New Native Trap-Jaw Ant, Strumigenys Smith1, from the Neotropical Excisa Species Group Discovered in a Disjunct Region and Climate on the Colorado Plateau

Authors: Booher, Douglas, and Uhey, Derek

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New Native Trap-jaw Ant, *Strumigenys* Smith[1], from the Neotropical *excisa* Species Group Discovered in a Disjunct Region and Climate on the Colorado Plateau

Douglas Booher[2-4]* and Derek Uhey[5]

Abstract. In the United States are 37 endemic *Strumigenys* ant species belonging to a single temperate and recently radiated Nearctic clade formerly classified as *Pyramica* (non-trap jaw *Strumigenys* Smith[1]). We report the discovery of a new unrelated and morphologically distinct endemic Nearctic *Strumigenys* we described as *Strumigenys superstes* sp. nov. known only from a single queen collected in a pitfall trap at high altitude in northern Arizona. In comparing *Strumigenys superstes* sp. nov. morphology with queens of other closely related species, we showed *Strumigenys superstes* sp. nov. is the only temperate member of the otherwise tropical (Panamanian) clade of short-mandibled trap jaw species formerly belonging to the genus *Glamyromyrmex* (now forming the *Strumigenys excisa* species-group).

Introduction

Globally, *Strumigenys* Smith[1] is a hyper-diverse genus with more than 850 described species (antcat.org 4-Mar-2019, Booher et al. 2019, Tang et al. 2019). They commonly are collected in moist tropical and subtropical forests but are noticeably absent or rare in arid or cool latitudes. *Strumigenys* lineages adapting and radiating to temperate environments are seemingly rare events. The largest temperate diversity of *Strumigenys* is in the Nearctic region because of an unusually large and recent radiation culminating in 37 extant *Strumigenys* species (Booher et al. 2020 unpublished manuscript). Additional native members of the Nearctic assemblage are two long-mandibled trap-jaw Neotropical/Panamanian species (*S. boneti* and *S. louisianae*) with ranges extending north into the United States.

Almost all Nearctic *Strumigenys* are closely associated with eastern mesic forests (Deyrup and Cover 2009). Western North America is an unlikely place to find *Strumigenys*; only five native species are known west of the Mississippi River and all of the species are known from less than a hundred collections combined. The species typically are found mainly in deep-litter microhabitats and mesic island patches of forests in southern California and Arizona. The climate of most of the western U.S. probably is too cold or dry for most *Strumigenys*. The five previously described endemic western species are closely related to each other and form a clade

[1]Hymenoptera: Formicidae
[2]Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, IL 60605
[3]University of Illinois, Department of Entomology, 320 Morrill Hall, 505 South Goodwin Avenue, Urbana, IL 61801
[4]Georgia Museum of Natural History, 101 Cedar Street, Athens, GA 30602
[5]School of Forestry, Northern Arizona University, 200 E Pine Knoll Drive, Flagstaff AZ 86011
*Corresponding author: dbooher@antmuseum.com

with 32 native eastern species and possibly are relics of a more mesic period when the climate was more favorable (Ward 1988). It was therefore surprising to discover a new native *Strumigenys* species on the Colorado Plateau belonging to a distantly related and morphologically distinct Neotropical species-group (*excisa*) previously in the genus *Glamyromyrmex*. However, recent unexpected range expansions (Lattke et al. 2018) and species discoveries in far-distant habitats (Longinoi and Booher 2019) continue to challenge our conceptions of *Strumigenys* and their distribution.

The three species complexes and 10 described species in the *excisa* group are: *azteca* group (*S. azteca, S. erikae, S. prex, S. rogata*, and *S. turpis*), *excisa* group (*S. dontopagis, S. excisa*, and *S. asaphes*), and *longinoi* group (*S. longinoi and S. augustandrewi*) (Bolton 2000, Longino 2006). Morphologically distinct from other *Strumigenys*, species of the *excisa* group are immediately recognized among Nearctic natives by their glossy-shining exoskeleton, enlarged conical teeth, and greatly expanded thin cuticular flanges on the postpetiole. The mandibles, labrum, and head capsule also are very modified, distinguishing them from most other *Strumigenys*, yet are similar to other short-mandible trap jaw species such as the Afrotropical *tetragnatha, nitens,* and *loveridgei* groups (Bolton 2000).

