

Taxonomic clarification of two Nearctic *Strumigenys* (Hymenoptera: Formicidae)

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Abstract

In 1901, Forel described an ant species from a relatively poorly known genus of ants from North America, naming it *Strumigenys pilinasis*. In 1931 M. R. Smith obtained the holotype and redescribed it, and he included a first illustration. The description was incomplete and the illustration resembled *Strumigenys brevisetosa* Smith, 1935, more than it resembled *S. pilinasis*, which led subsequent taxonomists to make consistent misidentifications and to consider *S. brevisetosa* to be a synonym of *S. pilinasis*. Here I redescribe both *S. pilinasis* and *S. brevisetosa* (**revived status**). *Strumigenys manni* Wesson & Wesson, 1939, and *S. ohioensis* Kennedy & Schramm, 1933, are new **junior synonyms** of *S. pilinasis*, and *S. medialis* Kennedy & Schramm, 1933, is a new **junior synonym** of *S. brevisetosa*.

Keywords: Dacetine, biodiversity, taxonomy, *ohioensis*, *pinlinasis*, junior synonym

Introduction

The hyper-diverse ant genus *Strumigenys* contains more than 840 species and is particularly noted for its variation in mandibular morphology (Bolton 2000, Baroni Urbani & de Andrade 2007). Although most species inhabit tropical and subtropical regions world-wide, the Nearctic region has a diverse assemblage of more than 40 species (Bolton 2016, AntWeb 2019). Examination of two of the more common nominal North American species, *Strumigenys pilinasis* Forel, 1901 and *S. ohioensis* Kennedy and Schramm, 1933 and their junior synonyms, has revealed a confusion of taxonomic identity. This is rectified here by a re-examination of relevant types.

The confusion of taxonomic identity of these species is traced back to Forel's brief and unillustrated description *S. pilinasis* (Forel, 1901). Several years later, M. R. Smith examined the holotype specimen of *S. pilinasis* and attempted to provide a more complete description, but he omitted key morphological characters and his illustration was inaccurate. All subsequent identifications of *S. pilinasis* were based on Smith's redescription, including his own (Smith 1931). Examination of Forel's holotype of *S. pilinasis* reveals it to be what has typically been referred to as *S. ohioensis* (Kennedy and Schramm 1933, AntWeb 2019). Thus, *S. ohioensis* is a junior synonym of *S. pilinasis*. This conclusion required additional clarification of specimens misidentified as *S. pilinasis*. After reviewing a much larger collection of more recently collected specimens as well specimens reported in literature that were misidentified as *S. pilinasis*, I redescribe *S. pilinasis* and revive and redescribe *S. brevisetosa* (Smith 1935, Wesson & Wesson 1939, Brown 1953).

Material and methods

Abbreviations of depositories. The collection abbreviations below follow Evenhuis (2019). The material upon which this study is 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
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland
SHSU	Sam Houston State University Entomological Collections, Huntsville, Texas, USA
TAMU	Texas A & M University, Texas College Station, USA
UGCA	University of Georgia, Athens, Georgia, USA
USNM	National Museum of Natural History, Washington D.C., USA

Imaged specimens can be identified with unique specimen-level codes affixed to each pin. Digital color images were used with permission of AntWeb.org and the USNM. All images presented are available online and can be viewed on AntWeb (<http://www.antweb.org>). The measurements and indices used in this study are based on those used by Bolton (2000). The measurements were taken using the measurement application of the LAX Leica software using a Leica IC90 E digital camera and Leica M165 C microscope with either 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.

MEASUREMENTS & INDICES

HL	Head length: the length of the head capsule excluding the 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 these margins is concave, the measurement is taken from the mid-point of a transverse line that spans the apices of the projecting portions.
HW	Head width: the maximum width of the head in full-face view, excluding the eyes.
ML	Mandible length: the straight-line length of the mandible at full closure, measured in the same plane for which the HL measurement is taken (i.e. full face view), from the mandibular apex to the anterior clypeal margin, or to the transverse line connecting the anteriormost points of the clypeus in taxa where the anterior clypeal margin is concave medially.
PW	Pronotal width: the maximum width of the pronotum in dorsal view. Projecting spines, tubercles or other cuticular prominences at the pronotal humeral angles are ignored.
SL	Scape length: the maximum straight line length of the scape, excluding the basal constriction or neck that occurs just distal of the condylar bulb. In taxa with a hypertrophied subbasal lobe on the scape SL is measured from the tip of the subbasal lobe to the scape apex.
FL	Femoral length: the length of femur from junction with trochanter to apex.
HT	Head thickness: the thickness of head in profile from vertex of dorsum to vertex of ventral outline.
EL	Eye Length: in profile, the maximum diameter of the compound eye.
TL	Total length: the total outstretched length of the ant from the mandibular apex to the gastral apex; when measured in profile the sum of ML + HL + WL + Petiole length + Postpetiole length + length of gaster.
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: $SL/CW * 100$

Strumigenys pilinasis Forel 1901

(Figure 1)

Strumigenys clypeata var. *pilinas* Forel 1901, 45:339. **Lectotype** worker (here designated from a unique syntype): Washington, D.C. (Forel) [MHNG, CAsent0909339, AntWeb.org image examined]. Raised to species: Wesson & Wesson, 1939: 109. In *Strumigenys* (*Cephaloxys*): Emery, 1924: 325; in *Strumigenys* (*Trichoscapha*): Smith, 1947: 587; in *Smithistruma*: Smith, 1951: 827; Brown, 1953: 60; in *Pyramica*: Bolton, 1999: 1673; in *Strumigenys*: Baroni Urbani & De Andrade, 2007: 126.

