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A Revision of the Genus *Callimoxys* Kraatz (Coleoptera: Cerambycidae) in America North of Mexico and Review of World Species

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Abstract

The North American species of *Callimoxys* Kraatz, 1863 are revised. *Callimoxys sanguinicollis* (Olivier, 1795), *Callimoxys fuscipennis* (LeConte, 1861), **new status**, and *Callimoxys pinorum* Casey, 1924, **new status,** are recognized as valid, and two **new species** (*Callimoxys ocularis* Hammond and Williams, type locality West Saylorville Lake, Iowa, and *Callimoxys nigrinis* Hammond and Williams, type locality near Brenham, Texas) are described. A key to the world fauna is included, as well as a review and diagnosis of the two known Palaearctic species, *Callimoxys gracilis* (Brullé, 1832) and *Callimoxys retusifer* Holzschuh, 1999. A morphometric study was conducted using 67 characters from adults of the North American species. Data were examined using stepwise discriminant analysis to determine which characters aid in the diagnosis of taxa, and their relative amounts of resolving power using canonical variates analysis. Significant sexual dimorphism and variability in morphological characters were detected, but ratios that control for body size were found to be useful in species diagnosis. Phylogenetic analysis using the genus *Stenopterus* Illiger, 1804 as outgroup returned a single most parsimonious tree and hypothesized *C. ocularis*+*C. nigrinis* as ancestral and *C. sanguinicollis* +*C. pinorum* most derived.

Key Words: Cerambycinae, Stenopterini, taxonomy, phylogenetics, morphology, morphometrics

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The tribe Stenopterini (Cerambycidae: Cerambycinae) is primarily a Palaearctic group represented by 10 genera: *Stenopterus* Illiger, *Callimus* Mulsant, *Guerryas* Pic, *Kunbir* Lameere, *Lampropterus* Mulsant, *Merionoeda* Pascoe, *Microdebilissa* Pic, *Procallimus* Pic, *Obscuropterus* Aldbauer, and *Callimoxys* Kraatz (Bense 1995; Sama 2002; Sama and Löbl 2010). Of these, only *Lampropterus* and *Callimoxys* have representatives in North America. *Callimoxys* species are relatively easy to recognize as they belong to a small group of species within the subfamily Cerambycinae that have abbreviated, narrow elytra, and are strikingly sexually dimorphic with males usually having a black or piceus pronotum, larger eyes, longer antennae, and smaller overall body size; females have an orange or bicolored pronotum, smaller eyes and antennae, and overall larger body size. As with most other Cerambycidae, larvae of *Callimoxys* are wood boring (Craighead 1923) and develop in various shrub species belonging to the Rhamnaceae, Anacardiaceae, and Rosaceae. Little is known about their natural history and habitat specificities or their phylogenetic affinities within the Stenopterini.

In North America, *Callimoxys* has been present since the late Eocene as fossil remains of *Callimoxys primordialis* Wickham have been recovered from the Florissant fossil beds in Colorado (Wickham 1911; Linsley 1942). The last revision of the group, by Linsley (1963) in his monograph 'The Cerambycidae of North America', recognized two subspecies of *Callimoxys sanguinicollis* (Olivier): the nominate subspecies *C. sanguinicollis sanguinicollis* (Olivier) and *C. sanguinicollis fuscipennis* (LeConte). Linsley's subspecies delineation was primarily based upon the length and form of the elytra and geographic distribution (Fig. 1): *C. sanguinicollis sanguinicollis* ranging from Ontario and Quebec south to Florida and west to Texas, and having relatively short elytra with the apex reaching the apex of the third abdominal segment; and *C. sanguinicollis fuscipennis* found west of the Rocky Mountains in the Pacific Northwest and California, with longer elytra surpassing the apex of the third abdominal segment. Also, there appear to be specimens showing 'intermediate' character states between the two subspecies (*e.g*. Burne 1997).

As part of a larger work on the 'Cerambycidae of Canada and Alaska' (Bousquet *et al*., in preparation), we evaluated the taxonomic status of *Callimoxys* species in North America. Because adults are very similar, a morphometric analysis using a multivariate approach to help identify characters that may be diagnostic was performed.

Material and Methods

Specimens. A total of 3,226 specimens were borrowed and examined from the following

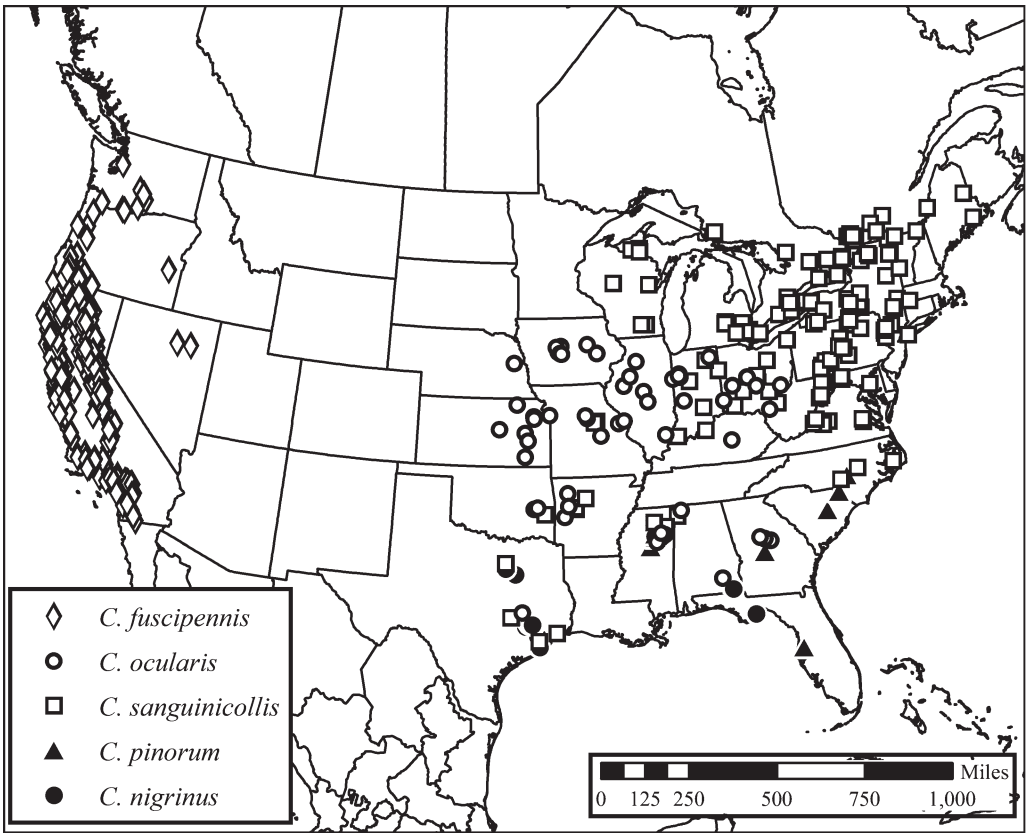

Fig. 1. Geographic distribution of *Callimoxys* spp. in North America.

institutions or private collections [contact person within brackets]:

AMNH: American Museum of Natural History, New York, New York [Lee Herman].

BMNH: The Natural History Museum, London, United Kingdom [Sharon Shute].

BYU: Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah [Shawn Clark].

CAS: California Academy of Sciences, San Francisco, California [David Kavanaugh].

CNC: Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada [Serge Laplante].

CUAC: Clemson University Arthropod Collection, Department of Entomology, Clemson University, Clemson, South Carolina [Ian Stocks].

DJHC: Dan J. Heffern personal collection, Houston, Texas [Daniel Heffern].

EMEC: Essig Museum Entomology Collection, University of California, Department of Entomological Sciences, Berkeley, California [Cheryl Barr].

FMNH: Field Museum of Natural History, Chicago, Illinois [James Boone].

FSCA: Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville, Florida [Michael Thomas].

JAMES: James Entomological Museum, Washington State University, Pullman, Washington [Richard Zack]

JBWM: J.B. Wallis Entomological Museum, University of Manitoba, Department of Entomology, Winnipeg, Manitoba, Canada [Rob Roughley].

JCBC: J.C. Burne personal collection, Macon, Georgia [Jeffrey Burne].

JDHR: Jeffrey D. Holland research collection, Purdue University, West Lafayette, Indiana [Jeffrey Holland].

MCZ: Museum of Comparative Zoology, Department of Entomology, Harvard University, Cambridge, Massachusetts [Philip Perkins].

MEM: Mississippi Entomological Museum, Department of Entomology and Plant Pathology, Mississippi State University, Mississippi State, Mississippi [Terry Schieffer].

NCSU: North Carolina State University Insect Museum, Department of Entomology, North Carolina State University, Raleigh, North Carolina [Bob Blinn].

PERC: Purdue Entomological Research Collection, Purdue University, West Lafayette, Indiana [Arwin Provonsha].

OSAC: Oregon State Arthropod Collection, Oregon State University, Corvallis, Oregon [Christopher Marshall].

RHTC: Robert Turnbow personal collection, Fort Rucker, Alabama [Robert Turnbow].

RBCM: Royal British Columbia Museum, Victoria, British Columbia, Canada [Robert Cannings].

SEMC: Snow Entomological Collection, University of Kansas, Lawrence, Kansas [Jennifer Thomas, Zachary Falin].

TAMU: Texas A&M Insect Collection, Texas A&M University, Department of Entomology, College Station, Texas [Edward Riley].

TNPC: Tatsuya Niisato personal collection, Kokubunji City, Tokyo, Japan [Tatsuya Niisato].

UAAM: University of Arkansas Arthropod Museum, University of Arkansas, Department of Entomology, Fayetteville, Arkansas [Jeffrey Barnes].

UASM: E.H. Strickland Entomological Museum, University of Alberta, Department of Biological Sciences, Edmonton, Alberta, Canada [Danny Shpeley].

UBCZ: George J. Spencer Entomological Museum, University of British Columbia Department of Zoology, Vancouver, British Columbia, Canada [Karen Needham].

UMRM: W.R. Enns Entomology Museum, College of Agriculture, Food and Natural Resources, Division of Plant Sciences, University of Missouri, Columbia, Missouri [Robert Sites].

USNM: Smithsonian Institution, National Museum of Natural History, Department of Entomology, Washington, DC [Steven Lingafelter].

WFBM: W.F. Barr Entomological Museum, University of Idaho, Department of Plant, Soil, and Entomological Sciences, Moscow, Idaho [Frank Merickel].

WVDA: West Virginia Department of Agriculture Reference Insect Collection, West Virginia Department of Agriculture Plant Industries Division, Charleston, West Virginia [Laura Miller].

Measurements and Illustrations. All observations and measurements were made using a Leica MZ8 dissecting microscope with 16X ocular lens with micrometer and 1.5X objective lens. Photographs were taken with a Leica M80 dissecting microscope with a Leica EC3 camera attached, and structures subsequently rendered into line drawings using OpenOffice Draw V3. Scanning electron micrographs were obtained using an Hitachi S-510 scanning electron microscope with Quartz PCI image capture software.

Morphometric Characters and Analysis. Data for morphometric analyses were obtained by measuring 67 morphological characters (Table 1, Fig. 2). Fifteen specimens of each sex were measured across the geographic range and size distribution for each species, except *Callimoxys pinorum* Casey for which only four males and ten females were complete.

Statistical Analyses. Ocular measurements were converted to lengths in millimetres. Two types of data were then used for statistical analysis: 1. Normalized measurements: measurements scaled to specimen size because the size distribution varied considerably within species. Total body length often varied due to the terminal abdominal segments telescoping in or out of the body. To reduce this variance we examined several characters such as elytral length and width, pronotal length, metafemoral length, and first abdominal sternite length that could be used as a surrogate for total body length. Elytral width (ELW) was used because elytral width varied the least while providing an accurate linear relationship with total length; and 2. Morphometric ratios: proportions of body structures that aid in identification (56 characters). Analyses were performed using SAS version 9.2 for UNIX (SAS Institute, Inc. 2008). Measurements were analyzed using stepwise discriminant function analysis (STEPDISC) to determine if any of the original 67 measured characters or any of the 56 ratios were uninformative. Forward, backward, and stepwise selection gave the same results, and results for stepwise selection (default) were used. Characters

Table 1. Morphometric characters measured on adult *Callimoxys* (see Fig. 2).

Number	Structure	Code	Character
1	Head	ID	Dorsal Interocular Distance: shortest distance between upper eye lobes, between medial margins
2	Head	GL	Genal Length: greatest distance from basal margin of gena near anterior margin of eye to its greatest lateral extent
3	Head	FH	Front Height: distance from ventral margin of gena to dorsal margin of antennal insertion
4	Head	AIW	Frontal Antennal Insertion Width: distance between antennal insertions across frons
5	Head	FL	Clypeus Length: distance from base of frontal excavation to base of labrum
6	Head	HW	Total Head Width: greatest width across eyes
7	Head	VEL	Lower Eyelobe Ventral Length: medial distance from pregular carina to a line drawn perpendicular to the shortest width ventrally between eyes
8	Head	PGC	Pregular Carina: length of the pregular carina between the medial margins of the maxillary palp cavities
9	Head	UEL	Upper Eye Lobe Length: greatest length of upper eye lobe parallel to medial eye margin along longitudinal axis of body
10	Head	NW	Neck Width: smallest neck width posterior to eyes
11	Head	LLS	Lower Eye Lobe Height: greatest length of lower eye lobe, tangentially from base of antennal process to lower posterior corner
12	Head	EH	Total Eye Height: longest distance from ventral to dorsal margin of eye, usually at an angle
13	Head	LEL	Lower Eye Lobe Length: from anterior margin to shortest distance of the posterior sinuation of eye, along longitudinal body axis
14	Head	TEL	Total Eye Length: total eye length from anterior margin of lower lobe to posterior margin of upper lobe along longitudinal axis
15	Antennae	A1L	Scape Length: length of scape from insertion suture to apical margin along center axis
16	Antennae	A1W	Apical Scape Width: greatest width of scape near apex
17	Antennae	A2L	Length of Antennomere 2: greatest length of antennal segment 2 along midline
18	Antennae	A3L	Length of Antennomere 3: greatest length of antennal segment 3 along midline
19	Antennae	A4L	Length of Antennomere 4: greatest length of antennal segment 4 along midline
20	Antennae	A5L	Length of Antennomere 5: greatest length of antennal segment 5 along midline
21	Antennae	A5W	Width of Antennomere 5: greatest width of segment 5 near apex.
22	Antennae	A6L	Length of Antennomere 6: greatest length of antennal segment 6 along midline
23	Antennae	A7L	Length of Antennomere 7: greatest length of antennal segment 7 along midline
24	Antennae	A8L	Length of Antennomere 8: greatest length of antennal segment 8 along midline
25	Antennae	A9L	Length of Antennomere 9: greatest length of antennal segment 9 along midline
26	Antennae	A9W	Width of Antennomere 9: greatest width of segment 9 near apex.
27	Antennae	A10L	Length of Antennomere 10: greatest length of antennal segment 10 along midline
28	Antennae	A10W	Width of Antennomere 10: greatest width of segment 10 near apex.
29	Antennae	A11L	Length of Antennomere 11: greatest length of antennal segment 11 along midline
30	Antennae	A11W	Width of Antennomere 11: greatest width of segment 11 near apex.
31	Antennae	TAL	Total Antennal Length: sum of A1L, A2L, A3L, A4L, A5L, A6L, A7L, A8L, A9L, A10L, A11L
32	Thorax	PL	Pronotal Length: greatest length of pronotum along midline
33	Thorax	PW	Pronotal Width: greatest pronotal width across lateral callosities
34	Thorax	PD	Pronotal Depth: greatest pronotal heigth to dorsal margin of procoxal cavity
35	Thorax	PAS	Apical Sulcus Width: shortest width of pronotum across apical sulcus of pronotum
36	Thorax	PSL	Prosternal Length: distance from apical margin of pronotum to apical margin of procoxae along midline
37	Thorax	MSD	Mesocoxal Distance: shortest distance between mesocoxae along midline
38	Thorax	LMT	Metasternal length: midline distance from apical margin of mesocoxae to apical margin of metasternum (not including metacoxae)
39	Thorax	ELL	Total Elytral Length: total lateral length of elytra from humerus to apex
40	Thorax	ELW[†]	Total Elytral Width: total width of both elytra from humeri across apex of scutellum
41	Thorax	ELD	Basal Elytral Dehiscence: length from base of scutellum to beginning of elytral dehiscence
42	Abdomen	ASL	Length of Sternite 1: total length of abdominal sternite 1 along midline

Table 1. Continued.