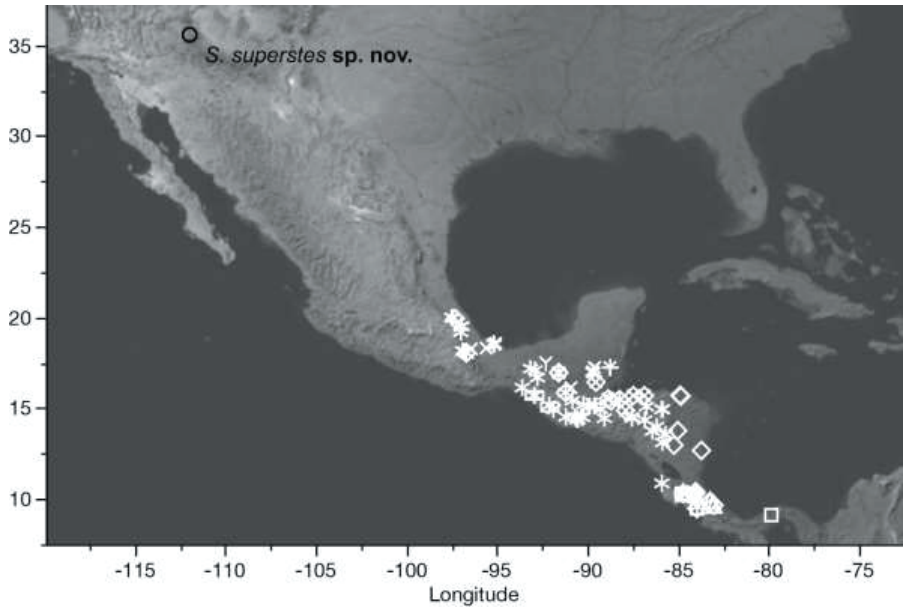
All 10 previously described species are endemic to Neotropical/Panamanian forests in Central America and southern Mexico. Collections of the *excisa* group are sparse and almost exclusively from samples of leaf litter in nondisturbed tropical forests (Bolton 2019; García-Martínez et al. 2015, 2017; Jack Longino personal communication). Two species, *S. turpis* and *S. asaphes*, are known from just a few specimens and several others (*S. augustandrewi*, *S. dontopagis, S. erikae*, *S. longinoi,* and *S. prex*) seem to be restricted to specific rainforest preserves. *S. rogata* and *S. excisa* are the most frequently collected species and have the largest ranges, from Costa Rica to southern Mexico (Fig. 1) with *S. rogata* having the northern-most record with a specimen collected in a subtropical montane forest ~200 km east of Mexico City (20.0°N, -97.5°W). Although several species in the *excisa* group have been collected in cool montane forests, climatic records from geographic collection sites of *excisa* group species reveal *S. superstes* inhabits a more extreme cold and dry region (Fig. 2).