Strumigenys ohioensis Kennedy & Schramm, 1933: 98, figs. 1, 2. Holotype worker: Ohio, Mies County, Tupper Plains (Schramm) [MCZC, examined]. Description of queen, male: Brown, 1953: 87. In *Strumigenys* (*Cephaloxys*): Wesson & Wesson, 1939: 108; in *Strumigenys* (*Trichoscapha*): Smith, 1947: 587; Creighton, 1950: 308; in *Smithistruma*: Smith, 1951: 828; Brown, 1953: 87; in *Pyramica*: Bolton, 1999: 1673; in *Strumigenys*: Baroni Urbani & De Andrade, 2007: 125. **New Synonym.**

Strumigenys (*Cephaloxys*) *manni* Wesson & Wesson, 1939: 97, pl. 3, fig. 3. Holotype worker: Ohio, Pike County, near Sinking Spring [MCZC, examined]. Junior synonym of *ohioensis*: Smith, 1951: 828; Brown, 1953: 87. **New Synonym.**

Diagnosis. *Strumigenys pilinas* is one of the most easily diagnosed Nearctic *Strumigenys* and can be distinguished from all other North American species by the unique clypeal pilosity. *Strumigenys pilinas* is the only species with simple coarse hairs extending from the lateral border of clypeus that are strongly J-shaped (Figure 1a). These hairs, although variable, have several to many inclined anteriorly at their bases, strongly curved along their mid-length, and directed posteriorly at their apices. These hairs are simple and coarse to extremely narrowly expanded, always more cylindrical than spatulate along their entire length. The brief description given below is in agreement with descriptive treatments of the junior synonyms *S. ohioensis* and *S. manni* (Kennedy and Schramm 1933, Wesson & Wesson 1939, Bolton 2000).

Lectotype measurements. Measurements taken from images (AntWeb 2019).

HL = 0.577; HW = 0.400; ML = 0.123; PW = 0.280; SL = 0.297; TL = 2.120;

WL = 0.581; CI = 69; MI = 21; SI = 74.

Description. Head. Mandibles with basal broad triangular lamella, half of which is concealed by clypeus and half is visible in full frontal view; lamella followed by five principle teeth; counting from base of mandible tooth one, two, and four similarly sized and smaller than tooth three; tooth five as long or longer than first two teeth; tooth three being obviously longer than any other tooth. Clypeus slightly wider (0.223) than long (0.210) and narrowing anteriorly toward mandibles; nearly equal in width as distance between mandible insertions; anterior border between mandible insertions convex. Scape narrow and not expanded at subbasal bend; sharply bent just above condyle forming nearly a 90° angle. Scape nearly ¾ the width of head (SI = 74). Mesosoma in profile pronotum and mesonotum broadly convex; metonotal groove weakly impressed to absent; propodeum flat. Propodeal spine triangular and well formed (ca. 0.055 mm long) followed ventrally by a narrowing lamella along the declivitous face of propodeum.

Sculpture. Clypeus and head heavily punctate to reticulopunctate. Dorsum and side of pronotum with reticulopunctate sculpture similar to that on dorsum of head. Most of the side of mesonotum, pleurae, and propodeum shining with peripherally punctate sculpture. Dorsum of petiole with reticulopunctate sculpture, disc of postpetiole smooth and shining. Basigastral costulae well developed and extending nearly one third of the length of the first gastral tergite. The rest of the abdomen smooth and shining.

Pilosity. Hairs on lateral margins of clypeus J-shaped and pointing posteriorly at apices. Hairs on anterior margins variable and tending to curve ventrally. Hairs on clypeal dorsum variably oriented, but tending to arch anterolaterally, extending anteriorly at their base and curving laterally to posterolaterally along midlength. Hairs on scape similar in shape to clypeal dorsum and variably directed with some hairs directed toward base of scape, some directed ventrally, but most hairs arched anterolaterally and directed towards apex of scape. Head, mesosomal dorsum, dorsum of petiolar node, and exposed disc postpetiole with abundant arched coarse to narrowly expanded hairs. On the dorsum of head, these hairs are directed medially and on petiolar and postpetiolar nodes they are directed posteriorly. Differentiated elongate to flagellate hairs at humeral angles and basitarsi present and apparent in most non-type specimens, not apparent on type images. However, these hairs are easily abraded and are often missing and in the case of the type specimen the excess of glue covering the basitarsi obscure examination and are not important diagnostic characters for *S. pilinas*.

Comments. *Strumigenys pilinas* is a common eastern North American litter-dwelling ant that has been collected in contiguous states between Connecticut and Florida and west to eastern Texas and Oklahoma. Throughout its range, unlike *S. brevisetosa*, pilosity and morphology vary little—making it easily identifiable across its range. Of 9,013 databased records of Nearctic *Strumigenys*, in a database maintained by the author, *S. pilinas* ranked

fourth with 646 specimen records (unpublished data). In two studies of *Strumigenys* found nesting in empty fallen nuts in forests near Washington D.C. (near lectotype collection), *S. pilinasis* was by far the most common species (Duffield & Alpert 2011, Booher et al. 2017).