Number	Structure	Code	Character
43	Leg	MTL	Total Metafemur Length: greatest length of metafemur from coxal insertion to apex of femur
44	Leg	MTCL	Metafemoral Club Length: greatest length of metafemoral club from apex of femur to an estimation of apex of pedicel
45	Leg	MTCW	Metafemoral Club Width: greatest width (near middle) of club
46	Leg	MSL	Total Mesofemur Length: greatest length of mesofemur from coxal insertion to apex of femur
47	Leg	MSCL	Mesofemoral Club Length: greatest length of mesofemoral club from apex of femur to an estimation of apex of pedicel
48	Leg	MSCW	Mesofemoral Club Width: greatest width (near middle) of club
49	Tarsus	Pt1L	Length of Protarsomere 1: length of protarsomere 1 from apex to base of condyle
50	Tarsus	Pt1W	Apical Width of Protarsomere 1: greatest apical width of protarsomere 1
51	Tarsus	Pt2L	Length of Protarsomere 2: length of protarsomere 2 from apex to basal constriction
52	Tarsus	Pt2W	Apical Width of Protarsomere 2: greatest apical width of protarsomere 2
53	Tarsus	Pt3L	Length of Protarsomere 3: length of protarsomere 3 from apex to basal constriction
54	Tarsus	Pt3W	Apical width of Protarsomere 3: greatest apical width of protarsomere 3
55	Tarsus	Ms1L	Length of Mesotarsomere 1: length of mesotarsomere 1 from apex to base of condyle
56	Tarsus	Ms1W	Apical Width of Mesotarsomere 1: greatest apical width of mesotarsomere 1
57	Tarsus	Ms2L	Length of Mesotarsomere 2: length of mesotarsomere 2 from apex to basal constriction
58	Tarsus	Ms2W	Apical Width of Mesotarsomere 2: greatest apical width of mesotarsomere 2
59	Tarsus	Ms3L	Length of Mesotarsomere 3: length of mesotarsomere 3 from apex to basal constriction
60	Tarsus	Ms3W	Apical width of Mesotarsomere 3: greatest apical width of mesotarsomere 3
61	Tarsus	Mt1L	Length of Metatarsomere 1: length of metatarsomere 1 from apex to base of condyle
62	Tarsus	Mt1W	Apical Width of Metatarsomere 1: greatest apical width of metatarsomere 1
63	Tarsus	Mt2L	Length of Metatarsomere 2: length of metatarsomere 2 from apex to basal constriction
64	Tarsus	Mt2W	Apical Width of Metatarsomere 2: greatest apical width of metatarsomere 2
65	Tarsus	Mt3L	Length of Metatarsomere 3: length of metatarsomere 3 from apex to basal constriction
66	Tarsus	Mt3W	Apical width of Metatarsomere 3: greatest apical width of metatarsomere 3
67	Total Length	TL	Total length of specimen, from the anterior margin of head to the apex of abdominal tergite 5 (measured in mm using ruler)

† Elytral width was used as a surrogate for total body size.

from STEPDISC analysis were then used in canonical discriminant analysis (CANDISC) to give a visual estimation of the variation in the data and identify the most informative of the measured characters (Fig. 3).

Phylogenetic Analysis. Both continuous and discrete morphological characters were selected for phylogenetic analysis, with continuous characters coded as discrete states (Tables 2 and 3). Several species of *Stenopterus* were examined to represent an out-group. This genus shares the apomorphically reduced apex of the elytra with *Callimoxys* and is considered its likely sister group (Ohbayashi *et al*. 2004), although the phylogeny of the Stenopterini has not been studied in detail. Out-group character states used are primarily those of *Stenopterus rufus* (L.) of which enough specimens were available to assess variation in all characters, but states were also assessed in *Stenopterus ater* (L.) and *Stenopterus flavicornis* Küster. Phylogenetic reconstruction was done with PAUP 4.0 (Swofford 1998) using an out-group rooted, unweighted, exhaustive analysis with maximum parsimony, and the shortest tree is presented.

Descriptions. A thorough redescription is provided for *C. sanguinicollis* as this was originally the defining species for the North American fauna, and there were a large number of specimens from a wide geographic area by which to judge the variation in character states. The description of *C. sanguinicollis* was then used as a template for subsequent species descriptions and only characters that differed from *C. sanguinicollis* were included.

Review of Morphology and Terminology in *Callimoxys*. Head and antennae: In *Callimoxys*, the orientation of the head varies from its ancestral

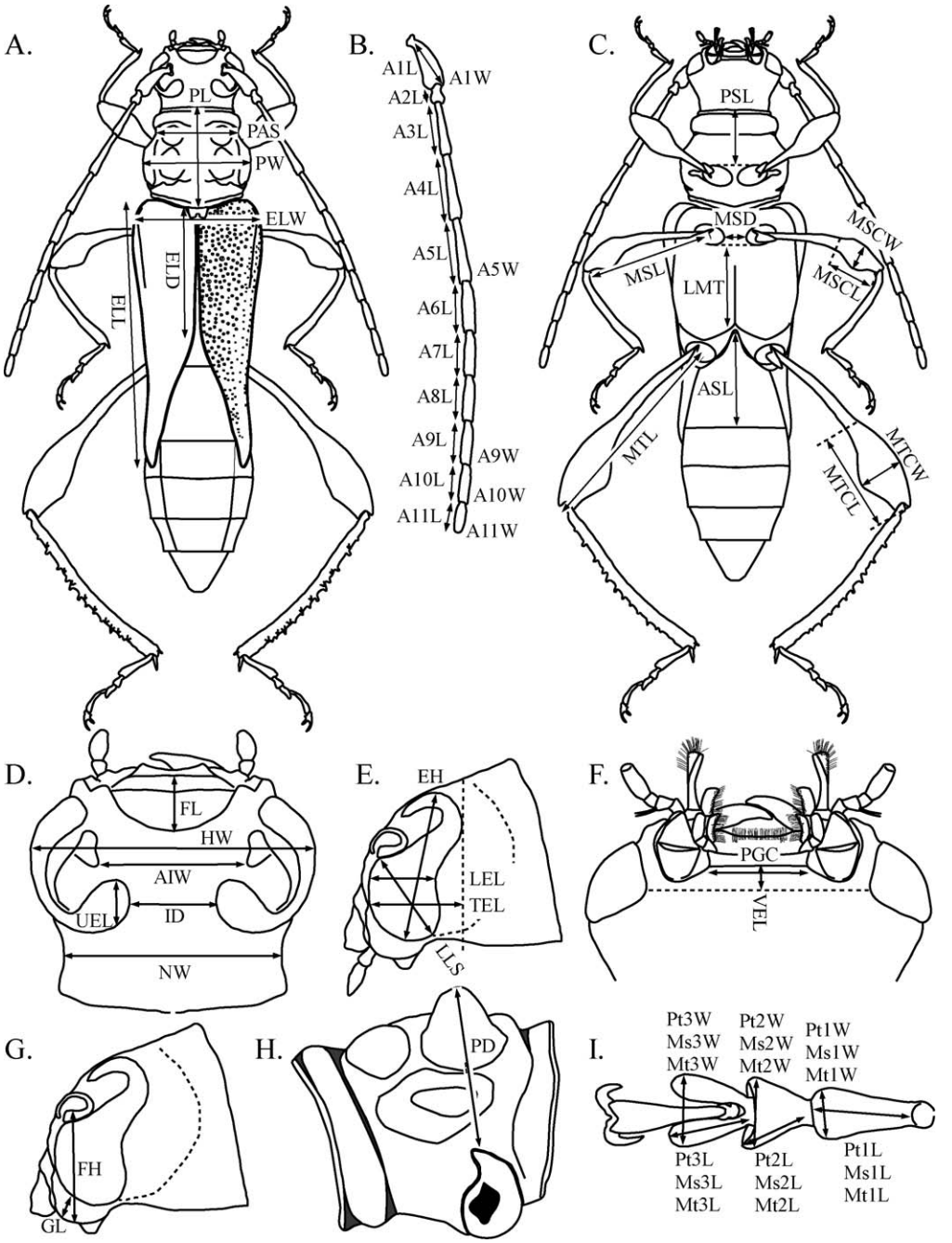

Fig. 2. Measurement points on adult female *Callimoxys sanguinicollis* (acronyms as in Table 1). A) Dorsal habitus, B) Antennomeres, C) Ventral habitus, D) Head, dorsal view, E) Head, lateral view, F) Head, ventral view, G) Head, lateral view, H) Prothorax, lateral view, I) Protarsus, dorsal view.

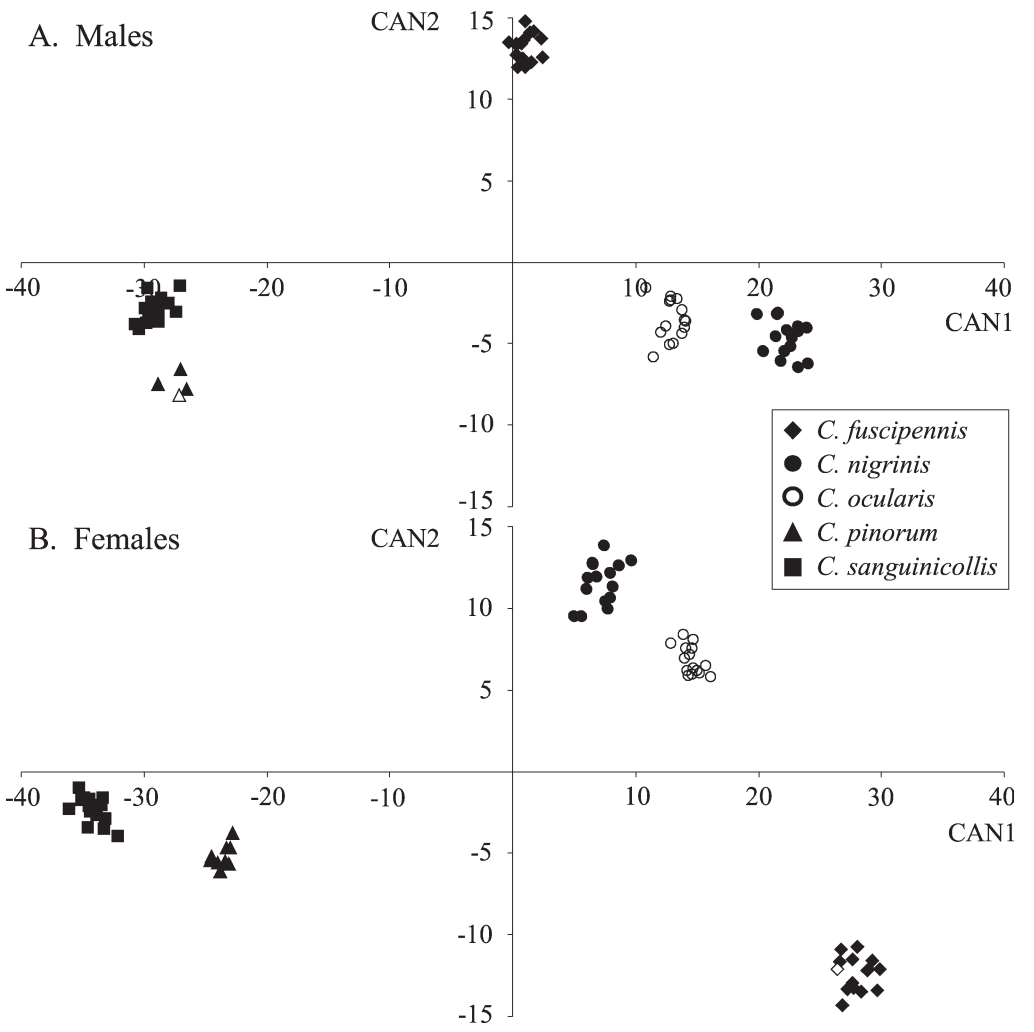

Fig. 3. Plot of the first two canonical variates for *Callimoxys* spp. in North America. The holotypes for *C. fuscipennis* and *C. pinorum* are represented by open symbols. Fifteen male and 15 female specimens were measured for each species, except *C. pinorum* for which four males and ten females were measured.

form of 'pseudo-prognathous' with front margin oblique, labrum and clypeus relatively elongate and mouthparts relatively forward projecting to hypognathous with front margin almost vertical, labrum and clypeus short, and the mouthparts relatively ventrally projecting. The labrum and clypeus vary in the shape of the apical margin and form of the punctation and setae. The eyes are deeply invaginated by the antennal insertion, resulting in a smaller posterior upper eye lobe and a larger more anterior lower eye lobe. The eye invagination varies in shape, surface smoothness, and presence of setae. The size, form and position of the lower eye lobe vary among species, and the eye has a weak to strong sinuation along the posterior margin. The total width of the head across the eyes is sexually dimorphic, with males wider and females narrower. Antennae are 11-segmented, with antennomeres 1–5 and 9–11 varying in length and width, as well as cross sectional shape at midlength. The antennal formula used in descriptions reflects the relative proportional length of each antennomere to total antennal length.

Thorax: The pronotum of *Callimoxys* is sculptured with various tuberosities and sulci. Posterior of the margined apical collar is an elevated area termed the subapical collar with a corresponding deep anterior sulcus immediately following, both of which completely encircle the prothorax. The flat area of the disk behind the subapical collar

Table 2. Characters and states used in phylogenetic analysis of *Callimoxys* species. The first state listed is plesiomorphic, except for character 14 where state 1 is plesiomorphic.

Number	Character	States	Type
1	Genal length	0- long, 1- medium, 2- short	Ordered
2	Lower eyelobe shape	0- triangular, 2- oblong triangular, 2- oblong quadrate	Unordered
3	Male eye invagination concavity	0- evenly curved, 1- angled dorsally	Ordered
4	Setae of dorsal eye invagination	0- present, 1- absent	Ordered
5	Surface of male eye invagination	0- smooth, 1-finely wrinkled	Ordered
6	Clypeal setation	0- medially sparse, 1- uniformly dense, 2- uniformly sparse and microsculptured	Unordered
7	Labral setation	0- apically dense, disk with transverse row of punctures, 1- entirely dense	Ordered
8	Total length of terminal 3 antennomeres	0- very short, 1- short, 2- long, 3- very long	Unordered
9	Color of male prothorax	0- black, 1- orange	Ordered
10	Color of female prothorax	0- black, 1- bicolored, 2- orange	Unordered
11	Female pronotal dimensions	0- L<W, 1- L>W	Ordered
12	Pronotal dorsal tubercle number	0- 2 tubercles, 1- 4 tubercles fused, 2- 4 tubercles partially fused, 3- 4 tubercles separated, 4- 4 tubercles widely separated	Unordered
13	Pronotal median keel	0- tuberculate, 1- elongate triangular basally thickened, 2- elongate triangular with small apical keel, 3- carinate elevated keel	Unordered
14	Pronotal tubercle punctation	0- dense, 1- sparse, 2- very sparse	Unordered
15	Latero-posterior pronotal carina	0- widened tuberosity limited to dorsal posterior half, 1- dorsal tuberosity with single low carina reaching procoxal cavity, 2- straight carina reaching procoxal cavity, 3- curved carina not reaching procoxal cavity	Ordered
16	Elytral length	0- long, covers entire abdomen, 1- medium, leaves ± 2 abdominal segments exposed, 2- short, leaves ± 3 abdominal segments exposed	Ordered
17	Color of female abdomen	0- brown to black, 1- orange	Ordered
18	Abdominal pubescence: long erect setae	0- present, 1- absent	Ordered
19	Abdominal pubescence: short, decumbent setae	0- absent, 1- present, moderately dense, 2- present, dense	Ordered
20	Abdominal punctation	0- large, circular, equally impressed, well seperated, 1- large, oval, basal edge raised, well seperated, 2- absent to minute, transverse, basal edges raised, close together when present	Ordered
21	Abdominal microsculpture	0- obsolete granular, 1- effaced transverse, 2- well developed transverse	Ordered
22	Female metafemoral club	0- gradually widened, 1- long club, 2- medium club, 3- short club	Ordered
23	Tegmen shape	0- uniform narrow, 1- wide basally, gradually narrowed apically, 2- wide basally, abruptly narrowed apically	Ordered
24	Aedeagus apex and basal apophyses length	0- apex < basally apophyses, 1- apex = basal apophyses, 2- apex > basal apophyses	Ordered
25	Aedeagus ventral lobe length	0- long, 1- medium, 3- short	Ordered
26	Internal sac spicule shape	0- elongate aciculate, 1- triangular, 2- triangular aciculate, 3- reduced aciculate, 4- capitate, 5- simple	Ordered
27	Internal sac spicule size	0- uniform, 1- variable longitudinally	Ordered
28	Internal sac spicule orientation	0- longitudinal rows, 1- longitudinal oblique rows, 2- transverse oblique rows	Ordered
29	Anal lobe wing veins, Ap3 and AA4	0- tubular throughout with pigmented stripe, 1- tubular at base, dissolving into membrane distally, with heavily pigmented stripe along leading edge, 2- tubular at base, dissolving into membrane distally, with little to no pigmentation	Ordered

Table 3. Character data matrix for *Stenopterus* and *Callimoxys*.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Stenopterus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. retusifer	0	2	1	1	1	2	0	3	0	2	1	4	0	1	3	0	1	1	2	2	2	0	2	2	0	1	0	2	1
C. gracilis	0–1	0	0	1	0	0	0	3	0	1	1	0	3	2	2	1	0	0	2	2	2	0	2	0	0	3	1	2	2
C. nigrinis	1	1	0	1	0	0	0	2	0	2	1	2	1	1	2	1	0	0	0	1	1	1	1	0	1	1	0	0	1
C. ocularis	1	1	0	1	0	0	0	2	0	2	1	2	1	1	2	1	0	0	0	1	1	2	1	0	1	2	1	2	1
C. fuscipennis	0	0	0	0	0	1	0	1	0	1–2	1	1	2	1	3	1	0	0	2	2	2	3	1	0	1	4	1	2	2
C. pinorum	2	0	0	0	0	1	1	1	1	2	0	3	2	0	1	2	0	0	1	2	2	3	2	2	2	4	1	2	2
C. sanguinicollis	2	0	0	0	0	1	1	1	0	1	0	3	2	0	1	2	0	0	1	2	2	3	2	1	2	5	1	1	2

is referred to as the apical transverse depression with a similar basal transverse depression anterior to the basal collar. The pronotal disk is armed with one or two pairs of elevated tuberosities laterally, with a median, posterior, elevated tubercle, or keel in some species, located between them. There is also one tuberosity laterally on each side of the prothorax running longitudinally. The punctation of the pronotum, metepisternum, and metasternum varies from circular to transverse and may be well-separated to contiguous. The posterolateral area of the prothorax, just behind the base of the lateral tuberosity, has a variously developed straight or curved carina that may also have a dorsal tuberosity, and may or may not reach the procoxal cavity. Pronotal color should be avoided in sexing *Callimoxys* as pronotal coloration varies between species.

Elytra: The elytra in all species are broad basally and taper towards a rounded to pointed apex. The entire length of the elytra, the degree of apical tapering, and the position along the suture where the tapering originates, termed the elytral dehiscence, varies among species. The elytra are punctate with a mixture of large and small circular punctures each bearing a long to short, fine, white seta; however, the punctures do not form regular striae. The surface microsculpture between punctures is usually reduced, resulting in a somewhat 'glossy' appearance in North American species.