Materials and Methods

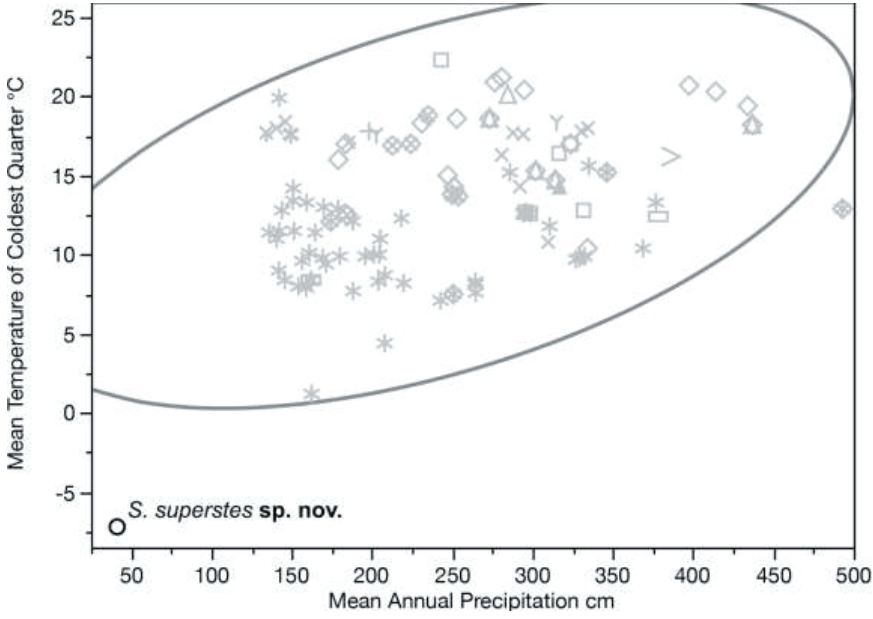
Specimen records were from primary literature, AntWeb.org (2019), and the following depositories. Climate records were derived from BioClim data (https://worldclim.org/data/ bioclim.html) in the R package 'sp' version 1.3-2 (Pebesma and Bivand 2005, Bivand et al. 2013, R Core Team 2019). Figures were made using JMP version Pro 14 Graph Builder.

The collection abbreviations follow Evenhuis (2020). The material upon which the study was based is located and/or was examined at the following institutions:

ABS Archbold Biological Station, Lake Placid, Florida, USA
DBBC Collection of Dr. Douglas Brent Booher, Athens, Georgia, USA
LACM Los Angeles County Museum of Natural History, Los Angeles, California, USA
LSAM Louisiana State University, Louisiana State Arthropod Museum, Baton Rouge, Louisiana, USA
MCZC Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MEM Mississippi State University, Starkville, Mississippi, USA



Figs. 1 (above) and 2 (below). *Strumigenys superstes* sp. nov. (open black circle) with disjunct geographic (Fig. 1) and climatic (Fig. 2) ranges compared with other *excisa* group species. *S. asaphes* "+" shape, *S. augustandrewi* solid triangle, *S. azteca* "X" shape, *S. dontopagis* box, *S. erikae* ">" shape, *S. excisa* diamond, *S. longinoi* open triangle, *S. prex* "Y" shape, *S. rogata* "*", and *S. turpis* rectangle. Encircled specimen records in Fig. 2 are within 0.99 normal bivariate density ellipse.



MHNG Muséum d'Histoire Naturelle, Genève, Switzerland
SHSU Sam Houston State University Entomological Collections, Huntsville, Texas, USA
TAMU Texas A&M University, College Station, Texas USA
UGCA University of Georgia, Athens, Georgia, USA
USNM National Museum of Natural History, Washington, DC, USA

Because *S. superstes sp. nov.* is known only from a single queen, we used characters common to workers and queens for the description and used characters of queens only when comparing queens for diagnostic characters to support the new species concept and distinguish them from closely related species. The imaged specimen was identified with a specimen-level code affixed to the pin. All images are available online and can be viewed on AntWeb (http://www.antweb.org). The measurements and indices in the study are based on those used by Bolton (2000) or described here. The measurements were taken using the measurement application of LAX Leica software using a Leica IC90 E digital camera and Leica M165 C microscope with a 1.0x or 1.6x PLANAPO objective. Measurements and indices are presented as minimum and maximum values with arithmetic means in parentheses; measurements are expressed in millimeters to three decimal places. The tooth count when not explicitly stated is from the base to the apex of mandibles. The development of the key provided is primarily based on a new set of characters but also have portions adapted from Bolton (2000).

Measurements and Indices

HL Cephalic length: length of the head capsule excluding mandibles, measured in full-face view in a straight line from the mid-point of the anterior clypeal margin to the mid-point of the cephalic margin. In species where one or both of the margins is concave, the measurement is from the mid-point of a transverse line that spans the apices of the projecting portions.