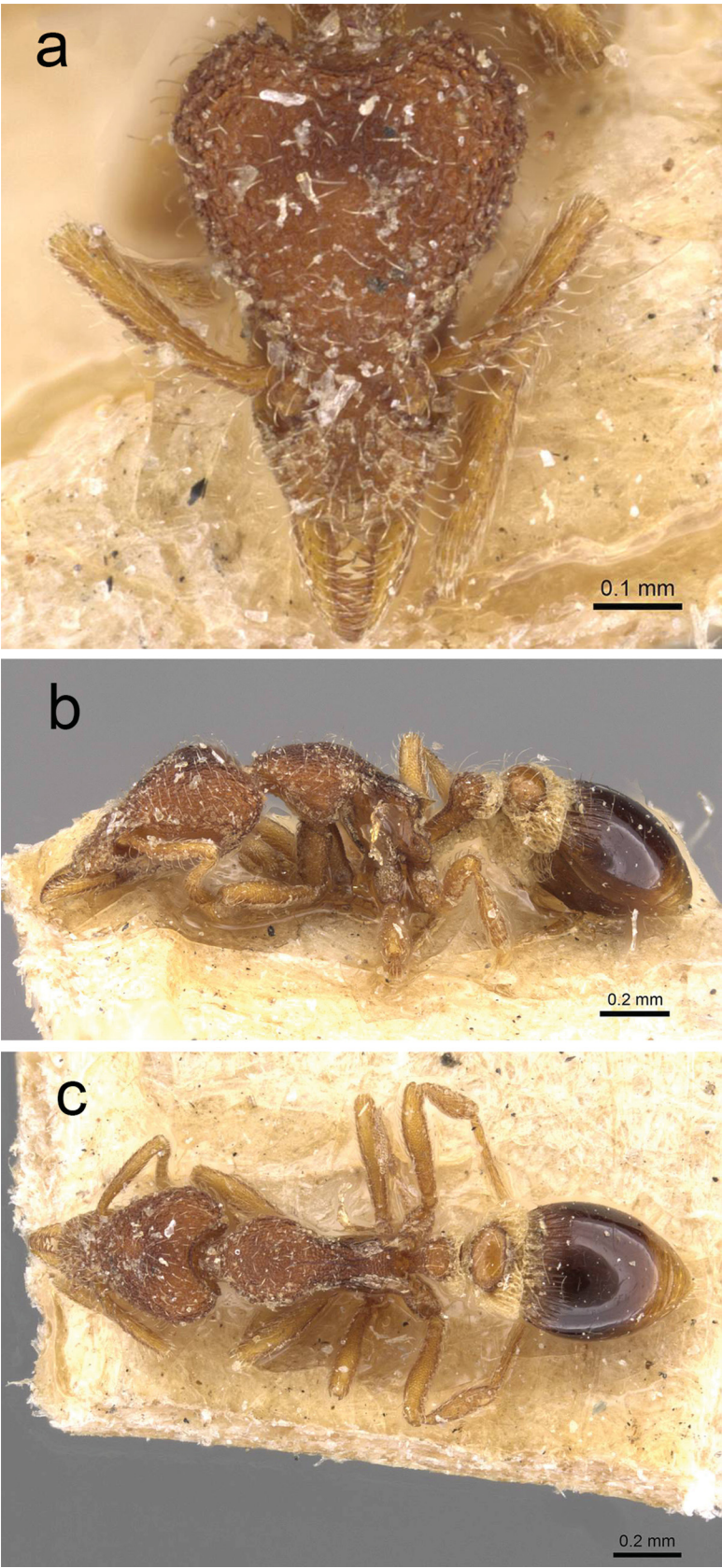


FIGURE 1. Holotype worker of *Strumigenys pilinasis* [MHNG: CASENT0909339] Photographed by Zach Lieberman, Ant-Web.org.

Kennedy and Schramm provided an inaccurate illustration of *S. ohioensis*. They described and illustrated hairs projecting from the lateral borders of the clypeus that were relatively short and directed anteriorly, when in fact these hairs are variable and several to many are strongly J-shaped—being inclined anteriorly at their bases, strongly curved along their mid-length, and point posteriorly at their apices. In 1939, Wesson & Wesson described *S. manni* (new junior synonym *S. pilinasis*) and it was the first description to accurately describe the key and unique distinguishing character of this species, the J-shaped clypeal pilosity. However, Wesson & Wesson did not realize *S. manni* was synonymous with *S. ohioensis* because they did not examine the type specimens of *S. ohioensis* and only relied on the original description and illustrative work (Kennedy and Schramm 1933). Brown (1953) provided greater detail and a full accounting of this set of events when he listed *S. manni* as a junior synonym of *S. ohioensis*, but Brown did not examine the *S. pilinasis* holotype (Brown 1953).

***Strumigenys brevisetosa* Smith, 1935**

(Figure 2, 3)

Strumigenys (*Cephaloxys*) *clypeata* var. *brevisetosa* Smith, 1935: 215. Holotype worker: Lucedale, George Co., MS, USA, 17-January-1932, sifting for beetles (Dietrich) [USNM, USNMENT00533161, examined]. Raised to species: Wesson & Wesson, 1939: 108. Description of queen: Brown, 1953: 60. Junior synonym of *pilinasis*: Brown, 1964: 197. In *Strumigenys* (*Trichoscapa*): Smith, 1947: 587; Creighton, 1950: 304; in *Smithistruma*: Smith, 1951: 827; Brown, 1953: 59. **Revived Status.**

Strumigenys (*Cephaloxys*) *medialis* Wesson & Wesson, 1939: 94, pl. 3, fig. 1. Syntype workers: Ohio, Pike County, Beaver [MCZC, four workers examined; USNM, one worker examined]. Junior synonym of *pilinasis*: Smith, 1951: 828; Brown, 1953: 60. **New Synonym**

Diagnosis. *Strumigenys brevisetosa* can be easily distinguished from most Nearctic species by the presence of a distinct peripheral groove that runs the entire free margin of the clypeus, placing it in the *clypeata* group. Of species in the *clypeata* group it is most similar to *S. laevinasis* M.R. Smith and *S. clypeata* Roger. Members of *Strumigenys brevisetosa* are distinguished from *S. laevinasis* by their linear-spatulate pilosity on dorsum and free margins of the clypeus (in *S. laevinasis* these hairs are fine and never expanded along their lengths). *Strumigenys brevisetosa* is distinguished from *S. clypeata* by the elevated positioning and elongated hairs on the clypeal dorsum (in *S. clypeata*, dorsal clypeal hairs are scale-like spatulate hairs that are tightly appressed), as well as the longer more linear hairs on the free margins of their clypeus (in *S. clypeata*, this fringe of hairs are spatulate, not linear spatulate).

Holotype measurements: HL = 0.656; HW = 0.435; ML = 0.133; PW = 0.289; SL = 0.359; FL = 0.477; HT = 0.32; EL = 0.055; TL = 2.477; WL = 0.641; CI = 66.3; MI = 20.3; SI = 82.5; Clypeal width = 0.230; Clypeal length = 0.219.