Wings: Wing vein terminology follows Kukalova-Peck and Lawrence (2004). The hindwings of *Callimoxys* range from mostly clear to darkly infuscate; often there are dark stripes and areas of dark pigmentation associated with various wing veins or cells. Wing veins r3, r4, and RP vary in size and development. The anal lobe veins AA3, AA4, and Ap3 are present in all species, however, they vary in development and pigmentation.

Legs: The femora in North American *Callimoxys* have a distinct apical club, and the ratio of club length to femoral length, or club length to width varies among species. The pedicel usually has oblong to transverse punctation with transverse microsculpture, and the club usually has reduced punctation and microsculpture, except for the metafemora where punctation and microsculpture varies. The pro- and mesotibia have punctures with slightly produced anterior edges, the surfaces appearing finely roughened. The metatibia have modified punctures with the anterior edge greatly protuberant and expanded into 'teeth', these punctures forming two loose longitudinal rows on the lateral edge the surface appearing coarsely roughened. The tarsomeres vary in length and width, and the shape is usually either filiform, triangular, goblet-shaped with arcuate sides, or bilobed.

Abdomen: The abdomen has five visible segments, with segment 1 the longest. The abdominal

Table 4. Mean ± SE of morphometric characters of adults of *Callimoxys* species. Measurements are in millimeters and values in parentheses ranges.

	C. fuscipennis		*C. nigrinis*		*C. ocularis*		*C. pinorum*		*C. sanguinicollis*	
Character	♀ (*n*=15)	♂ (*n*=15)	♀ (*n*=15)	♂ (*n*=15)	♀ (*n*=15)	♂ (*n*=15)	♀ (*n*=10)	♂ (*n*=4)	♀ (*n*=15)	♂ (*n*=15)
ID	0.54 ± 0.0142 (0.45–0.67)	0.46 ± 0.0196 (0.39–0.62)	0.45 ± 0.0142 (0.36–0.53)	0.33 ± 0.0073 (0.28–0.39)	0.41 ± 0.0169 (0.30–0.54)	0.33 ± 0.0111 (0.26–0.43)	0.63 ± 0.0311 (0.52–0.84)	0.52 ± 0.0202 (0.48–0.57)	0.62 ± 0.0136 (0.53–0.71)	0.53 ± 0.0199 (0.43–0.68)
GL	0.25 ± 0.0126 (0.18–0.34)	0.21 ± 0.0098 (0.16–0.29)	0.15 ± 0.0048 (0.12–0.18)	0.11 ± 0.0029 (0.10–0.13)	0.16 ± 0.0043 (0.14–0.19)	0.11 ± 0.0049 (0.08–0.14)	0.18 ± 0.0121 (0.12–0.23)	0.13 ± 0.0119 (0.10–0.16)	0.16 ± 0.0055 (0.13–0.20)	0.15 ± 0.0069 (0.10–0.19)
FH	0.68 ± 0.0227 (0.55–0.85)	0.65 ± 0.0204 (0.49–0.79)	0.60 ± 0.0167 (0.46–0.69)	0.55 ± 0.0109 (0.50–0.62)	0.59 ± 0.0210 (0.45–0.76)	0.57 ± 0.0128 (0.47–0.68)	0.78 ± 0.0343 (0.59–0.98)	0.73 ± 0.0330 (0.65–0.80)	0.73 ± 0.0203 (0.63–0.90)	0.70 ± 0.0259 (0.54–0.85)
AIW	0.91 ± 0.0283 (0.8–1.16)	0.82 ± 0.0293 (0.64–1.01)	0.84 ± 0.0276 (0.63–1.02)	0.71 ± 0.0166 (0.63–0.88)	0.79 ± 0.0263 (0.65–0.99)	0.71 ± 0.0203 (0.56–0.90)	1.07 ± 0.0475 (0.85–1.38)	0.94 ± 0.0534 (0.81–1.05)	0.97 ± 0.0306 (0.83–1.24)	0.92 ± 0.0311 (0.73–1.09)
FL	0.43 ± 0.0107 (0.37–0.5)	0.42 ± 0.0161 (0.33–0.53)	0.37 ± 0.0108 (0.32–0.45)	0.33 ± 0.0061 (0.29–0.37)	0.38 ± 0.0115 (0.32–0.47)	0.34 ± 0.0082 (0.28–0.39)	0.48 ± 0.0219 (0.35–0.59)	0.42 ± 0.0093 (0.40–0.43)	0.42 ± 0.0112 (0.35–0.50)	0.38 ± 0.0128 (0.31–0.45)
HW	1.58 ± 0.0452 (1.41–2.03)	1.53 ± 0.0583 (1.22–1.97)	1.47 ± 0.0477 (1.18–1.78)	1.31 ± 0.0292 (1.16–1.63)	1.41 ± 0.0444 (1.20–1.82)	1.37 ± 0.0295 (1.18–1.66)	1.86 ± 0.0893 (1.46–2.41)	1.76 ± 0.0881 (1.58–2.00)	1.75 ± 0.0517 (1.52–2.19)	1.70 ± 0.0584 (1.34–2.07)
VEL	0.28 ± 0.0111 (0.23–0.39)	0.27 ± 0.016 (0.20–0.39)	0.25 ± 0.0127 (0.16–0.36)	0.24 ± 0.0082 (0.20–0.33)	0.24 ± 0.0098 (0.19–0.32)	0.24 ± 0.0085 (0.18–0.31)	0.15 ± 0.0104 (0.10–0.21)	0.15 ± 0.0113 (0.13–0.18)	0.14 ± 0.0049 (0.10–0.17)	0.13 ± 0.0071 (0.07–0.16)
PGC	0.49 ± 0.0165 (0.40–0.62)	0.43 ± 0.0176 (0.33–0.54)	0.45 ± 0.0172 (0.34–0.60)	0.37 ± 0.0096 (0.32–0.47)	0.44 ± 0.0159 (0.36–0.57)	0.38 ± 0.0144 (0.22–0.47)	0.61 ± 0.0282 (0.48–0.79)	0.52 ± 0.0233 (0.47–0.58)	0.56 ± 0.0174 (0.48–0.70)	0.52 ± 0.0180 (0.42–0.67)
UEL	0.31 ± 0.0078 (0.27–0.37)	0.32 ± 0.0075 (0.27–0.37)	0.3 ± 0.0091 (0.24–0.35)	0.31 ± 0.0043 (0.28–0.35)	0.28 ± 0.0046 (0.25–0.32)	0.31 ± 0.0043 (0.27–0.33)	0.33 ± 0.0108 (0.28–0.38)	0.34 ± 0.0087 (0.32–0.36)	0.29 ± 0.0058 (0.25–0.34)	0.31 ± 0.0085 (0.23–0.38)
NW	1.13 ± 0.0217 (1.00–1.28)	1.00 ± 0.0169 (0.88–1.13)	0.95 ± 0.023 (0.80–1.09)	0.81 ± 0.0111 (0.72–0.88)	0.96 ± 0.0205 (0.82–1.12)	0.86 ± 0.0155 (0.72–0.96)	1.29 ± 0.0383 (1.08–1.50)	1.12 ± 0.0425 (1.02–1.22)	1.23 ± 0.0211 (1.08–1.41)	1.08 ± 0.0175 (0.94–1.19)
LLS	0.52 ± 0.0120 (0.45–0.62)	0.52 ± 0.0100 (0.46–0.59)	0.53 ± 0.0127 (0.45–0.62)	0.55 ± 0.0097 (0.49–0.61)	0.50 ± 0.0129 (0.42–0.59)	0.54 ± 0.0098 (0.45–0.60)	0.58 ± 0.0193 (0.45–0.67)	0.59 ± 0.0300 (0.54–0.67)	0.53 ± 0.0103 (0.48–0.64)	0.55 ± 0.0129 (0.48–0.67)
EH	0.89 ± 0.0230 (0.76–1.09)	0.86 ± 0.0161 (0.74–0.94)	0.79 ± 0.0178 (0.66–0.90)	0.76 ± 0.0119 (0.69–0.81)	0.78 ± 0.0179 (0.66–0.94)	0.79 ± 0.0124 (0.68–0.86)	0.97 ± 0.0354 (0.80–1.13)	0.92 ± 0.0093 (0.90–0.94)	0.91 ± 0.0183 (0.80–1.06)	0.87 ± 0.0176 (0.78–1.00)
LEL	0.48 ± 0.0069 (0.44–0.52)	0.48 ± 0.0125 (0.43–0.60)	0.53 ± 0.0154 (0.44–0.64)	0.54 ± 0.0083 (0.48–0.58)	0.49 ± 0.0134 (0.43–0.58)	0.53 ± 0.0136 (0.44–0.64)	0.45 ± 0.0177 (0.35–0.54)	0.50 ± 0.0326 (0.43–0.58)	0.40 ± 0.0135 (0.35–0.53)	0.43 ± 0.0145 (0.33–0.54)
TEL	0.69 ± 0.0145 (0.61–0.80)	0.68 ± 0.0137 (0.60–0.76)	0.64 ± 0.0191 (0.51–0.76)	0.62 ± 0.0107 (0.56–0.72)	0.60 ± 0.0136 (0.53–0.68)	0.64 ± 0.011 (0.56–0.70)	0.64 ± 0.0202 (0.50–0.74)	0.66 ± 0.0271 (0.63–0.74)	0.59 ± 0.0146 (0.53–0.68)	0.61 ± 0.0143 (0.50–0.72)
A1L	0.83 ± 0.0282 (0.70–1.07)	0.78 ± 0.0305 (0.61–1.01)	0.75 ± 0.0246 (0.59–0.91)	0.66 ± 0.0152 (0.57–0.79)	0.74 ± 0.0263 (0.60–0.98)	0.68 ± 0.0173 (0.57–0.85)	0.92 ± 0.0522 (0.70–1.16)	0.88 ± 0.0626 (0.76–1.05)	0.81 ± 0.0275 (0.68–1.05)	0.80 ± 0.0288 (0.60–0.98)
A1W	0.28 ± 0.0107 (0.22–0.37)	0.26 ± 0.0096 (0.21–0.33)	0.24 ± 0.0072 (0.20–0.29)	0.21 ± 0.0034 (0.19–0.25)	0.23 ± 0.0097 (0.18–0.30)	0.22 ± 0.0076 (0.18–0.29)	0.30 ± 0.0161 (0.22–0.39)	0.28 ± 0.0211 (0.24–0.34)	0.25 ± 0.0118 (0.20–0.37)	0.25 ± 0.0107 (0.18–0.31)
A2L	0.16 ± 0.0028 (0.15–0.18)	0.15 ± 0.0028 (0.14–0.17)	0.15 ± 0.0041 (0.13–0.18)	0.13 ± 0.0023 (0.12–0.15)	0.14 ± 0.0032 (0.12–0.16)	0.14 ± 0.0034 (0.1–0.15)	0.16 ± 0.0036 (0.15–0.18)	0.16 ± 0.0085 (0.14–0.18)	0.16 ± 0.0041 (0.13–0.18)	0.15 ± 0.0030 (0.13–0.18)

Continued on next page

Table 4. Continued.

	C. fuscipennis		*C. nigrinis*		*C. ocularis*		*C. pinorum*		*C. sanguinicollis*	
A3L	0.59 ± 0.0215 (0.50–0.82)	0.60 ± 0.0235 (0.49–0.76)	0.55 ± 0.0223 (0.40–0.70)	0.49 ± 0.0130 (0.38–0.57)	0.55 ± 0.0183 (0.43–0.70)	0.52 ± 0.0152 (0.41–0.67)	0.69 ± 0.0314 (0.55–0.85)	0.67 ± 0.0203 (0.63–0.71)	0.60 ± 0.0199 (0.47–0.74)	0.62 ± 0.0189 (0.50–0.78)
A4L	0.74 ± 0.0262 (0.61–1.02)	0.77 ± 0.0304 (0.61–1.01)	0.70 ± 0.0261 (0.53–0.87)	0.65 ± 0.0159 (0.54–0.79)	0.69 ± 0.0235 (0.57–0.87)	0.67 ± 0.0192 (0.55–0.85)	0.85 ± 0.0391 (0.68–1.05)	0.85 ± 0.0499 (0.73–0.95)	0.78 ± 0.028 (0.60–0.96)	0.80 ± 0.0245 (0.69–1.01)
A5L	0.82 ± 0.0169 (0.73–0.98)	0.83 ± 0.0214 (0.72–1.01)	0.77 ± 0.0249 (0.62–1.02)	0.74 ± 0.0149 (0.64–0.82)	0.75 ± 0.0175 (0.65–0.90)	0.76 ± 0.0113 (0.68–0.85)	0.87 ± 0.0368 (0.71–1.09)	0.86 ± 0.0388 (0.78–0.96)	0.78 ± 0.0193 (0.66–0.93)	0.80 ± 0.0216 (0.63–0.93)
A5W	0.17 ± 0.0040 (0.14–0.19)	0.16 ± 0.0031 (0.13–0.18)	0.16 ± 0.0042 (0.13–0.18)	0.14 ± 0.0049 (0.09–0.16)	0.15 ± 0.0037 (0.12–0.18)	0.14 ± 0.0043 (0.10–0.16)	0.22 ± 0.0092 (0.18–0.27)	0.19 ± 0.0041 (0.18–0.20)	0.18 ± 0.0032 (0.17–0.21)	0.17 ± 0.0062 (0.14–0.24)
A6L	0.64 ± 0.0104 (0.58–0.70)	0.71 ± 0.0150 (0.61–0.80)	0.63 ± 0.0139 (0.55–0.73)	0.65 ± 0.0119 (0.57–0.72)	0.61 ± 0.0104 (0.53–0.67)	0.65 ± 0.0114 (0.56–0.73)	0.69 ± 0.0225 (0.58–0.81)	0.69 ± 0.0173 (0.66–0.72)	0.62 ± 0.012 (0.54–0.70)	0.64 ± 0.0119 (0.58–0.74)
A7L	0.63 ± 0.0107 (0.57–0.70)	0.71 ± 0.0156 (0.60–0.80)	0.6 ± 0.0114 (0.53–0.67)	0.63 ± 0.0108 (0.55–0.69)	0.6 ± 0.0087 (0.53–0.65)	0.65 ± 0.0117 (0.55–0.74)	0.69 ± 0.0212 (0.58–0.83)	0.68 ± 0.0197 (0.65–0.73)	0.62 ± 0.0114 (0.54–0.68)	0.63 ± 0.0105 (0.55–0.74)
A8L	0.56 ± 0.0103 (0.49–0.63)	0.65 ± 0.0106 (0.58–0.72)	0.54 ± 0.0101 (0.48–0.59)	0.59 ± 0.0124 (0.51–0.68)	0.54 ± 0.0131 (0.45–0.65)	0.60 ± 0.0120 (0.50–0.69)	0.62 ± 0.0195 (0.53–0.74)	0.61 ± 0.0111 (0.59–0.64)	0.54 ± 0.0099 (0.48–0.63)	0.56 ± 0.0095 (0.52–0.66)
A9L	0.58 ± 0.0091 (0.52–0.63)	0.64 ± 0.0125 (0.56–0.71)	0.54 ± 0.0105 (0.48–0.61)	0.59 ± 0.0118 (0.51–0.67)	0.55 ± 0.01 (0.48–0.60)	0.60 ± 0.0110 (0.51–0.69)	0.63 ± 0.0227 (0.54–0.78)	0.61 ± 0.0048 (0.60–0.62)	0.56 ± 0.0105 (0.50–0.64)	0.58 ± 0.0088 (0.54–0.67)
A9W	0.18 ± 0.0044 (0.15–0.20)	0.16 ± 0.0030 (0.14–0.18)	0.16 ± 0.0042 (0.14–0.19)	0.15 ± 0.0026 (0.13–0.17)	0.15 ± 0.003 (0.13–0.17)	0.14 ± 0.0027 (0.13–0.16)	0.21 ± 0.0069 (0.17–0.24)	0.19 ± 0.0048 (0.18–0.20)	0.18 ± 0.0036 (0.16–0.21)	0.16 ± 0.0036 (0.14–0.20)
A10L	0.52 ± 0.0090 (0.48–0.58)	0.59 ± 0.0090 (0.53–0.64)	0.47 ± 0.0073 (0.40–0.51)	0.53 ± 0.0131 (0.47–0.64)	0.48 ± 0.0083 (0.42–0.52)	0.54 ± 0.0104 (0.45–0.60)	0.55 ± 0.0153 (0.47–0.65)	0.53 ± 0.0104 (0.50–0.55)	0.49 ± 0.0092 (0.43–0.56)	0.51 ± 0.0082 (0.46–0.57)
A10W	0.17 ± 0.0037 (0.15–0.19)	0.16 ± 0.0038 (0.14–0.19)	0.16 ± 0.0039 (0.14–0.19)	0.14 ± 0.0023 (0.13–0.16)	0.15 ± 0.0032 (0.13–0.16)	0.14 ± 0.0022 (0.13–0.15)	0.20 ± 0.0068 (0.16–0.23)	0.18 ± 0.0087 (0.15–0.19)	0.17 ± 0.0034 (0.15–0.20)	0.16 ± 0.0044 (0.14–0.20)
A11L	0.59 ± 0.0127 (0.52–0.65)	0.66 ± 0.0153 (0.57–0.73)	0.57 ± 0.0095 (0.50–0.64)	0.63 ± 0.0168 (0.55–0.75)	0.58 ± 0.0126 (0.48–0.64)	0.64 ± 0.0124 (0.52–0.70)	0.64 ± 0.0161 (0.58–0.72)	0.67 ± 0.0138 (0.64–0.70)	0.58 ± 0.0115 (0.52–0.65)	0.62 ± 0.0134 (0.54–0.77)
A11W	0.16 ± 0.0034 (0.14–0.18)	0.14 ± 0.0023 (0.13–0.16)	0.15 ± 0.0036 (0.14–0.19)	0.13 ± 0.003 (0.11–0.15)	0.14 ± 0.0022 (0.12–0.15)	0.13 ± 0.0021 (0.12–0.15)	0.19 ± 0.0065 (0.15–0.22)	0.17 ± 0.0091 (0.15–0.19)	0.16 ± 0.0042 (0.14–0.20)	0.15 ± 0.0025 (0.13–0.16)
TAL	6.66 ± 0.1199 (6.05–7.48)	7.09 ± 0.1558 (6.15–8.24)	6.28 ± 0.1431 (5.30–7.23)	6.28 ± 0.1162 (5.55–6.86)	6.23 ± 0.1336 (5.32–6.99)	6.44 ± 0.1183 (5.44–7.20)	7.32 ± 0.2533 (6.07–8.60)	7.21 ± 0.1758 (6.70–7.50)	6.53 ± 0.138 (5.63–7.26)	6.72 ± 0.1293 (5.79–7.69)
PL	1.83 ± 0.0623 (1.52–2.38)	1.69 ± 0.0656 (1.31–2.19)	1.53 ± 0.0498 (1.20–1.88)	1.28 ± 0.0301 (1.08–1.57)	1.48 ± 0.0482 (1.18–1.88)	1.34 ± 0.0395 (1.07–1.72)	2.05 ± 0.1165 (1.36–2.66)	1.85 ± 0.065 (1.74–2.03)	1.90 ± 0.0609 (1.47–2.25)	1.78 ± 0.0662 (1.36–2.22)
PW	1.80 ± 0.0578 (1.52–2.35)	1.58 ± 0.0626 (1.28–2.10)	1.48 ± 0.0459 (1.20–1.82)	1.22 ± 0.0292 (1.04–1.47)	1.45 ± 0.0461 (1.18–1.78)	1.27 ± 0.0291 (1.07–1.52)	2.20 ± 0.1209 (1.60–2.94)	1.84 ± 0.0977 (1.70–2.13)	1.91 ± 0.0612 (1.52–2.35)	1.73 ± 0.0672 (1.26–2.16)
PD	1.07 ± 0.038 (0.90–1.41)	0.96 ± 0.0469 (0.71–1.41)	0.93 ± 0.0356 (0.75–1.19)	0.77 ± 0.0250 (0.64–0.97)	0.94 ± 0.0569 (0.73–1.60)	0.79 ± 0.0250 (0.64–1.03)	1.32 ± 0.0716 (0.98–1.72)	1.17 ± 0.0574 (1.04–1.31)	1.19 ± 0.0458 (0.95–1.57)	1.07 ± 0.0450 (0.79–1.38)
PAS	1.47 ± 0.0515 (1.23–1.91)	1.26 ± 0.052 (1.03–1.66)	1.22 ± 0.0368 (0.96–1.44)	1.01 ± 0.0214 (0.89–1.19)	1.17 ± 0.0396 (0.94–1.47)	1.03 ± 0.0262 (0.86–1.25)	1.63 ± 0.0819 (1.20–2.13)	1.39 ± 0.0570 (1.28–1.53)	1.42 ± 0.0608 (0.88–1.75)	1.31 ± 0.0498 (1.00–1.63)