HW Cephalic width: maximum width of the head in full-face view, excluding eyes.

ML Mandible length: straight-line length of mandible at full closure, measured in the same plane as the HL measurement (i.e., full-face view), from the mandibular apex to the anterior clypeal margin, or to the transverse line connecting the anterior-most points of the clypeus in taxa where the anterior clypeal margin is concave medially.

PW Pronotal width: maximum width of the pronotum in dorsal view. Projecting spines, tubercles, or other cuticular prominences at the pronotal humeral angles were ignored.

SL Scape length: maximum straight-line length of the scape, excluding the basal constriction or neck just distal to the condylar bulb. In taxa with a hypertrophied subbasal lobe on the scape SL was from the tip of the subbasal lobe to the scape apex.

FL Femoral length: length of femur from junction with trochanter to apex.

HT Head thickness: maximum thickness of head in profile.

EL Eye length: in profile, the maximum diameter of the compound eye.

WL Weber's length: diagonal length of mesosoma in profile, from anterior declivity of pronotum (exclusive of pronotal ''neck'') to apex of metapleural lobe.

CI Cephalic index: HW/HL * 100.

MI Mandibular index: ML/HL * 100

SI Scape index: SL/HW * 100

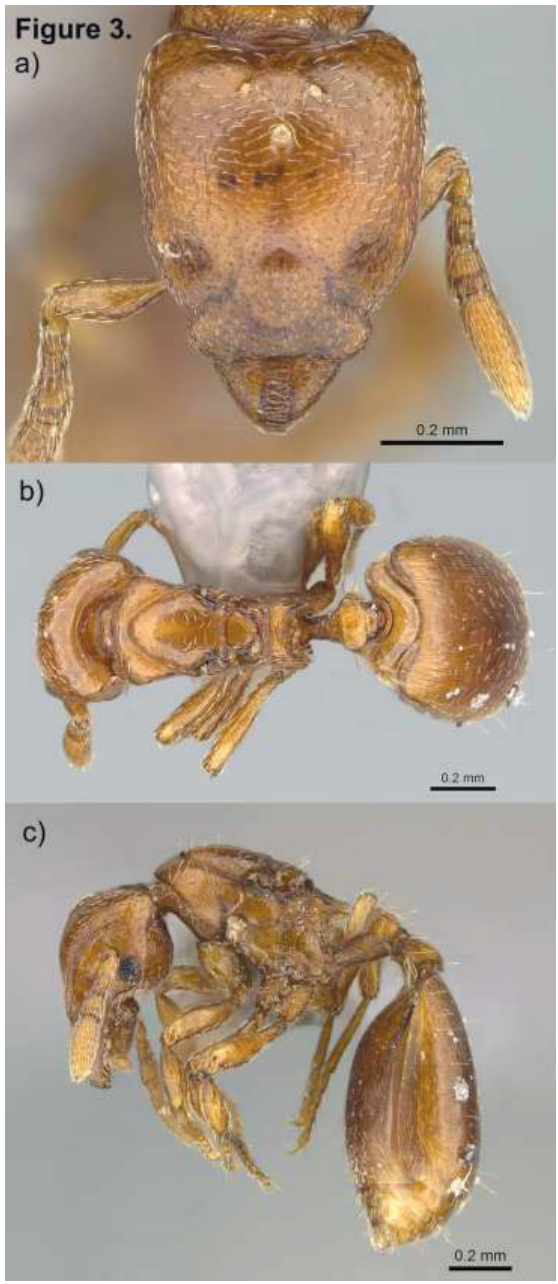


Fig. 3. Dealate holotype queen of *Strumigenys superstes* sp. nov. (CASENT0749291): a) full face view b) dorsal view c) profile view; hosted on antweb.org and imaged by Michele Esposito California Academy of Sciences, San Francisco, CA.