Non-type measurements (n = 29 workers). HL = 0.554-0.696(0.628); HW = 0.365-0.428(0.402); ML = 0.09-0.134(0.104); PW = 0.234-0.335(0.283); SL = 0.272-0.35(0.317); FL = 0.36-0.471(0.418); HT = 0.279-0.338(0.311); EL = 0.035-0.076(0.054); TL = 2.319-2.815(2.608); WL = 0.527-0.678(0.61); CI = 60.8-68(64); MI = 13.8-20.2(16.8); SI = 73.1-86.1(80.6).

Description. *Strumigenys brevisetosa* belongs to the *clypeata* species group, sharing the diagnostic peripheral clypeal groove common to that group. For the description of the *clypeata* species group see Bolton (2000). The following description accounts for variation among all examined specimens of *S. brevisetosa* within the definition of the *clypeata* group.

Mandibles with acute triangular basal lamella followed by a minute to absent diastemmic gap (0.002-0.015) that is almost always shorter than the first principle tooth. Basal tooth is followed by five principle teeth. Counting from base of mandible, first three teeth increase in size followed by a shorter fourth tooth and fifth tooth that is similar in sized as tooth two. Clypeus varies from longer than broad to broader than long (clypeal width/length n=31, 0.879-1.174).

In profile, pronotum evenly rounded and continuous with mesonotum, metanotal groove weakly impressed to absent. Propodeal teeth are well developed and triangular-spiniform to triangular. Lamella on declivitous face of propodeum between spine and lobe of metapleural gland narrow and never approaching length of tooth (rarely extending more than half the tooth length). Spongiform tissue is typical of the *clypeata* group, well developed as a ventral flange along the petiole, as a ventral and posterior lobe of the petiolar node, as a ventral process of the postpetiole, and as a collar surrounding the disc of postpetiole.

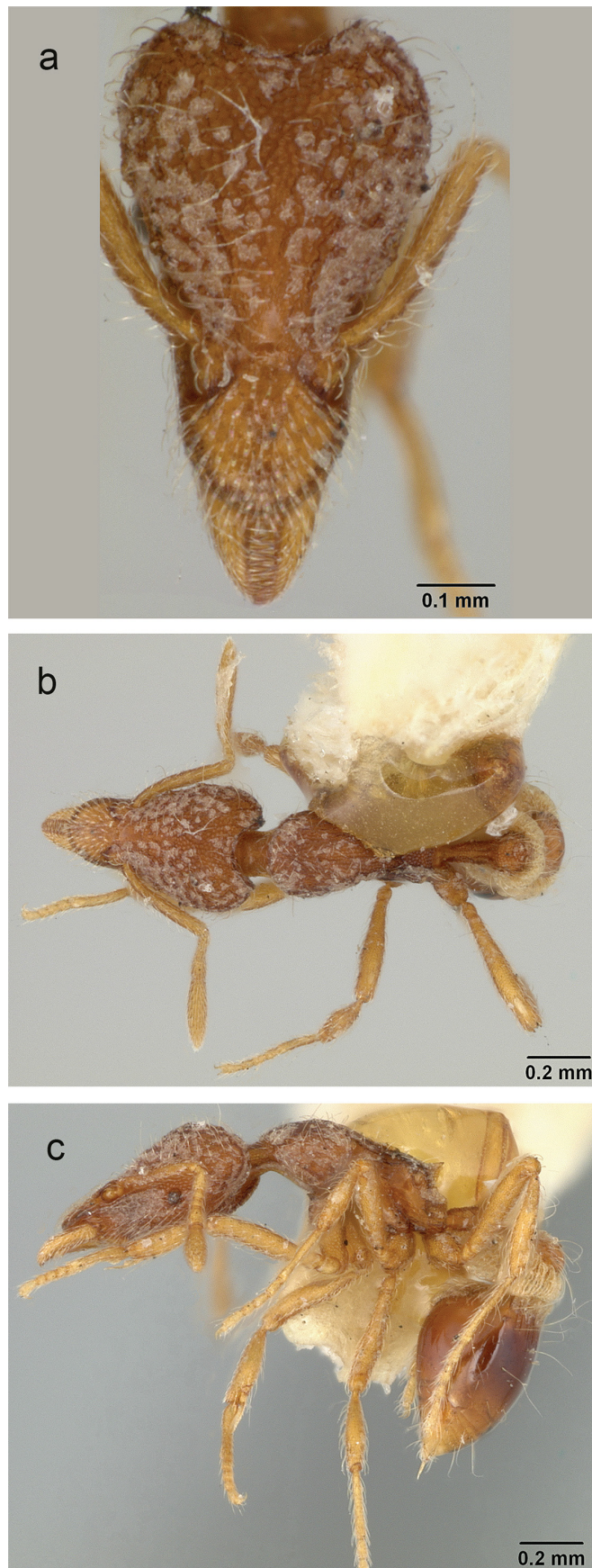


FIGURE 2. Holotype worker of *Strumigenys brevisetosa* [USNM: USNMENT00533161] Photographed by Matthew Kwe-skin.