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Table 4. Continued.

	C. fuscipennis		*C. nigrinis*		*C. ocularis*		*C. pinorum*		*C. sanguinicollis*	
PSL	0.70 ± 0.0308 (0.43–0.90)	0.6 ± 0.0285 (0.42–0.72)	0.67 ± 0.0392 (0.40–0.86)	0.60 ± 0.0236 (0.34–0.74)	0.62 ± 0.0304 (0.39–0.77)	0.61 ± 0.0212 (0.39–0.75)	0.85 ± 0.0618 (0.53–1.10)	0.8 ± 0.0928 (0.53–0.93)	0.80 ± 0.0422 (0.48–1.04)	0.70 ± 0.0416 (0.47–0.96)
MSD	0.53 ± 0.0181 (0.36–0.65)	0.43 ± 0.0232 (0.30–0.62)	0.38 ± 0.0153 (0.28–0.46)	0.29 ± 0.0073 (0.25–0.35)	0.37 ± 0.0137 (0.30–0.45)	0.32 ± 0.0118 (0.24–0.41)	0.68 ± 0.0405 (0.49–0.93)	0.55 ± 0.0231 (0.50–0.60)	0.64 ± 0.0203 (0.51–0.79)	0.55 ± 0.0216 (0.39–0.70)
LMT	1.45 ± 0.0544 (1.04–2.00)	1.25 ± 0.0543 (0.96–1.78)	1.29 ± 0.0397 (1.06–1.55)	1.02 ± 0.0221 (0.83–1.12)	1.28 ± 0.0436 (1.02–1.57)	1.08 ± 0.0303 (0.85–1.38)	1.54 ± 0.0691 (1.20–1.88)	1.24 ± 0.1147 (1.04–1.57)	1.38 ± 0.045 (1.15–1.72)	1.22 ± 0.0504 (0.91–1.63)
ELL	5.92 ± 0.1969 (5.15–7.81)	5.20 ± 0.2104 (4.00–6.89)	5.26 ± 0.1709 (4.30–6.47)	4.18 ± 0.1027 (3.55–5.12)	5.04 ± 0.1756 (4.15–6.65)	4.14 ± 0.1061 (3.55–5.25)	5.52 ± 0.282 (4.25–6.95)	4.88 ± 0.2812 (4.35–5.67)	4.90 ± 0.1764 (4.15–6.41)	4.54 ± 0.18 (3.50–5.61)
ELW	2.20 ± 0.0765 (1.86–2.82)	1.95 ± 0.0796 (1.52–2.57)	1.84 ± 0.0605 (1.40–2.28)	1.50 ± 0.0323 (1.28–1.75)	1.82 ± 0.0687 (1.48–2.44)	1.55 ± 0.0406 (1.32–1.97)	2.43 ± 0.1192 (1.78–3.07)	2.05 ± 0.0745 (1.90–2.25)	2.20 ± 0.0706 (1.82–2.82)	1.93 ± 0.0678 (1.46–2.38)
ELD	1.72 ± 0.0829 (1.16–2.28)	1.41 ± 0.0713 (0.91–1.78)	1.77 ± 0.0842 (1.16–2.22)	1.59 ± 0.05 (1.00–1.80)	1.79 ± 0.0712 (1.19–2.09)	1.56 ± 0.05 (0.97–1.74)	2.06 ± 0.1273 (1.44–2.66)	1.78 ± 0.1799 (1.25–2.06)	1.73 ± 0.075 (1.31–2.44)	1.51 ± 0.0898 (1.10–2.34)
ASL	1.67 ± 0.0563 (1.39–2.19)	1.39 ± 0.0612 (1.06–1.75)	1.49 ± 0.0564 (1.23–1.91)	1.05 ± 0.0331 (0.83–1.35)	1.52 ± 0.0432 (1.15–1.79)	1.17 ± 0.0397 (0.91–1.41)	2.07 ± 0.0974 (1.6–2.6)	1.66 ± 0.1473 (1.47–2.10)	1.85 ± 0.0583 (1.55–2.25)	1.48 ± 0.0781 (1.12–2.13)
MTL	3.97 ± 0.1575 (3.28–5.25)	3.76 ± 0.1636 (2.84–5.00)	3.38 ± 0.1220 (2.76–4.21)	2.88 ± 0.0735 (2.38–3.60)	3.37 ± 0.102 (2.88–4.33)	3.10 ± 0.0707 (2.68–3.78)	4.27 ± 0.2298 (3.20–5.55)	3.91 ± 0.2945 (3.40–4.76)	3.77 ± 0.127 (3.12–4.88)	3.58 ± 0.1353 (2.84–4.51)
MTCL	1.60 ± 0.0393 (1.46–2.06)	1.48 ± 0.0362 (1.34–1.81)	1.46 ± 0.0376 (1.26–1.72)	1.32 ± 0.0257 (1.09–1.47)	1.34 ± 0.0337 (1.14–1.56)	1.27 ± 0.0282 (1.04–1.42)	1.65 ± 0.0609 (1.38–1.94)	1.62 ± 0.0755 (1.44–1.78)	1.52 ± 0.0313 (1.34–1.82)	1.48 ± 0.035 (1.24–1.75)
MTCW	0.73 ± 0.0236 (0.60–0.94)	0.67 ± 0.0184 (0.56–0.81)	0.55 ± 0.017 (0.46–0.66)	0.49 ± 0.0100 (0.41–0.56)	0.58 ± 0.0116 (0.50–0.66)	0.53 ± 0.0103 (0.46–0.62)	0.76 ± 0.0315 (0.60–0.92)	0.65 ± 0.0144 (0.62–0.69)	0.70 ± 0.0150 (0.60–0.78)	0.65 ± 0.0146 (0.56–0.75)
MSL	2.32 ± 0.0597 (2.00–2.69)	2.16 ± 0.0690 (1.72–2.75)	2.04 ± 0.052 (1.80–2.38)	1.8 ± 0.0313 (1.56–2.04)	2.07 ± 0.0449 (1.76–2.44)	1.90 ± 0.0387 (1.60–2.16)	2.45 ± 0.0773 (2.00–2.84)	2.25 ± 0.0525 (2.16–2.40)	2.23 ± 0.0453 (2.00–2.56)	2.05 ± 0.0466 (1.76–2.56)
MSCL	1.03 ± 0.0263 (0.92–1.28)	0.92 ± 0.0209 (0.80–1.09)	0.92 ± 0.0245 (0.78–1.08)	0.81 ± 0.0123 (0.72–0.88)	0.89 ± 0.0201 (0.72–1.02)	0.81 ± 0.0172 (0.66–0.92)	1.11 ± 0.0382 (0.98–1.30)	1.03 ± 0.0465 (0.90–1.10)	1.01 ± 0.0194 (0.90–1.16)	0.93 ± 0.0211 (0.76–1.13)
MSCW	0.47 ± 0.0126 (0.40–0.56)	0.43 ± 0.0106 (0.38–0.53)	0.36 ± 0.009 (0.30–0.42)	0.31 ± 0.0068 (0.28–0.36)	0.48 ± 0.0648 (0.30–0.97)	0.33 ± 0.0066 (0.28–0.38)	0.55 ± 0.0183 (0.46–0.64)	0.50 ± 0.0157 (0.46–0.53)	0.51 ± 0.0107 (0.46–0.59)	0.48 ± 0.0099 (0.40–0.56)
Pt1L	0.27 ± 0.0066 (0.23–0.31)	0.25 ± 0.0070 (0.21–0.30)	0.23 ± 0.0069 (0.19–0.29)	0.21 ± 0.0063 (0.15–0.24)	0.24 ± 0.0049 (0.22–0.29)	0.22 ± 0.0068 (0.17–0.27)	0.36 ± 0.0153 (0.30–0.45)	0.38 ± 0.0193 (0.33–0.42)	0.33 ± 0.0083 (0.29–0.39)	0.34 ± 0.0056 (0.28–0.37)
Pt1W	0.19 ± 0.0063 (0.15–0.23)	0.17 ± 0.0058 (0.13–0.22)	0.13 ± 0.0032 (0.11–0.15)	0.11 ± 0.0031 (0.10–0.14)	0.12 ± 0.0028 (0.10–0.14)	0.11 ± 0.0027 (0.10–0.13)	0.18 ± 0.0071 (0.15–0.23)	0.18 ± 0.0075 (0.17–0.20)	0.17 ± 0.0036 (0.15–0.19)	0.17 ± 0.0051 (0.13–0.21)
Pt2L	0.17 ± 0.0041 (0.14–0.21)	0.16 ± 0.0052 (0.13–0.20)	0.14 ± 0.0043 (0.11–0.17)	0.13 ± 0.0045 (0.11–0.16)	0.14 ± 0.0021 (0.12–0.15)	0.13 ± 0.0033 (0.11–0.15)	0.24 ± 0.0090 (0.20–0.27)	0.26 ± 0.0233 (0.20–0.31)	0.22 ± 0.0058 (0.17–0.25)	0.22 ± 0.0068 (0.17–0.26)
Pt2W	0.24 ± 0.0064 (0.20–0.28)	0.22 ± 0.0051 (0.19–0.25)	0.18 ± 0.0036 (0.16–0.20)	0.16 ± 0.0046 (0.14–0.20)	0.17 ± 0.0045 (0.14–0.20)	0.16 ± 0.0046 (0.13–0.18)	0.25 ± 0.0084 (0.20–0.29)	0.26 ± 0.0149 (0.22–0.29)	0.23 ± 0.0046 (0.20–0.27)	0.24 ± 0.0060 (0.18–0.28)
Pt3L	0.25 ± 0.0057 (0.23–0.29)	0.24 ± 0.0066 (0.19–0.27)	0.23 ± 0.0057 (0.20–0.28)	0.21 ± 0.0049 (0.18–0.25)	0.22 ± 0.0055 (0.19–0.25)	0.22 ± 0.0041 (0.19–0.25)	0.32 ± 0.0112 (0.26–0.38)	0.33 ± 0.0065 (0.31–0.34)	0.29 ± 0.0071 (0.25–0.36)	0.30 ± 0.0079 (0.25–0.37)

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Table 4. Continued.

	C. fuscipennis		*C. nigrinis*		*C. ocularis*		*C. pinorum*		*C. sanguinicollis*	
Pt3W	0.26 ± 0.0055 (0.23–0.30)	0.24 ± 0.0044 (0.21–0.26)	0.21 ± 0.0041 (0.19–0.24)	0.20 ± 0.0043 (0.17–0.24)	0.21 ± 0.0043 (0.18–0.24)	0.19 ± 0.0033 (0.17–0.21)	0.28 ± 0.0062 (0.25–0.31)	0.28 ± 0.0111 (0.25–0.30)	0.26 ± 0.0041 (0.24–0.30)	0.26 ± 0.0042 (0.23–0.29)
Ms1L	0.33 ± 0.0100 (0.28–0.40)	0.32 ± 0.0115 (0.25–0.38)	0.26 ± 0.0103 (0.2–0.33)	0.24 ± 0.0051 (0.21–0.28)	0.28 ± 0.0066 (0.24–0.33)	0.26 ± 0.0062 (0.20–0.31)	0.41 ± 0.0183 (0.31–0.50)	0.44 ± 0.0194 (0.40–0.49)	0.37 ± 0.0086 (0.32–0.42)	0.38 ± 0.0092 (0.31–0.44)
Ms1W	0.17 ± 0.0046 (0.14–0.20)	0.15 ± 0.0043 (0.12–0.18)	0.12 ± 0.0032 (0.10–0.14)	0.11 ± 0.0027 (0.09–0.13)	0.12 ± 0.0019 (0.10–0.13)	0.11 ± 0.0025 (0.10–0.13)	0.17 ± 0.0079 (0.11–0.20)	0.17 ± 0.0103 (0.15–0.19)	0.16 ± 0.0035 (0.14–0.18)	0.16 ± 0.0049 (0.12–0.20)
Ms2L	0.18 ± 0.0049 (0.15–0.22)	0.17 ± 0.0059 (0.13–0.21)	0.14 ± 0.0040 (0.11–0.17)	0.13 ± 0.0045 (0.11–0.16)	0.14 ± 0.0032 (0.12–0.16)	0.14 ± 0.0028 (0.12–0.16)	0.23 ± 0.0088 (0.19–0.28)	0.25 ± 0.0048 (0.24–0.26)	0.21 ± 0.0081 (0.17–0.27)	0.21 ± 0.0057 (0.17–0.24)
Ms2W	0.21 ± 0.0056 (0.18–0.25)	0.20 ± 0.0038 (0.17–0.22)	0.17 ± 0.0046 (0.14–0.20)	0.15 ± 0.0040 (0.13–0.18)	0.16 ± 0.0037 (0.13–0.19)	0.15 ± 0.0046 (0.12–0.18)	0.23 ± 0.0061 (0.19–0.25)	0.24 ± 0.0194 (0.19–0.28)	0.22 ± 0.0037 (0.19–0.24)	0.21 ± 0.0055 (0.16–0.25)
Ms3L	0.25 ± 0.0053 (0.22–0.28)	0.24 ± 0.0072 (0.20–0.30)	0.23 ± 0.0055 (0.20–0.27)	0.21 ± 0.0057 (0.18–0.25)	0.22 ± 0.0050 (0.18–0.25)	0.22 ± 0.0045 (0.18–0.25)	0.31 ± 0.0108 (0.27–0.38)	0.32 ± 0.0111 (0.30–0.35)	0.28 ± 0.0074 (0.24–0.36)	0.28 ± 0.0077 (0.23–0.34)
Ms3W	0.24 ± 0.0049 (0.21–0.27)	0.22 ± 0.004 (0.19–0.25)	0.20 ± 0.0050 (0.15–0.22)	0.19 ± 0.0046 (0.17–0.24)	0.20 ± 0.0043 (0.17–0.23)	0.19 ± 0.0045 (0.15–0.22)	0.27 ± 0.0065 (0.24–0.30)	0.28 ± 0.0149 (0.24–0.31)	0.25 ± 0.005 (0.22–0.29)	0.25 ± 0.0057 (0.20–0.29)
Mt1L	0.57 ± 0.0205 (0.45–0.71)	0.54 ± 0.0163 (0.41–0.64)	0.40 ± 0.0147 (0.32–0.49)	0.36 ± 0.0077 (0.30–0.41)	0.42 ± 0.0099 (0.35–0.50)	0.39 ± 0.0099 (0.3–0.47)	0.61 ± 0.0290 (0.43–0.75)	0.59 ± 0.0111 (0.57–0.62)	0.54 ± 0.0126 (0.46–0.65)	0.52 ± 0.0128 (0.42–0.59)
Mt1W	0.16 ± 0.0043 (0.15–0.20)	0.15 ± 0.0028 (0.13–0.17)	0.12 ± 0.0028 (0.11–0.14)	0.11 ± 0.0026 (0.10–0.13)	0.12 ± 0.003 (0.10–0.14)	0.11 ± 0.0019 (0.10–0.13)	0.17 ± 0.0054 (0.14–0.20)	0.16 ± 0.0048 (0.15–0.17)	0.16 ± 0.0033 (0.14–0.19)	0.16 ± 0.0038 (0.13–0.19)
Mt2L	0.24 ± 0.0076 (0.20–0.31)	0.23 ± 0.0079 (0.19–0.30)	0.17 ± 0.0049 (0.13–0.20)	0.15 ± 0.0043 (0.12–0.18)	0.18 ± 0.0054 (0.14–0.22)	0.16 ± 0.0035 (0.13–0.18)	0.26 ± 0.0094 (0.22–0.32)	0.26 ± 0.0111 (0.23–0.28)	0.24 ± 0.0073 (0.21–0.3)	0.23 ± 0.006 (0.18–0.28)
Mt2W	0.20 ± 0.0053 (0.18–0.24)	0.19 ± 0.0034 (0.16–0.20)	0.16 ± 0.0037 (0.14–0.18)	0.15 ± 0.0036 (0.13–0.18)	0.16 ± 0.0039 (0.13–0.19)	0.15 ± 0.0046 (0.12–0.18)	0.23 ± 0.0085 (0.18–0.28)	0.22 ± 0.0144 (0.18–0.25)	0.20 ± 0.0041 (0.18–0.23)	0.2 ± 0.0053 (0.15–0.24)
Mt3L	0.27 ± 0.0086 (0.22–0.34)	0.25 ± 0.0055 (0.21–0.27)	0.25 ± 0.0061 (0.21–0.29)	0.23 ± 0.0056 (0.19–0.26)	0.25 ± 0.0063 (0.20–0.29)	0.23 ± 0.0044 (0.19–0.25)	0.34 ± 0.0125 (0.28–0.39)	0.32 ± 0.0155 (0.29–0.36)	0.31 ± 0.0093 (0.25–0.38)	0.29 ± 0.0062 (0.24–0.33)
Mt3W	0.24 ± 0.0062 (0.22–0.28)	0.23 ± 0.0048 (0.19–0.26)	0.20 ± 0.0056 (0.16–0.23)	0.19 ± 0.0042 (0.16–0.22)	0.20 ± 0.0039 (0.17–0.23)	0.19 ± 0.0034 (0.16–0.20)	0.27 ± 0.0094 (0.20–0.31)	0.26 ± 0.0091 (0.24–0.28)	0.25 ± 0.0040 (0.22–0.28)	0.25 ± 0.0064 (0.20–0.31)
TL	10.47 ± 0.2693 (9.0–12.5)	8.93 ± 0.2433 (7.5–11.0)	8.83 ± 0.2374 (7.0–10.0)	7.47 ± 0.1856 (6.5–8.5)	8.57 ± 0.1944 (7.5–10.0)	7.60 ± 0.1839 (6.5–9.0)	11.65 ± 0.4537 (8.5–14.0)	10.13 ± 0.1250 (10.0–10.5)	10.40 ± 0.2726 (9.0–13.0)	9.03 ± 0.1856 (7.5–10.0)

Table 5. Standardized canonical coefficients and cumulative percentage of variation explained per canonical variate for morphometric data of *Callimoxys* species. Characters highlighted in bold were rated significant by STEPDISC analysis.