Type Material Examined

Holotype Queen. Only known from a single alate queen. USA, Arizona, Coconino County, Blue Chute, 35.5868, -111.9694 ±100 m, 1942 m, 25 June-16 July 2014, pinyon-juniper woodland, pitfall trap under a Juniper tree, Collector Derek Uhey. (unique specimen identifier CASENT0749291). ***Holotype queen measurements.*** HL = 0.542; HW = 0.483; ML = 0.091; PW = 0.343; SL = 0.232; FL = 0.371; HT = 0.360; EL = 0.102; WL = 0.643; CI = 89.1; MI = 16.9; SI = 48.2.

Material Compared. *Strumigenys azteca,* dealate queen (JTLC000014469), 4 workers (JTLC000730377, JTLC000730366, JTLC00073028, and CASENT0618604); undescribed species *S. JTL-pyr018,* dealate queens (CASENT0606311, CASENT0636943); *S. prex,* dealate queens (CASENT0610482, CASENT0612824), worker (JTLC0007303340); *S. excisa*, dealate queen (CASENT0612328), alate queen (CASENT0628732), worker (JTLC000730399); *S. rogata*, dealate queen (CASENT0612803) workers (CASENT0747758, JTLC000730430, and JTLC000730366); and *S. longinoi*, dealate queen (CASENT0636758).

Imaged material compared (AntWeb 9 September 2019) *S. asaphes*, holotype worker (CASENT0900211); *S. augustandrewi*, paratype worker (INB0003666649); *S. azteca*, worker compared with type (CASENT0281949); *S. dontopagis*, paratype worker (CASENT0900212); *S. erikae* holotype worker (INB0003214077); *S. excisa*, worker compared with type INBIOCRI001283701; *S. longinoi*, paratype worker (INBIOCRI001282480); *S. prex*, paratype worker (CASENT0900209); *S. rogata*, paratype worker (CASENT0900210); *S. turpis*, worker (CASENT0281950).

Diagnosis. *Strumigenys superstes* is a member of the *excisa* group and the only member of the group collected north of Mexico. Bolton (2000) placed nine species into the group: *S. asaphes, S. azteca, S. dontopagis, S. excisa, S. longinoi, S. prex, S. rogata,* and *S. turpis.* Two other more recently described species also fit in the *excisa* group, *S. augustandrewi* and *S. erikae* (Longino 2006). Although morphological characters and relative measures defined workers as members of the *excisa* group and the *azteca*-complex in that group, almost all the characters also apply to queens of the *azteca*-complex. *S. superstes* differs in only one minor character from Bolton's definition of the *excisa* group description, but is an obvious member of the group (see description) (Bolton 2000). This minor character however, helps differentiate *S. superstes* from all other *excisa* members. In full-face view, the lateral outline of the head is interrupted by a pronounced indentation that forms a short right-corner triangular impression where the clypeus and frontal lobes fuse. Although *S. azteca, S. rogata, S. erikae,* and *S. turpis* might have shallow and evenly convex indentations, only *S. asaphes* has a similar sharp indentation. In *S. asaphes* the indentation is less pronounced and can be further differentiated from *S. superstes* by head pilosity (*S. asaphes* has scattered and numerous flagellate setae on the dorsum of head where *S. superstes* has only minute appressed simple setae). *S. superstes* most closely resembles *S. azteca,* but differs from all other *azteca*-complex species in the following characters; the truncated apical free margin of the basal mandibular process is wider than the projected length from the apex to junction with the mandible; and absence of translucent flattened elongate specialized setae extending anteriorly from the apex of labral lobes (although one to two minute simple setae may project forward on each lobe). In all other *azteca*-complex species (*S. prex, S. excisa, S. azteca,* and *S. rogata*), the apical margin of the basal mandibular process is shorter than long and labral lobes have numerous elongate filiform and

translucent elongate expanded setae that curve medially and project anterior past the apex of labral lobes.