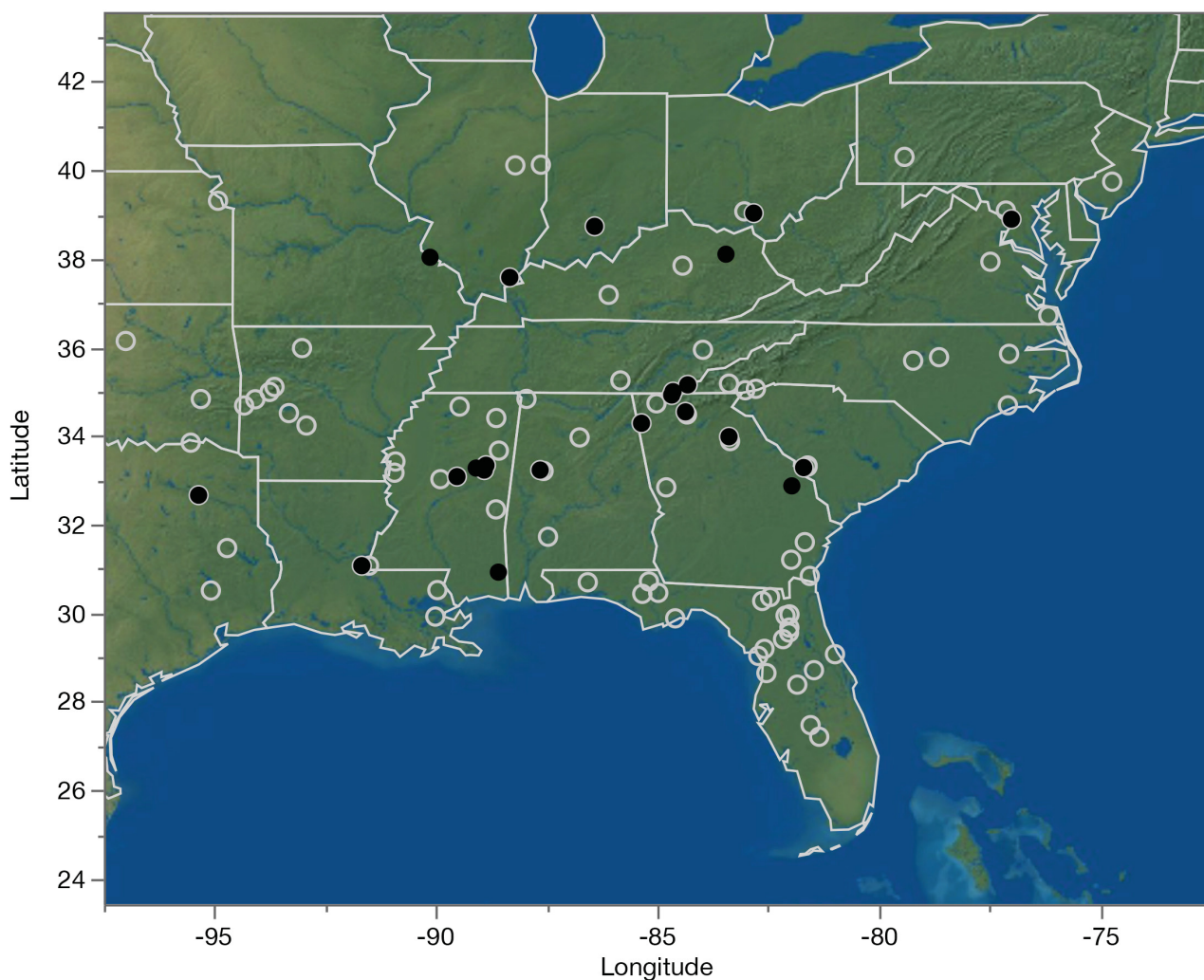


FIGURE 3. Map of *Strumigenys brevisetosa* specimens examined in this study. Filled circles are measured specimens.

Pilosity. Clypeal dorsum and free margins of clypeus with linear-spatulate hairs. Those on dorsum vary but are slightly to moderately elevated and never tightly appressed. Hairs on free margin of clypeus vary in shape from finely to broadly linear-spatulate but are never simple. Ground pilosity of head and mesosoma consists of numerous arched simple hairs tending to orient medially, hairs on gastral tergites subflagellate to flagellate. Differentiated standing flagellate hairs vary as follows, scrobal margin with 1-2 (one pair always present at apicoscrobal position and if a second pair is present it occurs at near the midlength of the scrobal margin); dorsum of head with 2 and sometimes 3 pairs of hairs near posterior margin of head (one pair straddling the midline, one pair at posterior-most position of occipital lobes, and sometimes a pair between); humeral hair present as well as another pair present on dorsum of pronotum, and 1-2 pairs present on mesonotum; fore-tibia usually with no hairs but some specimens having up to two hairs; mesa- and meta- femur, tibia, and basitarsi with one to two.

Sculpture. Clypeus varies from punctate to smooth. Head and dorsum of mesosoma are reticulopunctate. Side of pronotum usually to punctate with heavier rugulo-striate sculpture but some specimens with a large smooth patch; the side of mesonotum and propodeum smooth and shining. Abdomen with well-developed basigastral costulae that extend near a third of the length of the first gastral tergite; the remainder of the abdomen free of sculpture and shining.

Comments. There is a fairly long history of confusion in the species concept of *Strumigenys brevisetosa*. It has the most variable clypeal hair and clypeal shape of any North American *Strumigenys*. It is likely that *S. brevisetosa* is a single species that has hybridized or still hybridizes with both *S. laevinasis* and *S. clypeata* (Brown 1964). It is also possible *S. brevisetosa* contains more than one cryptic species: one or two that are more closely related to *S. laevinasis* and one that is more closely related to *S. clypeata*. *Strumigenys medialis* (junior synonym of *brevisetosa*)

originally referred to species more similar to *S. laevinasis* and *Strumigenys brevisetosa* referred to species more similar to *S. chypeata* (Brown 1964). Another potential closely related species, mentioned as *Strumigenys* near *pili-nasis* (see below), represents morphological variants that are closest to *S. laevinasis*. However, after examining all of the type specimens, nearly all the collection material available to previous taxonomists, and additional new collections, it has become clear that there are no distinct morphological characters to distinguish *S. brevisetosa* from *S. medialis* and I retain it as combined for the same reasons as Brown (1964) combined these two species. Specimens that are most similar to *S. laevinasis* tend to have one scrobal hair (at apical position, but this varies within the same nest series), have a smooth non-sculptured patch on the side of the pronotum, conical and stout teeth, and a clypeus that is longer than wide. Specimens that are more similar to *S. chypeata* tend to have two scrobal hairs (one along midlength and one at apical position, though rarely a specimen will have only one at apicoscrobal position), the side of pronotum with punctate and striate sculpture and without a smooth patch, spiniform elongate teeth, and a clypeus that is wider than long. However, after looking at many more specimens than were available to my predecessors, it has become clear that none of these characters are stable and at this time I am reluctant to separate *S. brevisetosa* into more than one species.