		Males					Females		
Group†	Character‡	CAN1	CAN2	CAN3	Group†	Character‡	CAN1	CAN2	CAN3
a	HW	−11.1471	15.5565	2.3449	a	PSL/PL	−34.5208	13.0410	8.8698
a	UEL	9.9683	14.9123	−17.9646	a	PSL	31.6844	−9.3797	−14.9263
a	LLS	−7.2763	−4.9578	17.0418	a	Pt1L	−21.3128	5.5235	−10.3983
a	**VEL**	**6.1348**	**3.8523**	**−4.9953**	a	TEL	−16.1178	5.3864	−10.5580
a	**GL/FH**	**−5.8386**	**−1.2335**	**6.3025**	a	FL/HW	15.5137	−10.8940	17.9918
a	NW/HW	−4.4964	−0.9535	−0.0187	a	UEL/ID	14.8381	2.0618	3.2241
a	UEL/TEL	−4.1186	−4.8010	5.8191	a	HW/PW	10.2866	2.0773	−6.6430
a	LEH/LEL	4.0028	1.8224	−12.0538	a	LLS	−9.0060	0.4511	−5.4789
a	Pt2L/Pt2W	−3.6488	−1.4176	5.7415	a	Pt1W	8.3684	−6.5313	7.2734
a	A1W	−2.7745	−3.9154	0.1330	a	PL/ELL	8.0973	9.8298	−0.3845
a	ELL/ELW	2.3951	−1.9186	1.1126	a	**GL/FH**	**6.9485**	**−2.9956**	**2.8952**
a	Ms2W	−2.2315	−1.5661	−1.6551	a	**MSD**	**6.5473**	**−2.4613**	**2.3250**
a	Mt1W	−2.1857	0.5134	2.5117	a	Pt1L/Pt1W	6.5284	−7.2647	10.3268
a	TEL	−2.0857	−8.2753	7.9846	a	A11L/TAL	−6.5245	0.0560	1.1135
a	A9W	−1.7424	−4.0390	8.2665	a	LEL	5.5649	−0.2591	3.6068
a	Pt3L/Pt3W	1.7324	−1.9764	0.8817	a	Mt3L/Mt3W	5.0582	−0.2068	3.1280
a	**MSD**	**−1.3775**	**0.7653**	**−2.8466**	a	MTCL/MTL	4.4238	0.5067	−0.2042
a	A6L/TAL	−1.1525	−2.2659	−0.1884	a	**VEL/PGC**	**4.2890**	**−1.8039**	**−2.0393**
a	Ms3L/Ms3W	−1.0181	−0.5942	−0.4959	a	PAS/PW	4.0949	−0.0972	1.8787
a	AIW/HW	−0.9635	−1.1969	0.9959	a	MSCW	−3.1899	3.7818	4.7362
a	MTCL/MTCW	0.8810	−0.0866	2.0778	a	A7L	−2.8386	0.8876	0.5284
a	Mts1/MtW1	−0.3190	−0.5788	0.7846	a	A5W	2.2783	1.3790	0.7316
a	Pt1L/Pt1W	−0.1468	0.4665	−1.8606	a	MSL/MTL	1.5672	1.0195	2.5222
a	A10L/TAL	−0.0602	−0.2556	0.2170	a	Ms2L/Ms2W	1.2342	0.4017	−1.7700
b	HW/PW	4.7646	−18.0421	0.0002	a	Mt2W	0.4455	1.0251	12.0351
b	PAS/PW	−4.0953	12.5316	1.0941	a	A2L/TAL	0.3533	−0.7354	0.0778
b	PD	3.3923	−0.3022	−7.4972	a	ELD/ELL	0.3381	−5.3197	7.3103
b	A5L/A5W	−2.1681	1.2492	−3.8562	a	A5L/TAL	0.0095	1.6911	1.1542
b	TL	−1.5240	1.8557	3.1909	b	FL	−15.6270	12.4500	−18.9320
b	FL	−1.2419	0.7786	1.1615	b	A11W	11.8841	1.7195	1.0189
b	A11L/A11W	1.0346	−0.3599	−0.4357	b	PW/PL	11.3505	−0.7322	−2.0350
b	ID	1.0291	1.1323	−1.8378	b	UEL/TEL	−9.0154	0.8574	−2.2416
b	TAL/TL	−0.7249	1.2147	0.6443	b	A4L	−8.7549	2.1285	−1.1866
b	TEL/EH	−0.7074	−2.0225	−4.3011	b	Pt1L/(Pt2L+Pt3L)	6.8825	0.1955	3.4205
b	A3L/A1L	−0.5385	−0.8391	−0.7187	b	A3L	5.1397	−5.9732	2.6480
b	Mt3L/Mt3W	0.4775	0.0155	−0.5781	b	HW	−4.5426	−8.4157	16.7075
c	A6L	10.5364	4.7391	3.5546	b	Mt2L/Mt2W	−4.1049	2.0359	10.4558
c	LEL/TEL	7.4287	−1.3080	−11.3581	b	AIW/HW	−2.9467	1.1467	−1.3982
c	PD/EH	−5.6641	0.1962	11.5556	b	Pt3L	2.8981	0.8647	−2.8806
c	GL	4.9311	1.9551	−6.8989	b	A8L/TAL	−2.0114	−0.5329	1.4405
c	Pt2L	4.5049	0.6986	−3.3786	b	A9L/TAL	−1.8111	1.4406	−1.1784
c	Pt3L	−2.7951	−0.6251	1.5723	b	Mt2L	0.9686	−0.9373	−17.9107
c	PD	2.5966	−11.4861	2.5592	b	GL	−0.3825	−0.4927	−3.0229
c	A5W	−2.2999	1.6404	−5.4965	c	A11L/A11W	14.2176	2.1308	1.6899
c	A1L/A1W	−1.7806	−3.3241	−2.2171	c	ELL	11.6308	6.9770	−2.6645
c	PL/ELL	1.4959	−2.8430	−1.7570	c	Mt3W	5.6556	−1.8794	3.5281
c	PGC	1.4084	0.0375	−1.5032	c	TL	−5.6542	0.5002	−2.4520
c	Pt1L	−1.3263	−0.5210	−0.4235	c	MSCL	4.3866	−3.3582	1.2068
c	A10W	1.2553	−0.4046	−1.3020	c	ID/HW	4.0778	−0.5876	−0.7353
c	A4L/A1L	−1.1238	−0.9697	0.2094	c	A6L/TAL	3.9018	1.4268	−0.3444
c	A11L/TAL	0.9040	−0.0793	−2.9841	c	A3L/TAL	3.2178	5.6592	−1.2847

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Table 5. Continued.

		Males					Females		
Group†	Character‡	CAN1	CAN2	CAN3	Group†	Character‡	CAN1	CAN2	CAN3
c	MTL	0.4691	−0.4533	−1.8549	c	MSCL/MSCW	−3.0829	4.3725	3.2398
c	Mt2L	0.2076	3.1566	3.0950	c	Ms3W	2.8100	1.0564	−1.1924
	Cumulative Variance (%)	83.39	94.72	97.75	c	ASL	2.1471	1.0341	−0.0190
					c	Pt2W	−1.9080	−2.5578	2.1324
					c	PGC	1.0351	−0.3950	−0.2929
					c	A1W	0.9132	−1.1449	1.2560
					c	MTL	−0.6965	−0.7470	2.4286
					c	Mt1L/Mt1W	−0.1923	−0.1043	−0.0130
						Cumulative Variance (%)	81.89	93.14	98.01

* Characters are listed in descending order of absolute value of canonical coefficient 1, which is proportional to the contribution of each character to the variate.
† a = discriminates between *C. fuscipennis*, *C. sanguinicollis*+*C. pinorum*, *C. ocularis*+*C. nigrinis;* b = discriminates between *C. sanguinicollis* and *C. pinorum*; c = discriminates between *C. ocularis* and *C. nigrinis.*
‡ Acronyms as given in Table 1. Single acronyms represent characters normalized to body size (ELW).

sternite punctation is usually strongly transverse with the anterior edge from slightly to greatly elevated, however, this varies to oval or circular punctation in some species. Each puncture bears either a long to short, erect to decumbent, fine or coarse, white, grey, or golden seta. In most species, moderately to deeply transverse microsculpture is present. The surface of the abdomen appears glossy or matte depending on the density of the punctation and microsculpture, and in some species the setation can be dense enough to obscure the surface of the sternites.

Male genitalia: Males can be distinguished from females externally by the shape of abdominal segment V. Males have tergite V elongate, evenly arcuate and curved ventrally, and sternite V abbreviated so that the genitalia exit the segment ventrally; in females, tergite and sternite V are subequal in length, resulting in a conical segment that exits posteriorly.

There are few references to genitalic structures and arrangement for the Cerambycinae, so we have adopted the terminology found in Villiers (1978) and Mermudes and Napp (2004). The male genitalia in *Callimoxys* are arranged as in Fig. 11A. Tergite VIII is broad and shield-like, and overlaps the apex of the median lobe. Sternite VIII has been reduced to two smaller lightly sclerotized lateral lobes connected by a median basal apophysis. Sternite VII is a very lightly sclerotized small transverse sclerite that overlaps the spiculum ventrale. The tegmen consists of a basal ring through which the median lobe fits, as well as two lateral apical apophyses. The median lobe of the aedeagus is divided into two parts, the apical median lobe and the basal apophyses. The apex of the median lobe has a pointed ventral lobe, and two lateral arms forming the dorsal lobe. The internal sac of the aedeagus is clothed with spicules that vary in shape and size, especially in the basolateral half of the sac.

Results and Discussion

Morphometric Analysis. The initial survey for diagnostic characters revealed significant morphometric variation between the sexes with females of all species being wider (ELW) and longer (TL) than males and larger in the following characters: ID, GL, NW, A11W, PW, MSD, LMT, ASL, MTCW, and MSCL (Table 4). After normalizing to elytral width, the lengths of all antennomeres (except antennomere 2), total antennal length (TAL), eye measurements (UEL, LEH, LEL, TEL), frontal height (FH), head width (HW), pronotal length (PL), and metafemur length (MTL) were larger in males. Most of these characters are involved in either host- or mate-finding behaviors. Further confirmation of sexual dimorphism is given by the stepwise discriminant function analysis which identified 24 character measurements for males and 28 measurements for females that clearly separated North American *Callimoxys* into three main groups: *C. fuscipennis*, *C. sanguinicollis*+*C. pinorum*, and *C. ocularis*+*C.nigrinis*. Only the three most significant characters that distinguish these three groups were shared by both sexes (Table 5): the proportional length of the lower eye lobe ventrally (♂ VEL/ELW, ♀ VEL/PGC), the proportional length of the gena to the frontal height of the head (GL/FH), and the normalized width of the mesocoxa (MSD/ELW). These data reflect the shift from the mouthparts pointing forward to ventrally, resulting in the genae and lower eye lobe becoming increasingly shortened from *C. fuscipennis* to *C. sanguinicollis* and *C. pinorum*. *Callimoxys ocularis*

Hammond and Williams and *Callimoxys nigrinis* Williams and Hammond, two new species described in this paper, are the most slender of the North American species, and this may be reflected in the greatly narrowed mesocoxae and significance of the mesocoxal character (MSD/ELW) in separating groups. To resolve *C. pinorum*+*C. sanguinicollis*, an additional 12 and 15 character measurements for males and females, respectively, were required; a further 17 and 16 additional character measurements for males and females, respectively, were required to resolve *C. ocularis*+*C. nigrinis*. These data suggest that *C. pinorum* and *C. sanguinicollis* are morphometrically more similar to each other than are *C. nigrinis* and *C. ocularis* as fewer characters discriminate between them.

Canonical discriminant functions generated three canonical variates which explained approximately 98% of the variation in both sexes (Table 5). The order of the characters differs between the two sexes, a further example of the significant morphometric sexual dimorphism. The first canonical variate captured approximately the same amount of variation in both sexes (♂ 83.39%, ♀ 81.89%). Surprisingly, different characters were identified as important for separating the species in the canonical variates analysis compared with the stepwise discriminant function analysis, which may be a result of having to add extra characters to resolve the eastern species. Twenty-five normalized measurements and 28 morphometric ratios were needed to discriminate between the males of each species, and 29 normalized measurements and 30 morphometric ratios were needed to separate females. The large number of morphometric characters needed to adequately separate species suggests that North American species of *Callimoxys* are very conservative morphologically.

Males and females separated equally well when the first two canonical variates were plotted (Fig. 3). The canonical variates plots also demonstrated how distinct species are, and that *C. sanguinicollis*+*C. pinorum* and *C.ocularis*+*C.nigrinis* are very similar in morphology. This grouping was also reflected by the class means (Table 6), where there was greater similarity within each of the groupings than there is among the different taxa. Canonical variate 1 (CAN1) separated *C. sanguinicollis*+*C. pinorum* from the others, whereas CAN2 separated males of *C. fuscipennis* from the eastern species, and females of *C. ocularis*+*C. nigrinis* from the others (Fig. 3). The characters contributing the most variation to the male plot were HW, UEL, LLS, VEL, and GL/FH (Table 5). Body size and eye and gena shape separate species on CAN1, whereas characters associated with prognathous mouthparts separate *C. fuscipennis* on CAN2. The additional characters of HW/PW, PAS/PW, and PD contributed significantly to separating males of *C. sanguinicollis* and *C. pinorum*, and characters A6L, LEL/TEL, PD/EH, GL, and Pt2L significantly aided in separating males of *C. ocularis* and *C. nigrinis*. The wider and deeper pronotum of *C. pinorum*, and the longer lower eye lobe of *C. nigrinis* contributed significantly to the placement of these species on CAN1.

Separation of females on CAN1 was based on a larger number of significant characters than the males (Table 5). Of the 16 characters contributing the most variation to the female plot, the most important seemed to be PSL, Pt1L, TEL, FL/HW, and UEL/ID. These characters reflect the shortened protarsomere1, shortened prosternum, and the elongate clypeus of *C. fuscipennis* females. One additional character, PL/ELL, contributed to separation of the *C. ocularis*+*C. nigrinis* on CAN2, reflecting the relatively elongate elytra found in these species. The additional characters FL, A11W and PW/PL contributed in separating *C. pinorum* from *C. sanguinicollis* females, as well as characters A11L/A11W, which is greater in *C. ocularis*, and ELL, which is greater in *C. nigrinis*.

Phylogenetic Analysis. Characters. Of the 29 characters used in the phylogenetic analysis (Table 2), twenty are multistate (characters 1, 2, 6, 8, 10, 12, 13, 14, 15, 16, 19–26, 28, 29) and nine are binary (3–5, 7, 9, 11, 17, 18, 27). Thirteen of the multistate characters are ordered (characters 1, 15, 16, 19–26, 28, 29) and seven are unordered (characters 2, 6, 8, 10, 12–14). For unordered characters 6, 10, and 12–14, states were sufficiently unlike one another that it was assumed that any state could have been derived from any other state. For character 2, eye shape, it was determined that the enlarged state in *Callimoxys retusifer*

Table 6. Class means on canonical variables for morphometric data for *Callimoxys* species.

