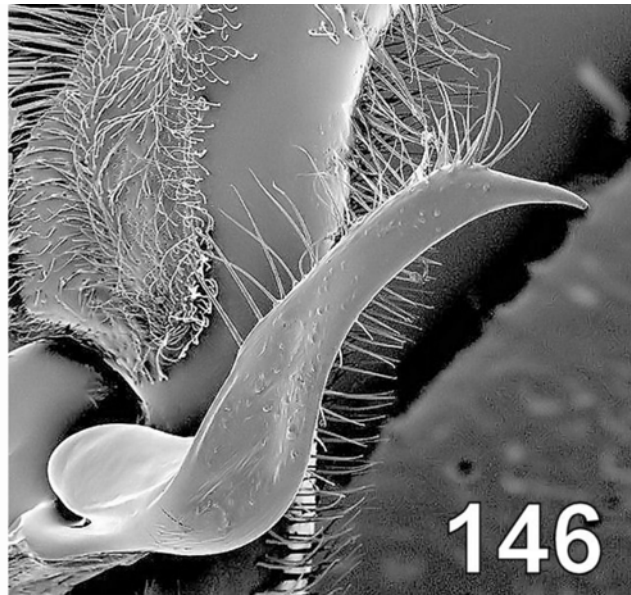


Figure 137. Paramere of *N. texanus*. **Figures 138-140.** Volsella of: 138, *N. kiowapache*; 139, *N. melshaemeri*; 140, *N. microps*.



Figures 141-144. Volsella of: 141, *N. minor*; 142, *N. mojave*; 143, *N. ndeh*; 144, *N. nigrescens*.



Figures 145-148. Volsella of: 145, *N. opacithorax*; 146, *N. pilosus*; 147, *N. swainsonii*; 148, *N. texanus*.

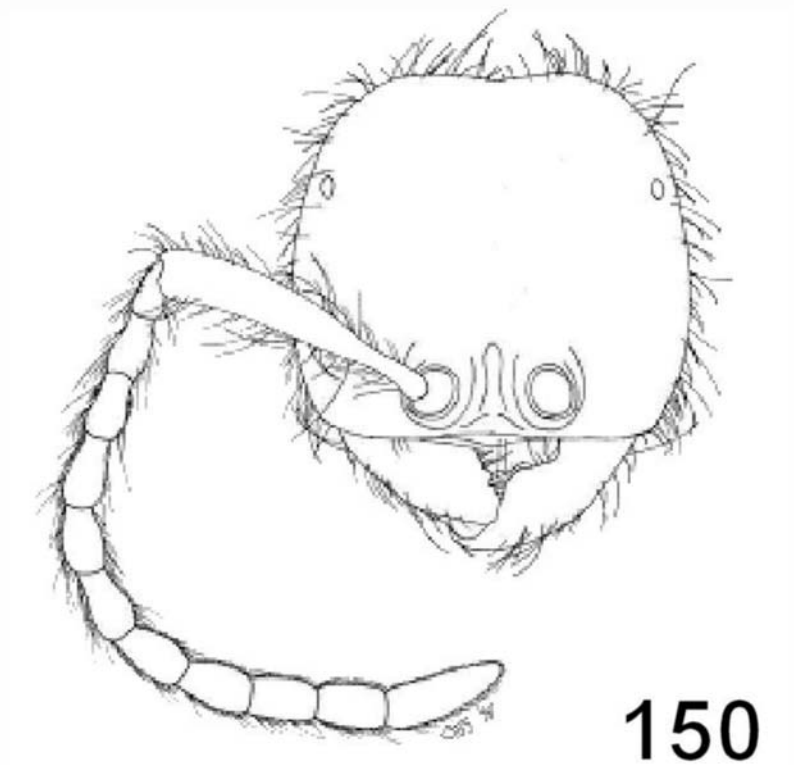
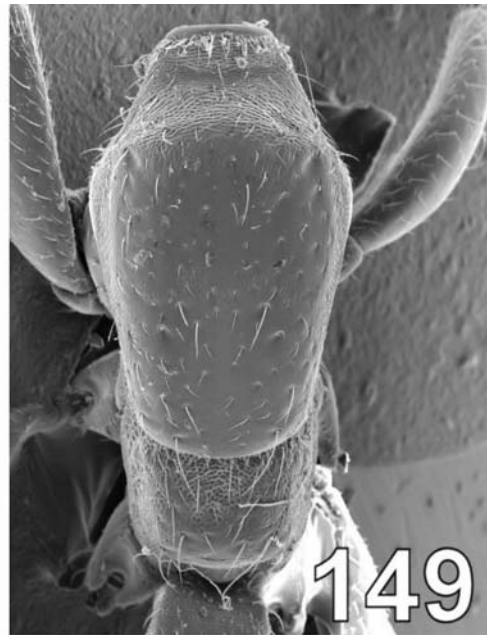


Figure 149. Dorsal view of mesosoma of *N. swainsonii*.

Figure 150. Frontal view of head of *N. pilosus* (type). Figure by James Snelling.



Figure 151. Lateral view of head of *N. pilosus* (type). Figure by James Snelling.