Brown (1964: 199) mentioned a possible new species as *Strumigenys* sp. near *brevisetosa*, based on two worker collections (Karber's Ridge, Perry County, IL [Sanderson & Standard]; and Urbana, Champaign County, IL [Tanquary]). I identify these as *Strumigenys brevisetosa*.

Due to the great variability of this species and the potential for future taxonomic revision, I provide a complete list of examined material.

Non-type material examined and measured.

All specimens from the United States. MS: Tombigbee National Forest, Winston Co., collected by S.H. & R.T Allen, 6-Mar-2016, 33.2753, -89.0922, 1 worker, [DBBC, CASENT0875996]. KY: 5.5 miles S of Morehead, Rowan Co., collected by L.E. Watrous, 9-October-2014, 38.1044, -83.4503, 1 worker, [DBBC, CASENT0875995]. GA: Magnolia Springs SP, Jenkins Co., collected by D. Booher, berlese, 4-October-2014, 32.873, -81.9635, 1 worker, [DBBC, CASENT0751786]. SC: SRS, Aiken Co., collected by D. Booher, berlese, 10-September-2014, 33.2866, -81.6951, 1 worker, [DBBC, CASENT0799681]. GA: Sandy Creek Nature Center, Clarke Co., collected by D. Booher, berlese, 8-July-2012, 33.9841, -83.3822, 1 queen, [DBBC, CASENT0799621]. GA: Cohutta WMA, Murray Co., collected by D. Booher & R. Duffield, berlese, 29-May-2012, 34.9259, -84.6755, 2 workers, [DBBC, CASENT0750448, CASENT0750449]. TN: Cohutta WMA, Polk Co., collected by R.M. Duffield & D. Booher, berlese, 29-May-2012, 35.0009, -84.6457, 1 worker, [DBBC, CASENT0799699]. GA: Dawson Forest, Pickens Co., collected by D. Booher & R. Duffield, berlese, 27-May-2012, 34.5443, -84.3644, 1 worker, [DBBC, CASENT0799674]. MS: Noxubee Wildlife Refuge, Winston Co., collected by D. Booher & R. Duffield, berlese, 24-May-2012, 33.2304, -88.9103, 1 worker, [DBBC, CASENT0799668, CASENT0799669, CASENT0799670, CASENT0799676]. GA: Big Texas Valley, Floyd Co., collected by D. Booher, berlese, 3-May-2012, 34.2874, -85.3578, 1 worker, [DBBC, CASENT0799672]. MO: Magnolia Hollow, Genevieve Co., collected by L.E. Watrous, 30-September-2012, 38.0347, -90.1328, 1 worker, [DBBC, CASENT0875998]. MS: Natchez Trace, mi 165, Attala Co., collected by J.A. MacGown & J.G. Hill, 9-July-2008, 33.0822, -89.5258, 1 worker, [DBBC, MEM 86771]. MS: Clarke Creek Natural Area, Wilkinson Co., collected by J.A. MacGown & J.G. Hill, 7-June-2005, 31.0714, -91.6753, 1 worker, [MEM, MEM 86725]. TX: Hainsville, Godwin Woods, 3.5 miles SW of Hainsville, Wood Co., collected by E.G. Riley, berlese, 30-April-2000, 32.6633, -95.3601, 1 worker, [DBBC, CASENT0799679]. MS: Dorman Lake, Oktibbeha Co., collected by G.L. Snodgrass, 6-July-1981, 33.3389, -88.8705, 1 worker, [DBBC, CASENT0875767]. IN: Spring Mill State Park, Lawrence Co., collected by S. Peck, 18-July-1968, 38.7336, -86.4168, 1 worker, [MEM, MEM 86722]. TN: Farner, Polk Co., collected by D.W. Pfitzer, 24-May-1951, 35.154, -84.3148, 1 worker, [UGCA, CASENT0751274]. IL: Karber's Ridge, Perry Co., collected by Sanderson & Stannard, 4-May-1950, 37.5798, -88.3334, 1 worker, [USNM, CASENT01015706]. AL: Bryce Lake, Tuscaloosa Co., collected by E.O. Wilson, 9-November-1949, 33.23, -87.6467, 1 worker, [USNM, USNM01128824]. Washington D.C.: College Hill, Georgetown, Arlington Co., 10-August-1885, 38.8946, -77.0026, 1 worker, [USNM, USNM01128822].

Other material examined.