	Males			Females		
	CAN1	CAN2	CAN3	CAN1	CAN2	CAN3
C. fuscipennis	0.9918	13.2087	0.9672	27.9953	−12.3779	−2.7715
C. nigrinis	22.3395	−4.7037	2.4543	7.2467	11.5059	−6.7240
C. ocularis	13.0350	−3.6075	−3.8057	14.6409	6.7607	8.4029
C. pinorum	−27.4022	−7.4995	11.2837	−23.6387	−5.2619	5.8043
C. sanguinicollis	−29.0591	−2.8976	−2.6248	−34.1238	−2.3807	−2.7770

Holzschuh was unlike that found in *C. nigrinis*+*C. ocularis*. In fact, close examination of eye and dorsal invagination shape in *C. retusifer* showed that it is somewhat different from all other *Callimoxys*. Though superficially similar to the state in *C. nigrinis*+*C. ocularis*, it has been coded differently and left unordered. Character 8, apical antennomere length, was shown by the degree of intra- and interspecific variation in both in- and out-groups to be quite labile, and although a logical arrangement from short to long could be made, we were not confident that this reflected evolutionary reality and chose to treat this character conservatively.

Callimoxys is a well-defined genus, unique in the tribe in possession of shortened (with the exception of *C. retusifer*) and apically acute elytra, and a relatively long and multi-tuberculate pronotum that is sexually dimorphic in color (with the exception of *C. pinorum*). Phylogenetic analysis has shown a number of other synapomorphic characters for the genus (Fig. 4).

Phylogenetic analysis returned a single most parsimonious tree (Fig. 4, No. of steps = 75, CI = 0.7733, RI = 0.7258). There are 16 hypothesized homoplasies, in characters 4, 8, 10, 11, 15, 16, 19, 23, 24, 27, and 28, representing both reversals (4 characters) and independent derivations of apomorphic states (5 characters). It is noteworthy that of 11 characters displaying homoplasy, five constitute reversals occurring in the *C. fuscipennis*+*C. pinorum*+*C. sanguinicollis* clade, and four involve the atypical and apomorphic *C. retusifer*. The position of *C. nigrinis*+*C. ocularis* and *C. pinorum*+*C. sanguinicollis* as sister groups is congruent with results from morphometric analysis (Fig. 3), and the impression through inspection by the authors that these species pairs are highly similar and difficult to separate within groups, but very different and easily separated by a number of diagnostic characters between the two groups. The grouping of *C. fuscipennis*+*C. pinorum*+*C. sanguinicollis* is also unsurprising, reflecting the state of taxonomy prior to this study wherein *C. sanguinicollis* and *C. fuscipennis* were treated as conspecific subspecies.

The position of *C. retusifer* in the phylogeny was less expected. This species shares derived states with other *Callimoxys* species in only 11 of 29 characters, the remainder being either plesiomorphic (11 characters) or autapomorphic (eight characters), the fewest shared characters of any species aside from the out-group. *Callimoxys retusifer* is an outlier morphologically, is somewhat unlike other *Callimoxys* in general habitus, and possesses a number of unusual features, particularly in dorsal eye structure and shape, setation, and sculpture of the legs, that are not discussed in the species treatment or list of phylogenetic characters. It also possesses outlier states in the pronotum and shape of the elytra, characters considered diagnostic for *Callimoxys*. It is quite possible that this species should be removed from *Callimoxys* and placed in its own genus. However, this should best be done in the context of a phylogenetic study of the entire Stenopterini, which is outside the scope of this study, so *C. retusifer* is retained in *Callimoxys* for the present.

Callimoxys Kraatz, 1863

Callimoxys Kraatz, 1863: 105

Diagnosis. Members of this genus can be separated from other genera of the Stenopterini by the following combination of characters: antennae 11-segmented, filiform; pronotum with one or two pairs of dorsolateral tubercles, surface densely punctured and pubescent; elytra relatively short and narrow, dehiscing from basal third to half, leaving 1–3 abdominal tergites exposed; abdominal segments

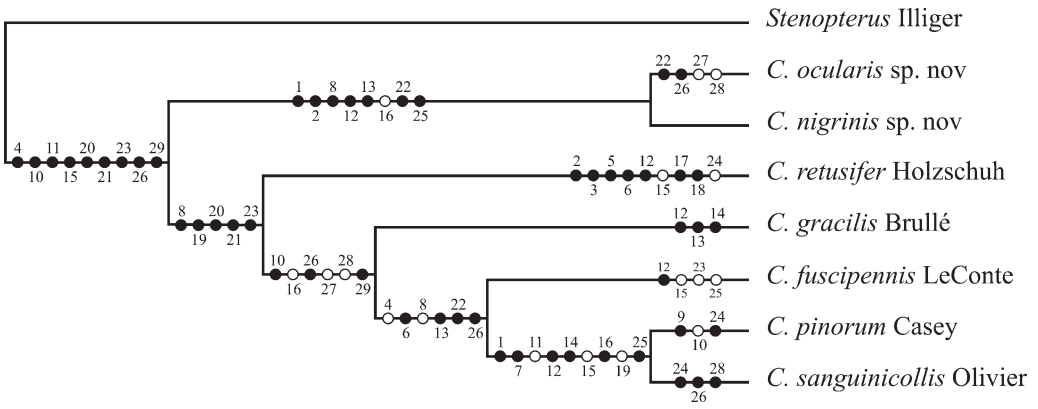

Fig. 4. Reconstructed phylogeny of *Callimoxys* spp. using *Stenopterus* as the out-group. Circles represent apomorphic character changes along each branch. Open circles represent homoplastic characters.

elongate and narrow; pro- and mesofemora distinctly clavate, metafemora clavate to gradually enlarged apically; metatibia with modified punctures with leading edges enlarged and protuberant, forming ±2 rows of acute teeth; median lobe of aedeagus elongate and narrow with developed ventral lobe; tegmen bilobed, with two lateral apical apophyses.

Redescription. Male. Length: 6–12 mm. **Color**: Light brown to black except as follows: pronotum usually black, orange in one species; legs and tarsi completely brown to black to bicolored with apex dark and base yellow; tarsi light to dark brown with base lighter. **Head**: Wide dorsally across eyes. Elongate, mouthparts projecting forward to ventrally. Labrum truncate to bilobed, variously punctured. Clypeus short, with hind margin arcuate to V-shaped, variously punctured. Vertex deeply impressed between antennal bases, deeply punctured to longitudinally rugose. Interocular distance wide. Eyes deeply emarginated; upper lobe small and rounded, lower lobe larger, globose to triangular. Hind margin of eye with shallow to deep sinuation. Small to large postocular temple. **Antennae**: Long**,** usually reaching or surpassing elytral apex. Eleven-segmented, filiform, with apical antennomeres triangular to oval in cross section. Sensory pits situated laterally on antennomeres 5–11. **Pronotum**: Width subequal to or shorter than length. Disk with one or two pairs of lateral tuberosities, often with a smaller triangular or linear elevated area between posterior pair. Laterally with a single larger protuberant tuberosity. Surface densely punctured with erect fine to coarse setae of variable length. **Sternum**: Prosternum long before procoxae. Procoxae separated by narrow, entire prosternal process. Mesocoxae separated by broad intercoxal process. Metacoxae separated by narrow gap. **Elytra**: Short, leaving from one to three apical abdominal tergites exposed. Broad at base, narrowing from basal third to half, apex attenuated and subulate. Punctation with a mixture of large and small punctures, not forming striae. Scutellum emarginate to bilobed. **Wings**: Veins r3, r4, RP, Ap3, AA4, and AA3 present and variously developed. **Legs**: Pro- and mesocoxae globose and slightly transverse. Pro- and mesofemora distinctly clavate. Metafemora range from gradually widened apically to distinctly clavate. Metatibia along lateral margin with modified punctures with leading edges enlarged and protuberant, forming ±2 rows of acute teeth. **Abdomen**: Five segmented with segment 1 longest, overall long and narrow. Abdominal sternites with variously developed transverse to oval punctation. Transverse microsculpture usually present. **Genitalia**: Tergum VIII broad and shield-like. Sternum VIII reduced to 2 small lateral lobes joined by medial basal apophysis. Spiculum ventrale present. Median lobe of aedeagus with variously developed ventral lobe. Tegmen bilobed, with two lateral apical apophyses.

Female. Similar to male except as follows: **Length**: 7–14 mm. **Color**: Light brown to black except as follows: pronotum usually bicolored orange with basal and apical margins black, to completely orange in some species. **Head**: Narrow across eyes. **Antennae**: Short, shorter than or reaching elytral apex. **Pronotum**: Width ≥ length.

Hosts. *Acer* spp., *Carya* spp.*, Ceanothus* spp., *Cornus* spp., *Crataegus* spp. *Lithocarpus* spp., *Paliurus* spp., *Prunus* spp., *Quercus* spp. (Bense 1995; Linsley and Chemsak 1997; Sama 2002; Vlasak and Vlasakova 2002).

Flower and Associated Vegetation Records. *Ceanothus* spp., *Cornus* spp., *Crataegus* spp.*, Eriogonum* spp., *Heracleum* spp., *Holodiscus* spp., *Phacelia* spp., *Photinia* spp., *Prunus* spp., *Quercus* spp., *Rhamnus* spp., *Rhus* spp., *Spiraea* spp., *Toxicodendron* spp., *Viburnum* spp. (Linsley and Chemsak 1997; Sama 2002).

Distribution. Species of *Callimoxys* are known from Bulgaria, Canada, Caucasus, China, Croatia, Crimea, Greece, Hungary, Iran, Romania, Slovakia, Transcaucasus, Turkey, and United States.

Remarks. This genus is superficially similar to both the European *Stenopterus* and to the Oriental *Merionoeda* in sharing the tapered and shortened elytra and the distinctly bicolored and clavate metafemora. However, the male genitalia of *Callimoxys* are unique in that the median lobe is narrow and elongate and the tegmen is completely bilobed, with two completely separate lateral apical apophyses, whereas both *Stenopterus* and *Merionoeda* have short and broad aedeagi and a single lobed tegmen.

Key to the Species of *Callimoxys*

1. Elytra proportionately short (L:W ♂ 2.16–2.52; ♀ 2.06–2.45; Fig. 5A).....2
1′. Elytra proportionately long (L:W >2.5; Fig. 5B–D) 3
2. Pronotum black (♂) or bicolored orange and black (♀); pronotal punctures separated at least on anterior pronotal tubercles, punctures round with little to no microsculpture between punctures, pronotal surface glossy (Fig. 6A); interocular distance wide (ID:ELW ♂ 0.26–0.28; ♀ 0.27–0.29, 95% confidence, Fig. 7B); male metatarsomere 1 somewhat short (L:W 3.21–3.4, 95% confidence); female head proportionally wide (HW:PW 0.88–0.95, 95% confidence).....***C. sanguinicollis*** **(Olivier)**
2′. Pronotum orange in both sexes; pronotal punctures contiguous over entire pronotum, punctures reticulate with sharp edges, pronotal surface usually dull (Fig. 6B); interocular distance narrow (ID:ELW ♂ 0.24–0.25; ♀ 0.25–0.27, 95% confidence, Fig. 7D); male

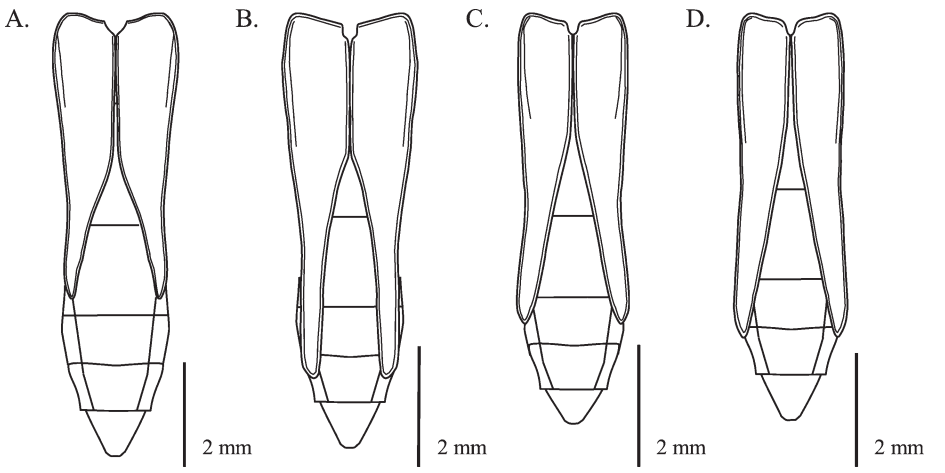

Fig. 5. Elytra in dorsal view of adult female *Callimoxys* spp. A) *C. pinorum*, B) *C. fuscipennis*, C) *C. ocularis*, D) *C. nigrinis*.

metatarsomere 1 elongate (L:W 0.62–0.71, 95% confidence); female head proportionally narrow (HW:PW 0.82–0.88, 95% confidence) .....***C. pinorum* Casey**

3. Pronotal surface with well-defined punctation, punctures conspicuous, large, round to reticulate, deeply impressed and dense, smooth between punctures; pronotal pubescence white or grey, with fine erect and suberect hairs varying in length or falling into two distinct size classes in some specimens; pronotum with ≤4 dorsolateral tubercles, often with a single reduced posteromedian tubercle or elongate longitudinal keel (Fig. 6C–F); elytral surface smooth between punctures or with minute punctures; abdomen black to brown in both sexes.....4

3′. Pronotal surface longitudinally and transversely rugulose to rugose, punctation small, inconspicuous, scattered within rugosity, punctation round, shallowly impressed and sparse; pronotal pubescence double and strongly contrasting with dark, coarse, long erect hairs on disk, and minute, yellow to gold, inconspicuous, erect, bristle-like hairs on lateral aspects; pronotum with 4 strongly produced dorsolateral callosities, and single posteromedian, oblong, triangular tubercle between posterior tubercles, limited to basal 1/3 of disk (Fig. 6G); elytral surface between punctures uneven, rough; male abdomen black, female abdomen orange to light brown ....***C. retusifer* Holzschuh**

4. Gena long (GL:FH ♂ >0.26; ♀ > 0.31, Fig. 7E, K); thoracic and abdominal sternite pubescence dense, decumbent, partially obscuring surface; abdominal punctation oval to transverse with anterior edges moderately raised, tiny, dense, contiguous to separated by ≤2X puncture diameter; abdominal microsculpture transverse, dense, deep; abdominal surface dull (Fig. 8E,F,K,L).....5

4′. Gena short (GL:FH ♂ 0.16–0.25; ♀ 0.20–0.29, Fig. 7G, I); thoracic sternite pubescence moderately dense, abdominal sternite pubescence sparse, suberect to erect, not obscuring surface; abdominal punctation oval to round with anterior edges at most slightly raised, medium to large, sparse, punctures separated by >2X puncture diameter; abdominal microsculpture transverse, sparse, lightly to moderately impressed; abdominal surface glossy (Fig. 8G, H, I, J).....6

5. Pronotum with short median, inconspicuous, slightly elevated, keel lower than dorsolateral tubercles and limited to posterior half of disk (Fig. 6C); punctures of metafemoral club small, basal edges slightly raised, surface appearing minutely roughened; metafemoral club abruptly widened towards apex forming distinct apical club (Fig. 6H); at least metafemur and metatibia bicolored, pedicel yellow with apex brown to black .....***C. fuscipennis* (LeConte)**

5′. Pronotum with well-developed, strongly elevated, median keel as tall as dorso-lateral tubercles and extending from anterior sulcus to the posterior sulcus (Fig. 6F); punctures of apex of metafemur large, basal edges strongly protuberant, surface appearing coarsely roughened; metafemur gradually widened towards apex (Fig. 6I); all legs brown to black ....***C. gracilis* Brullé**

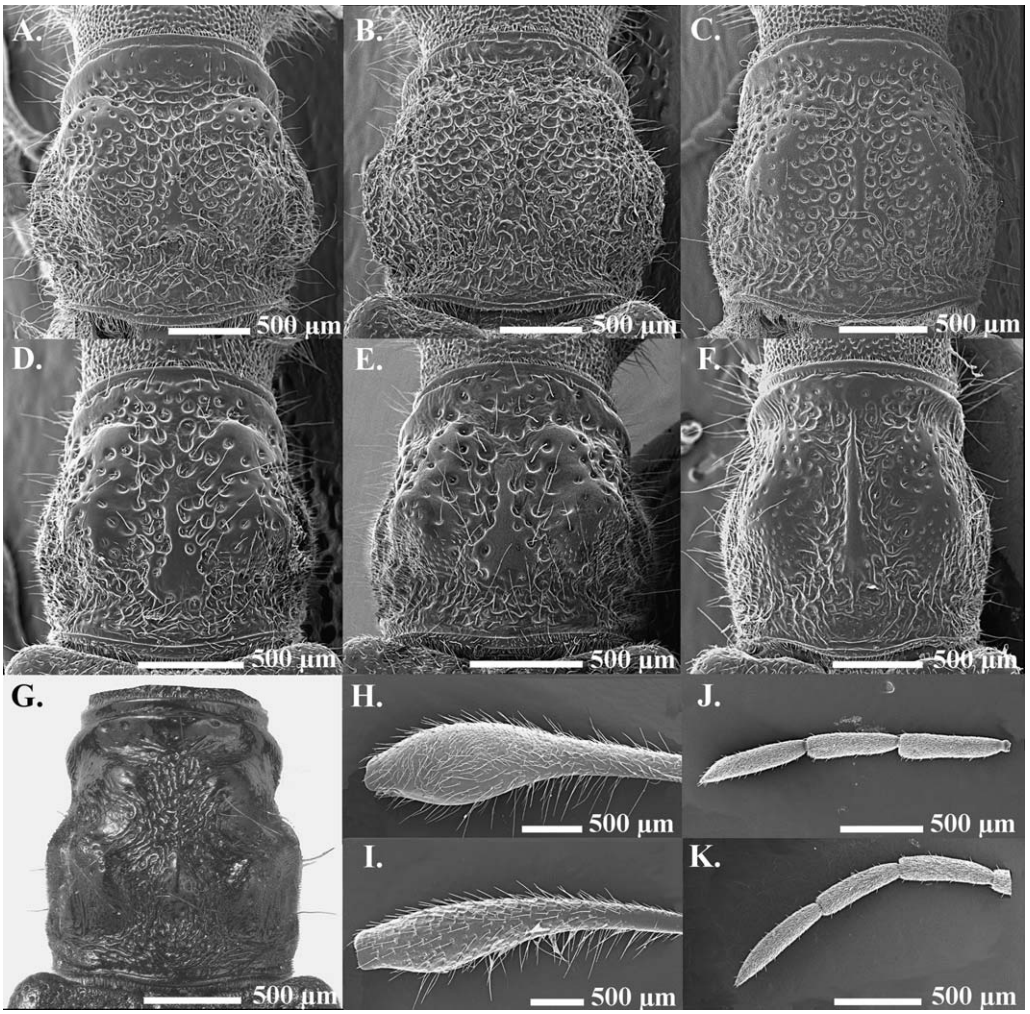

Fig. 6. Pronota (A–G), metafemora (H–I), and apical antennomeres (J–K) of male *Callimoxys* spp. A) *C. sanguinicollis*, B) *C. pinorum*, C and H) *C. fuscipennis*, D and J) *C. ocularis*, E and K) *C. nigrinis*, F and I) *C. gracilis*, G) *C. retusifer.*

6. Color lighter, elytra light to dark brown, rarely black; all femora bicolored with sharp transverse line of demarcation between yellow pedicel and dark apical club; metafemoral club less elongate (L:W ♂ 2.33–2.48; ♀ 2.25–2.41, 95% confidence, Fig. 9C); antennomere 9 elongate (L:W ♂ 4.02–4.36; ♀ 3.56–3.77, 95% confidence, Fig. 6J); female mesofemoral club somewhat short (L:W 1.81–2.49, 95% confidence, Fig. 9A).....
.....***C. ocularis*** **Hammond and Williams**

6′. Color darker, elytra black; legs usually dark, if somewhat bicolored then no distinct line between light and dark areas; metafemoral club elongate (L:W ♂ 2.58–2.78; ♀ 2.58–2.73, 95% confidence, Fig. 9D); antennomere 9 somewhat shortened (L:W ♂ 3.75–4.02; ♀ 3.21–3.50; 95% confidence, Fig. 6K); female mesofemoral club elongate (L:W 2.50–2.65, 95% confidence, Fig. 9B).....
.....***C. nigrinis*** **Williams and Hammond**

Callimoxys sanguinicollis (Olivier, 1795)

(Figs. 1, 2, 6A, 7A–B, 8A–B, 10B, 11)

Necydalis sanguinicollis Olivier, 1795: 9, pl. 1, fig. 7. Junior primary homonym of *Necydalis sanguinicollis* F., 1787 [= *Ischnomera sanguinicollis* (F., 1787), Oedemeridae].