S. superstes also differs from other *azteca*-complex queens in two key features: the mesoscutellum of *S. superstes* is free of sculpture, smooth and shining, and the greatest width of the mesonotum is shorter than the width between pronotal shoulders. All other *azteca*-complex species have queens with striate to rugulose sculptured mesoscutellums and have mesonotums 1.12-1.27 times wider than the distance between pronotal humeral angles.

Description. *S. superstes* agrees with the descriptions of the *excisa* group except for the minor difference in size of basal mandibular lamella mentioned previously. Mandibles with 10 teeth follow a widely truncated basal lamella without a diastemmic gap. The basal lamella has a complementary labral indentation where mandible can rest in locked position when open (a morphological feature of trap-jaw *Strumigenys*) (Gronenberg 1996). The basal lamella, although it projects past first teeth, is not as long as the following longest tooth when measured from base of tooth to apex. The labrum is heavily sclerotized at the base and slightly expanding along lateral free margins of labral lobes. Labral lobes truncated with flattened apices; with setae along apical and interior free margins of lobes with short simple appressed setae that do not project anteriorly past margins. Teeth stout and conical, gradually increase in size from tooth 1 through tooth 6 with basal three teeth obviously smaller than following three teeth; teeth 7 and 8 slightly smaller than their preceding tooth, tooth 9 similar sized as tooth 8, and apical tooth 10 enlarged. Teeth interlock along entire interior margin when closed.

Clypeus with anterolateral lobes that project past the medial clypeal anterior margin and is flatly transverse between lobes. Anteriolateral and lateral margins of clypeus rounded and convex, terminating in a sharp indentation where clypeus meets frontal lobes. Frontal lobes are expanded laterally and conceal preocular carinae in full-face view. Ventrolateral margin of head sharply marginate in front of eye, narrowly concave, and terminating in a minute inconspicuous tooth. Postbuccal impression in ventral view narrow and deep. Scape short, SI 48.2, without a prominent subbasal bend or projecting cuticle on anterior margin, expanded and swollen at mid-length, and only slightly dorso-ventrally flattened. Petiole 1.8 times wider than long. Post-petiole broadly U-shaped with a deep concave anterior border and convex posterior border; approximately four times wider (0.096) than long (0.393). First gastral tergite extremely elongate (1.4 times longer than wide).

Sculpture. Dorsum of head behind clypeus free of sculpture, sculpture on head limited to light reticulate striations along lateral borders of frontal lobes. Cuticle at side of head within scrobal area absent of sculpture; smooth and shining. Nodes of petiole and postpetiole free of sculpture and shining. Dorsum and side of pronotum and mesonotum free of sculpture and shining. Side of propodeum is free of sculpture and shining. Dorsal and declivitous faces of propodeum are lightly punctate with transverse striate sculpture. Basigastral costulae fine and numerous, extending about 2/3 the length of first gastral tergite; posterolaterad to conspicuous costulae the tergite superficially punctate.

Pilosity. No erect setae on the head. Erect to shallowly curved simple filiform setae limited to a pair at humeral angles, three pairs on mesonotal dorsum, two pairs on petiole, two pairs on postpetiole and on gaster. Dorsum of clypeus with short, fine, appressed pubescence and without any setae on lateral and anterior margins of clypeus. Pilosity on scape limited to inconspicuous appressed pubescence directed toward apex.

Spongiform Appendages. Ventral surfaces of petiole and post-petiole absent of cuticular spongiform process. Spongiform-like cuticle present only as lamellate petiolar and postpetiolar lateral lobes that are triangular and flat tooth-like process.

Etymology. Meaning "survivor" and referring to the disjunct temperate locality of the species compared to the centralized Panamanian distribution of other members of the *excisa* group.

Notes. Strumigenys *superstes* is known only from a single queen collected from a pitfall trap at a mid-elevation (1940 m) pinyon-juniper woodland approximately 30 km south of the Grand Canyon. The smaller width of the mesosoma suggested the species might have reduced dispersibility by flight (Keller et al. 2014) and could potentially be a social parasite of another species.

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