AL: Bryce Lake, Tuscaloosa Co., collected by E.O. Wilson, 5 workers [MCZC]. AL: Cleveland, 7 miles South of Cleveland, Blount Co., collected by S. Peck & A. Fisk, 1 queen [ABS]. AL: Colbert Creek, Colbert Co., collected by J.A. MacGown, 1 worker [MEM]. AL: Haines Island Reserve, Monroe Co., collected by V. Behan, 1 worker [MEM]. AL: Tuscaloosa, Tuscaloosa Co., collected by E.O. Wilson, 3 workers [MCZC]. AR: Blue Mountain Lake, Yell Co., collected by C. Carlton & H. Robison, 11 workers [ABS]. AR: Buffalo River National Park, 2 miles west of Erbie Camp, Newton Co., collected by C. Carlton, 1 worker [ABS]. AR: Crystal Recreation Area, 1.5 miles east of Crystal Recreation Area, Montgomery Co., collected by H. Robison & C. Carlton, 1 worker [ABS]. AR: Day Creek, Scott Co., collected by H. Robison & C. Carlton, 1 queen [ABS]. AR: Donaldson, Hot Spring Co., collected by Ross & Stannard, 2 workers [MCZC]. AR: Hogan Mountain, Scott Co., collected by H. Robison & C. Carlton, 1 queen [ABS]. AR: Rich Mountain, Ouachita National Forest, Polk Co., collected by H. Robison & C. Carlton, 1 worker [ABS]. AR: Rich Mountain, Ouachita National Forest, Polk Co., collected by H. Robison & C. Carlton, 1 worker [ABS]. AR: Rich Mountain, Ouachita National Forest, Polk Co., collected by H. Robison & C. Carlton, 19 workers [ABS]. FL: Jackson Co., collected by S. Peck, 1 worker [MCZC]. FL: Archbold Biological Station, Junction of state road 70 and 17, Highlands Co., collected by W. Suter, 1 queen, 7 workers [ABS]. FL: Archbold Biological Station, Lake Annie, Alachua Co., collected by M. Deyrup, 2 workers [ABS]. FL: Blountstown, 18 miles west of Blountstown on highway 20, Calhoun Co., collected by C. Johnson, 4 workers [ABS]. FL: Bristol, The Nature Conservancy Apalachicola Bluffs, Ravine near Main office, Liberty Co., collected by M. Deyrup & S.P. Cover, 2 workers [ABS]. FL: Bronson, On Camp road about 15 miles west on Camp road, Levy Co., collected by M. Deyrup, 1 queen [ABS]. FL: Brooksville, Annutteliga Hammock, 7 miles northwest of Brooksville, Hernando Co., collected by W. Suter, 1 queen, 6 workers [ABS]. FL: Crestview, Little Shoal River on US 85, Ockaloosa Co., collected by M. Deyrup, 13 workers [ABS]. FL: Groveland, 10 miles south of Groveland on Oil Well road, Lake Co., collected by M. Deyrup, 1 queen [ABS]. FL: Highlands Hammock State Park, Highlands Co., collected by W. Suter, 1 worker [ABS]. FL: Kingsley Village, along route 16, Clay Co., collected by L.R. Davis, 2 workers [ABS]. FL: Kingsley Village, T6S R23E Section 16, Clay Co., collected by L.R. Davis, 1 worker [ABS]. FL: Lake City, 6.4 miles north of Lake City, Columbia Co., collected by J. Kethley, 2 workers [ABS]. FL: Lanark, Franklin Co., collected by W. Suter, 1 queen [ABS]. FL: Lanark, Franklin Co., collected by W. Suter, 1 queen, 2 workers [ABS]. FL: Melrose, Ordway Preserve 3 miles East of Melrose, near Lake Rowan, Putnum Co., collected by L.R. Davis, 1 queen [ABS]. FL: Melrose, Ordway Preserve 3 miles East of Melrose, near Lake Rowan, Putnum Co., collected by L.R. Davis, 2 alate queens, 9 workers [ABS]. FL: Osceola National Forest, Old Sand Road near Columbia County Line, Baker Co., collected by M. Deyrup, 1 queen [ABS]. FL: Redwater Lake, West end of lake, Putnam Co., collected by M. Deyrup, 1 worker [ABS]. FL: Spruce Creek Preserve, Volusia Co., collected by M. Deyrup, 1 queen [ABS]. FL: Starke, Bradford Co., collected by L.R. Davis, 1 worker [ABS]. FL: Wekiwa Springs State Park, Orange Co., collected by Z. Prusak, 3 workers [ABS]. FL: Yankeetown, just east of junction County road 40D and 40A, Levy Co., collected by M. Deyrup & L.R. Davis, 1 queen, 4 workers [ABS]. GA: Athens, Whitehall Forest, Clarke Co., collected by M. Deyrup & L. Deyrup, 1 queen [ABS]. GA: Big Texas Valley, Floyd Co., collected by D. Booher, 1 queen, 1 worker [DBBC]. GA: Cohutta WMA, Murray Co., collected by D. Booher & R. Duffield, 3 workers [DBBC]. GA: Crooked River SP, Camden Co., collected by D. Booher, 1 worker [DBBC]. GA: Dalton Mount Sinai, Whitfield Co., collected by D. Booher, 1 queen [DBBC]. GA: Dawson Forest, Pickens Co., collected by D. Booher & R. Duffield, 1 worker [DBBC]. GA: FDR SP, Harris Co., collected by D. Booher, 1 worker [DBBC]. GA: Mt. Oglethorpe, Dawson Co., collected by S. Peck & A. Fisk, 3 workers [MCZC]. GA: Nahunta, Brantley Co., collected by W. Suter, 1 worker [ABS]. GA: Sandy Creek Nature Center, Clarke Co., collected by D. Booher, 1 worker [DBBC]. GA: Sandy Creek Nature Center, Clarke Co., collected by D. Booher, 1 worker [DBBC]. GA: Sandy Creek Nature Center, Clarke Co., collected by D. Booher, 1 worker [DBBC]. GA: Townsend WMA, Long Co., collected by D. Booher, 1 worker [DBBC]. IL: Danville, Vermilion Co., 1 worker [MCZC]. IL: Karber's Ridge, Perry Co., collected by Sanderson & Stannard, 1 queen, 8 workers [MCZC]. IL: Urbana, Champaign Co., collected by M.C. Tanquary, 2 workers [MCZC]. IN: Spring Mill State Park, Lawrence Co., collected by S. Peck, 3 queens, 4 workers [MCZC]. KS: Leavenworth State Lake, Leavenworth Co., collected by M.B. Duboise, 2 workers [MCZC]. KY: Mammoth Cave National Park, Boyle Valley, Edmonson Co., collected by S. Peck & A. Fisk, 9 workers [MCZC]. KY: Valley View, Jessamine Co., collected by S. Peck, 1 worker [MCZC]. LA: Abita Creek Preserve, St. Tammany Co., collected by C. Carlton & D. Prowell, 1 alate queen [LSAM]. LA: Algiers, Orleans Co., collected by