Stenopterus sanguinicollis Say, 1835: 194.

Callimoxys sanguinicollis Leng, 1885: pl. 3, fig. 19; Leng, 1886: 30.

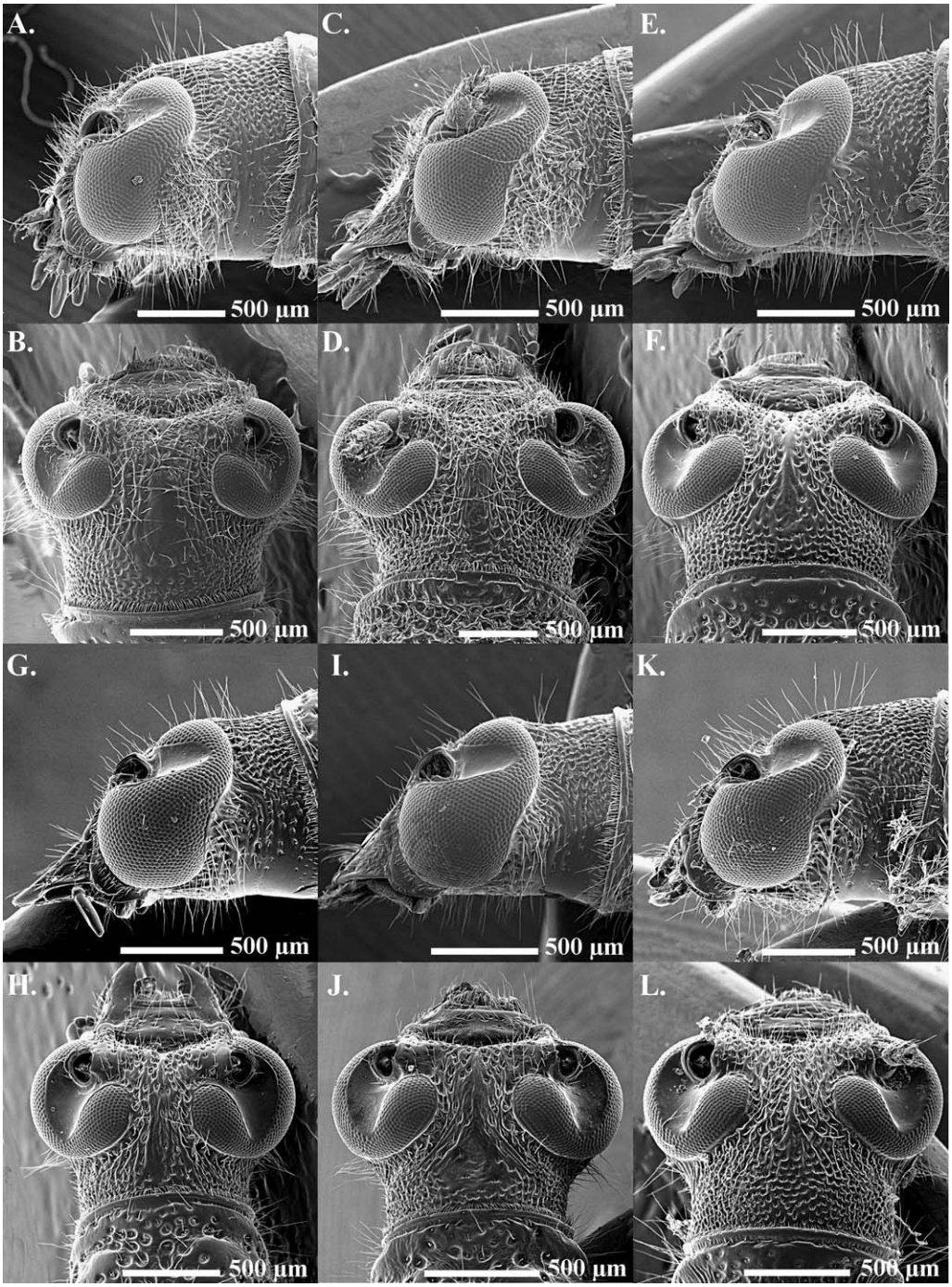

Fig. 7. Lateral and dorsal views of the heads of male *Callimoxys* spp. A–B) *C. sanguinicollis*, C–D) *C. pinorum*, E–F) *C. fuscipennis*, G–H) *C. ocularis*, I–J) *C. nigrinis*, K–L) *C. gracilis*.

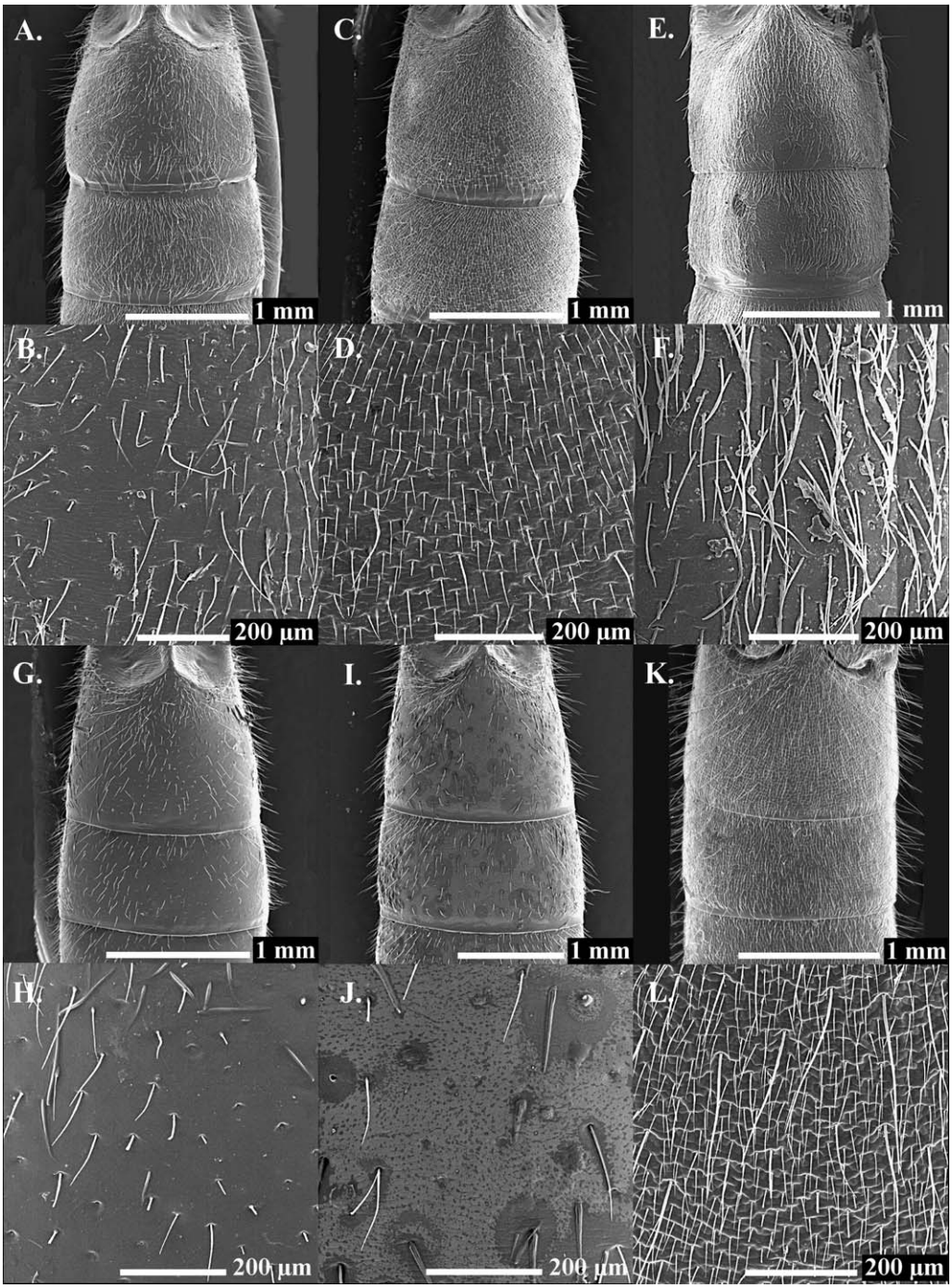

Fig. 8. Abdominal sternites of male *Callimoxys* spp. A–B) *C. sanguinicollis*, C–D) *C. pinorum*, E–F) *C. fuscipennis*, G–H) *C. ocularis*, I–J) *C. nigrinis*, K–L) *C. gracilis*.

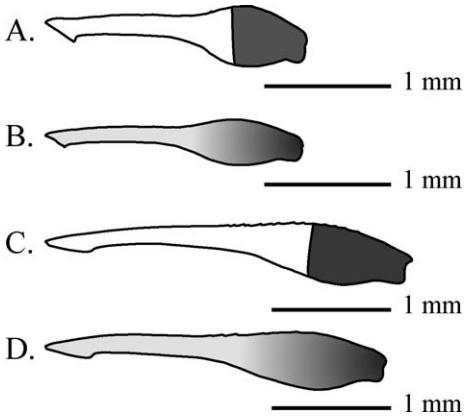

Fig. 9. A) Mesofemur of female *Callimoxys ocularis*, B) Mesofemur of female *Callimoxys nigrinis*, C) Metafemur of male *C. ocularis*, D) Metafemur of male *C. nigrinis*.

According to article 23.9.5 of the Code of Zoological Nomenclature (further referred to as the Code), when an author discovers that a species group name in use is a junior primary homonym [Art. 53.3] of another species group name also in use, but the names apply to taxa not considered congeneric after 1899, the author must not automatically replace the junior homonym; the case should be referred to the commission for a ruling under the plenary power and, meanwhile, prevailing usage of both names is to be maintained [Art. 82].

Material Examined. 190 females, 208 males.

Neotype. Male (USNM); labeled "Catskill Mts./Ulster Co. N.Y./VI-28-1915//E. Shoemaker/ Collector//Shoemaker/Collection/1956". A red label was added to the specimen with the following: "NEOTYPE/Callimoxys sanguinicollis/ (Olivier, 1795)/Hammond & Williams, 2011". A single slash (/) represents a line break, and a double slash (//) indicates a new label. The specimen is glued to a point, with its fore and middle legs folded together underneath the body, and is in good condition without any appreciable damage.

A neotype is hereby designated with the purpose of clarifying the taxonomic status and type locality for this species, as per article 75.3 of the Code. It was thought that Olivier's original holotype of *Necydalis sanguinicollis* was housed at the Muséum National d'Histoire Naturelle (MNHN, Paris), but recently other Olivier specimens have been found at the Hunterian Museum, University of Glasgow (HMUG). The type specimen of *C. sanguinicollis* could not be located at any of the above institutions, although other Olivier type specimens of *Necydalis* were found at the HMUG. Olivier's original description is as follows:

> "Necydalis sanguinicollis. Pl. 1. Fig. 7.
>
> N. black; elytra subulate; prothorax red. It is slightly larger than the Nécydale mineure. The antennae are black, slightly shorter than the body. The head is black. The prothorax is uneven, somewhat vivid blood-red. The elytra are subulate, blackish. The body is black underneath, with the base of the posterior thighs and of the legs reddish. It is found in northern America. From C. Bosc's cabinet."

The original written description for this species does not entirely match the figure in Olivier's (1795) manuscript as he expressly writes that the metafemora are bicolored. However, the figure shows all three femora as bicolored, and does not specify the length of the elytra, only that they are subulate. Given the ambiguity of the original description, the currently accepted form of *C. sanguinicollis*, and that there are three species previously thought of as *C. sanguinicollis*, we chose to designate a new type specimen.

New Type Locality. Catskill Mountains, Ulster County, New York. Olivier's type locality for *N. sanguinicollis* was simply listed as "America septentrionale", and prior to 1795 this area included most of the eastern seaboard of the United States and Canada. However, the exact location of the collection is unknown. We assign the new type locality as approximately the center of the known geographic area from this time period.

Diagnosis. This species is separated from the other North American *Callimoxys* species by the following combination of characters: pronotum black (♂) or bicolored black and orange (♀); gena short; labrum densely setose; eye oriented vertically; eye deeply sinuate posteriorly; lower eye lobe small, triangular, ventrally short; dorsal interocular distance wide, dorsal eye invagination evenly curved, setae present; pronotum with strong subapical collar and deep apical sulcus; width subequal to length; two pairs of dorsolateral tubercles, posterior pair distinctly larger and greatly elevated, most of surface with deep, circular, closely arranged punctures except near anterior margin and especially on anterior tubercles where punctures more widely separated, surface with little to no microsculpture, appearing glossy; elytra short, dehiscing near middle; abdominal punctation small, transverse with apical margins elevated, punctures close, with moderately impressed transverse microsculpture, pubescence moderately dense but sternal surface visible; apical margin of tergite VIII transversely truncate to slightly sinuate; median lobe of aedeagus apically blunt with ventral lobe short,

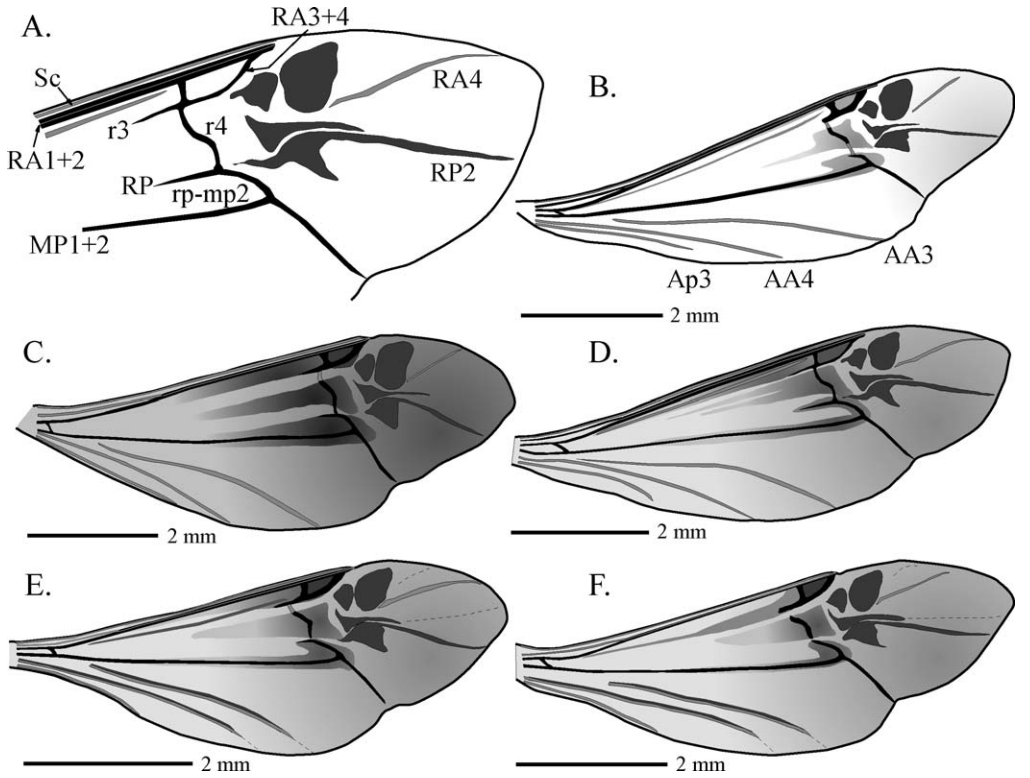

Fig. 10. Hindwing venation in North American *Callimoxys* spp. A) Generalized wing, B) *C. sanguinicollis*, C) *C. pinorum*, D) *C. fuscipennis*, E) *C. ocularis*, F) *C. nigrinis*. Pigmented veins are depicted by black lines, opaque or translucent veins are depicted with light grey lines. Terminology follows Kukalova-Peck and Lawrence (2004). Sc = subcosta; RA, RP, and r = anterior and posterior radial, and radial crossveins, respectively; MP = media posterior; AA, AP = anterior anal and posterior anal, respectively.

apex equal in length to basal apophyses; internal sac spicules simple, variable in size, oriented in longitudinal oblique rows.