R.S. Howard, 4 workers [MCZC]. MD: Rockville Civic Center, Montgomery Co., collected by R.M. Duffield, 4 workers [MCZC]. MS: 2 mi NE of West Point, Clay Co., collected by J.A. MacGown, 2 workers [MEM]. MS: Bonita Lakes Res., Lauderdale Co., collected by J.G. Hill, 1 worker [MEM]. MS: Clarke Creek Natural Area, Wilkinson Co., collected by J.A. MacGown & J.G. Hill, 1 worker [MEM]. MS: Clarke Creek Natural Area, Wilkinson Co., collected by J.A. MacGown & J.G. Hill, 4 workers [MEM]. MS: Dorman Lake, Oktibbeha Co., collected by G.L. Snodgrass, 1 worker [MCZC]. MS: Dorman Lake, Oktibbeha Co., collected by G.L. Snodgrass, 1 worker [MEM]. MS: Dorman Lake, Oktibbeha Co., collected by G.L. Snodgrass, 6 workers [MEM]. MS: Dorman Lake, Oktibbeha Co., collected by R.L. Brown, 2 workers [MCZC]. MS: Dorman Lake, Oktibbeha Co., collected by R.L. Brown, 2 workers [MEM]. MS: Dorman Lake, Oktibbeha Co., collected by R.L. Brown, 3 workers [MCZC]. MS: Holmes Co. St. Pk., Holmes Co., collected by J.A. MacGown & J.G. Hill, 1 worker [MEM]. MS: Leroy Percy State Pk., Washington Co., collected by J.A. MacGown & J.G. Hill, 6 workers [MEM]. MS: Natchez Trace, mi 165, Attala Co., collected by J.A. MacGown & J.G. Hill, 1 worker [MEM]. MS: Natchez Trace, mi 165, Attala Co., collected by J.A. MacGown & J.G. Hill, 35 workers [MEM]. MS: Natchez Trace, mi 273, Lee Co., collected by R.L. Brown, 1 worker [MEM]. MS: Noxubee Wildlife Refuge, Winston Co., collected by D. Booher & R. Duffield, 1 worker [DBBC]. MS: Noxubee Wildlife Refuge, Winston Co., collected by J.A. MacGown & J.G. Hill, 4 workers [MEM]. MS: Stoneville, Washington Co., collected by G.L. Snodgrass, 1 worker [MEM]. MS: Wall Doxey St. Park, Marshall Co., collected by J.A. MacGown & R.J. Jones, 1 worker [MEM]. NC: Boneyard Lake, Raleigh Co., collected by M.W. Wing, 3 workers [MCZC]. NC: Cedar Point, Croatan National Forest, Carteret Co., collected by M. Deyrup, 1 worker [ABS]. NC: Franklin, Macon Co., 1 worker [MCZC]. NC: Pittsboro, Rocky Hill Farm, Chatham Co., collected by Ron Clouse, 1 worker [ABS]. NC: White Water Falls, Jackson Co., collected by D. Booher, 1 worker [DBBC]. NC: Williamston, Martin Co., collected by D.L. Wray, 1 worker [MCZC]. NJ: East of Atsion, Burlington Co., collected by W.L. Brown & R.C. Kugler, 3 workers [MCZC]. OH: Pike Co., 1 worker [LACM]. OH: Beaver, Aiken Co., collected by Wesson & Wesson, 1 queen [MCZC]. OK: Latimer Co., collected by K. Stephan, 9 workers [ABS]. OK: Payne Co., collected by W.G. Carter, 2 queens, 5 workers [MCZC]. PA: Beatty, Westmoreland Co., 1 queen, 1 worker [MCZC]. SC: Sassafras Mt, Pickens Co., collected by S. Peck & A. Fisk, 1 worker [MCZC]. SC: Savannah River Site, Barnwell Co., collected by D. Booher, 1 worker [DBBC]. SC: SRS, Aiken Co., collected by D. Booher, 1 worker [DBBC]. SC: SRS, Aiken Co., collected by D. Booher, 1 worker [DBBC]. TN: Cohutta WMA, Polk Co., collected by R.M. Duffield & D. Booher, 1 queen [DBBC]. TN: Farner, Polk Co., 2 workers [LACM]. TN: Farner, Polk Co., collected by D.W. Pfitzer, 1 worker [UGCA]. TN: Farner, Polk Co., collected by W.J. Cloyd, 3 workers [ABS]. TN: Farner, Polk Co., collected by W.S. Cloyd, 1 queen, 4 workers [MCZC]. TN: Farner, Polk Co., collected by W.S. Cloyd, 2 workers [MCZC]. TN: Knoxville, Knox Co., collected by D. Booher, 3 workers [DBBC]. TN: Monteagle, Grundy Co., collected by D. Booher & J. Gibson, 20-September-2015, 35.253, -85.8341, 1 worker [DBBC]. TX: Big Creek Scenic Area, San Jacinto Co., collected by J.L. Cook & J.B. Martin, 1 worker [SHSU]. TX: Big Creek Scenic Area, San Jacinto Co., collected by J.L. Cook & J.B. Martin, 1 worker [SHSU]. TX: Big Creek Scenic Area, San Jacinto Co., collected by J.L. Cook & J.B. Martin, 1 worker [SHSU]. TX: Camp Maxey, Lamar Co., collected by S.F. Godwin, 1 worker [DBBC]. TX: Hainsville, Godwin Woods, 3.5 miles SW of Hainsville, Wood Co., collected by E.G. Riley, 1 worker [TAMU]. TX: Nacogdoches, 12 miles south southwest of Nacogdoches, Nacogdoches Co., collected by Byers & Jenks, 13 workers [ABS]. VA: NE of Fentress on VA 165, Norfolk Co., collected by W. Suter, 4 workers [MCZC]. VA: Ruther Glen, Days Inn at the junction of I-95 and 20, Caroline Co., collected by M. Deyrup, 2 workers [ABS]. Washington D.C., College Hill, Georgetown, Arlington Co., 1 queen, 2 workers [MCZC, USNM, LACM].

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