Redescription. Male. Length: 6.0–10.5 mm (n = 39). **Color**: Dark brown to black, except as follows: antennae light brown to black, often with apical antennomeres lighter. Pronotum black, rarely bicolored orange and black. Elytra light brown, often with scutellum, humeri, and apices darker. Metafemur usually bicolored, with pedicel yellow and apical club black, rarely all black. Metatibia bicolored with basal half to 3/4 yellow with apex dark brown, rarely entirely dark brown to black. Tarsomeres bicolored light brown with apex darker. **Head**: Moderately broad across eyes (HW/PW = 0.91–1.06). Interocular distance wide (ID/HW = 0.27–0.37). Labrum broadly emarginated with apex unpigmented, densely setose on most of surface; clypeus evenly punctate and setose, some specimens slightly less punctate medially. Frons moderately deeply punctate with punctures separated by approximately one puncture diameter, vertex contiguously, deeply, coarsely, irregularly punctured, longitudinally rugose in some specimens. Frons and postocular pubescence sparse, white to grey, long, fine, erect. Neck moderately wide (NW/HW = 0.53–0.71). Clypeus short, genae short (GL/FH = 0.16–0.26). Apical portion of gula moderately to strongly transversely rugose, punctures tiny, asperate. Field of scattered setae present on dorsal eye invagination, male eye invagination evenly curved and smooth. Eyes strongly oriented vertically, eye narrow (TEL/EH = 0.64–0.78); upper eye lobe moderately long (UEL/TEL = 0.46–0.53), lower eye lobe triangular, moderately short (LEL/ELW = 0.18–0.27), height > length (LEH/LEL = 1.09–1.48), with long posterior sinuation (TEL/LEL = 1.20–1.55) and large postocular temple, lower eyelobes ventrally short (VEL/PGC = 0.16–0.32). **Antennae**: Overall length almost reaching elytral apex, approximately 3/4 of total body length (TAL/TL = 0.66–0.79). Antennomere 1 length >3X width (A1L/A1W = 3.05–4.11); antennomere 3 longer, ≥3/4 length of

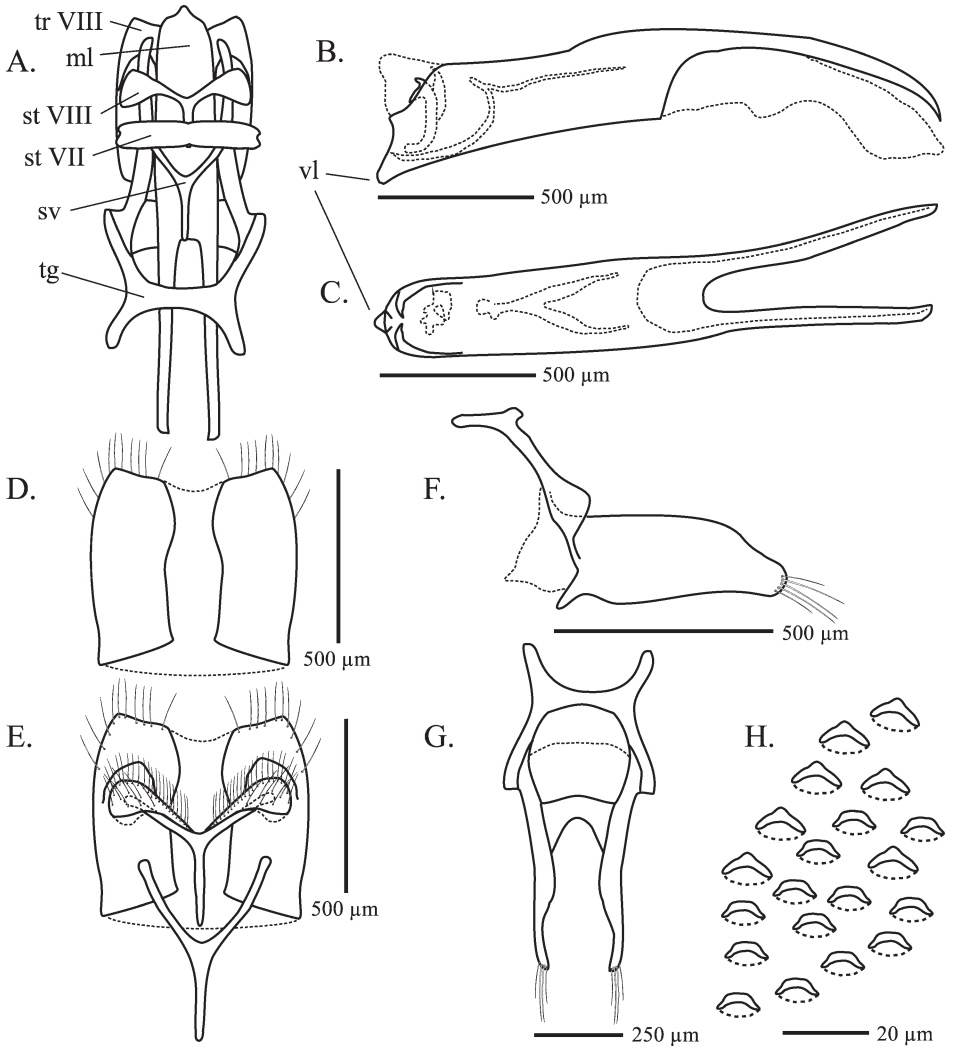

Fig. 11. Genitalic structures of male *Callimoxys sanguinicollis*. A) General orientation of male genitalia, B) Median lobe of aedeagus, lateral view, C) Median lobe, dorsal view, D) Tergite VIII, E) Sternite VIII and spiculum ventrale, ventral view, F) Tegmen, lateral view, G) Tegmen, dorsal view, H) Basolateral spicules of internal sac. Tr = tergite; ml = median lobe; st = sternite; sv = spiculum ventral; tg = tegmen; vl = ventral lobe.

antennomere 1 (A3L/A1L = 0.67–0.87); antennomeres 4 and 5 subequal to antennomere 1 (A4L/A1L = 0.87–1.20; A5L/A1L = 0.82–1.15); antennomere 5 ≤5.5X longer than wide (A5L/A5W = 3.87–5.70); antennomere 9 about 3.5X longer than wide (A9L/A9W = 3.24–4.13); antennomere 10 about 3.3X longer than wide (A10L/A10W = 2.78–3.71); antennomere 11 about 4.2X longer than wide (A11L/A11W = 3.63–4.81). Antennal formula: 0.104–0.134:0.020–0.025:0.083–0.102:0.108–0.132:0.109–0.133:0.087–0.102:0.085–0.099:0.077–0.091:0.081–0.093:0.072–0.080:0.084–0.100. Antennomeres 5–11 with circular to oblong sensory pits laterally. Apical 4 antennomeres triangular in cross section at midlength. **Pronotum**: Width subequal to length (PW/PL = 0.90–1.20), about 90% of elytral width (PW/ELW = 0.85–0.96), and 40% of elytral length (PL/ELL = 0.29–0.45). Subapical collar produced, globose. Pronotal width across apical sulcus very narrow (PAS/PW = 0.70–0.79), with apical sulcus deeply impressed. Length of basal transverse marginal depression slightly wider medially than apical depression. Dorsally with 2 pairs of sublateral tubercles; ante-

rior pair slightly smaller and ovoid, posterior pair strongly elevated and rounded; often with a linear to triangular, median, basally impunctate, elevated area between posterior tubercles. Pronotal height across posterior tubercles tall (PD/ELW = 0.51–0.61). Pronotal disk punctation circular to irregularly shaped, moderately deep, contiguous medially, area between punctures smooth on anterior part of pronotum, finely granulate on posterior part; often the dorsal tubercles are at least partially impunctate or with punctures more widely separated. Pronotal pubescence sparse, white to grey, long, fine and erect. Pronotum laterally with an elongate, longitudinally oriented, moderately protuberant tubercle. Posteroventral area of pronotum with rugose carina that is more strongly developed than posterior pronotal margin, separated from lateral tubercle and dorsal margin of the coxal cavity by deep grooves. **Sternum**: Prosternum moderately short (PSL/PL = 0.23–0.63), subapical collar moderately produced. Procoxal cavities moderately transverse, prosternal process narrow, entire. Mesocoxal process wide (MSD/ELW = 0.26–0.31), apex sinuate to slightly emarginate. Metepisternal punctation double; smaller and larger punctures, both moderately deep, evenly impressed, circular, contiguous anteriorly to separated by 0.5X diameter of puncture posteriorly. Metasternum short (LMT/ELW = 0.57–0.68), punctures medium to small, moderately deep, anterior margin slightly raised, circular, separated by 1X puncture diameter near base to almost contiguous at apex. Pubescence relatively sparse to denser along apex, white to grey, very long, fine, suberect to erect. **Elytra**: Elytra short (ELL/ELW = 2.17–2.52) leaving ±3 apical abdominal tergites exposed, dehiscing from about basal third to half (ELD/ELL = 0.21–0.50), apical half wide and robust, apex pointed. Sutural and lateral margins elevated and thickened. Punctation double; large punctures moderately large and deep, evenly impressed, circular, separated by 1X puncture diameter, not forming stria, each bearing a white to grey, long, fine erect seta; smaller punctures very tiny, circular, arranged irregularly between larger punctures, each bearing a short, fine, white, depressed seta; pubescence in basal 1/3 erect to semi-erect, sparse. **Scutellum**: Emarginate to bilobed, with sparse, short, white depressed pubescence. **Wings**: Clear except for apical 1/3 and area surrounding veins r4 and rp-mp2 lightly infumate; veins r3 and RP usually reduced to absent; vein r4 with anterior and posterior terminus translucent. Anal lobe veins tubular throughout with little to no pigmentation. **Legs**: Procoxa globose and slightly transverse. Protrochanter moderately pointed. Profemur short, with apical club approximately 1/2 to 2/3 the length of the profemur; punctation small to minute, shallow, circular to transverse, sparse to very dense on pedicel and underside of profemur, very sparse to impunctate on anterior and posterior club faces, each puncture bearing a white, long, thin erect seta; microsculpture shallow and transverse on pedicel, effaced to absent on club. Protibia subequal to or slightly longer than profemur, apex bearing 2 subequal, short spurs; punctures large, coarse, circular to transverse with elevated anterior margins, moderately dense; pubescence double; white, long, thin erect seta, on most of protibia, and golden, shorter, stouter, semi-erect seta on underside and at the apex. Protarsus about 2/3 length of protibia; protarsomere 1 filiform, about 2X as long as wide (Pt1L/Pt1W = 1.76–2.36), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.59–0.73); protarsomere 2 emarginate and evenly widened apically, length subequal to width (Pt2L/Pt2W = 0.78–1.08); protarsomere 3 strongly bilobed, asymmetrical, posterior lobe longer than anterior lobe, inner margins sinuate, convergent basally and divergent apically, slightly longer than wide (Pt3L/Pt3W = 1.04–1.32); protarsomere 4 small, hidden in protarsomere 3; protarsomere 5 longer than protarsomere 1, with a moderately long projection extending from the apex ventrally. Protarsomeres 1–3 with dense pad of golden setae on ventral surface, with scattered white, long thin setae on dorsal surface. Mesocoxa globose, slightly transverse. Mesotrochanter moderately pointed. Mesofemur short (MSL/ELW = 0.85–1.22), pedicel relatively thin, with apical club just under half the length of mesofemur (MSCL/MSL = 0.42–0.48), apical club ≤2X as long as wide (MSCL/MSCW = 1.83–2.09); punctation small to minute, shallow, circular to transverse, dense on pedicel and underside of mesofemur, very sparse to impunctate on anterior and posterior club faces, each puncture bearing a white, long, thin erect seta; microsculpture shallow and transverse on pedicel, effaced or absent on club. Mesotibia subequal to or slightly longer than mesofemur, apex bearing 2 spurs, medial spur subequal to or slightly longer than lateral spur; punctures coarse, circular to transverse with elevated anterior margins, moderately dense, with moderate transverse microsculpture; pubescence double; golden, long, thin, erect seta on most of mesotibia, and golden, shorter, stouter, semi-erect seta on underside and at the apex. Mesotarsus about 2/3 length of mesotibia; mesotarsomere 1 filiform and narrow, about 2.5X as long as wide (Ms1L/Ms1W = 2.12–2.86), about 3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.66–0.85); mesotarsomere 2 truncate, length subequal to width (Ms2L/Ms2W = 0.81–1.10); mesotarsomere 3 strongly bilobed, asymmetrical, posterior lobe longer than anterior lobe, inner margins sinuate, convergent basally and divergent apically, length ≥ to width (Ms3L/Ms3W = 1.00–1.25);

mesotarsomere 4 small, hidden in mesotarsomere 3; mesotarsomere 5 slightly longer than mesotarsomere 1, with a much shorter projection extending from the apex ventrally. Mesotarsomeres 1–3 with dense pad of golden setae on ventral surface, with scattered white, long thin setae on dorsal surface. Metacoxa globose and moderately transverse. Metatrochanter triangular and strongly pointed. Metafemur relatively short and stout (MTL/ELW = 1.60–1.98), pedicel stout, with apical club just over 1/3 length of the metafemur (MTCL/MTL = 0.34–0.51), apical club ≤2.5X as long as wide (MTCL/MTCW = 1.95–2.58); punctures small, transverse, shallow, relatively sparse on pedicel, a mixture of large and small transverse and circular punctures with elevated anterior margins that range from shallow to deep on anterior and posterior club faces, each bearing either a small or long thin erect golden seta; microsculpture transverse, moderately deeply impressed on pedicel, effaced to absent on club. Metatibia longer than metafemur, apex bearing 2 apical spurs, with medial spur larger and stouter than lateral spur; outer margin of metatibia bearing ±2 rows of modified punctures with the anterior margins greatly elongate and asperate, forming moderately long, coarse teeth each bearing a long fine golden seta; remaining punctures a mixture of small, transverse, shallow and slightly larger asperate punctures. Metatarsus about 1/2 length of metatibia; metatarsomere 1 filiform and narrow, about 3.4X as long as wide (Mt1L/Mt1W = 3.15–3.93), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.87–1.18); metatarsomere 2 truncate, slightly longer than wide (Mt2L/Mt2W = 1.00–1.40); metatarsomere 3 strongly bilobed asymmetrical, posterior lobe shorter than anterior lobe, inner margins sinuate, convergent basally and divergent apically, slightly longer than wide (Mt3L/Mt3W = 0.83–1.30); metatarsomere 4 small, hidden in metatarsomere 3; metatarsomere 5 subequal to metatarsomere 1, with a moderately long projection extending from the apex ventrally; metatarsomeres 1–3 with dense pad of golden setae on ventral surface, with scattered white, long thin setae from dorsal surface. **Abdomen**: First abdominal sternite long (ASL/ELW = 0.61–0.89), almost as long as next two segments combined; segment 4 subequal in length to segment 3, apices very broadly emarginate. Punctation of segments 1–4 double; larger punctures shallow, anterior edges slightly raised, circular, widely separated, each bearing a white to grey, very long, fine, erect setae; smaller punctures moderately deep, anterior edges moderately raised, strongly transverse, contiguous to separated by about 2X puncture width, each bearing a white to grey, shorter, slightly thicker depressed seta, however, surface of sternites visible; lateral margins with a field of depressed, small, posteromedially directed hairs. Sternites with moderately impressed transverse microsculpture medially, more granulate microscuplture laterally, sternites matte. Segment 5 shorter than segment 4, trapezoidal with prolonged apex, apical margin rather deeply sinuate to emarginate, with similar punctation and sculpture to previous segments. **Genitalia**: Tergite VIII broad, more or less rounded to angulate laterally; apical margin truncate with fine, scattered, medium pubescence. Sternum VIII and spiculum ventrale with basal arms long, 3/4 length to as long as the lateral arms, apex rounded. Tegmen one solid piece with membranous areas within the proximal ring and at base of apical apophyses; posterior ring with lateral arms wide basally in lateral view; apical apophyses relatively wide basally and narrow quite suddenly at apex, in lateral view. Median lobe apex subequal in length to the basal apophyses; apex oriented vertically, appearing somewhat truncate in lateral view, ventral lobe slightly longer and more angulate than dorsal lobe; ventral lobe narrowly rounded, blunt and short in dorsal view. Spicules of the internal sac simple and rounded, variable in size, and oriented into longitudinal oblique rows.

Female. Similar to male, except as follows: **Length**: 8–13 mm (n = 33). **Color**: Pronotum bicolored orange with basal and apical margins varying black. Prosternum, proepimeron and procoxae black. **Head**: Broad across eyes (HW/PW = 0.85–1.09). Interocular distance wide (ID/HW = 0.29–0.38). Neck wide (NW/HW = 0.56–0.78). Front short, genae short (GL/FH = 0.18–0.29). Eyes oriented strongly vertically, eye narrow (TEL/EH = 0.55–0.79); upper eye lobe long (UEL/TEL = 0.42–0.55), lower eye lobe short (LEL/ELW = 0.14–29), height ≥ length (LEH/LEL = 0.95–1.45), with long posterior sinuation (TEL/LEL = 1.26–1.68); lower eyelobes ventrally short (VEL/PGC = 0.18–0.32). **Antennae**: Overall length shorter, just over half the body length (TAL/TL = 0.55–0.77). Antennomere 1 length ≤3.5X width (A1L/A1W = 2.80–3.64); antennomere 3 longer, 3/4 length of antennomere 1 (A3L/A1L = 0.66–0.82); antennomeres 4 and 5 subequal to antennomere 1 (A4L/A1L = 0.85–1.03; A5L/A1L = 0.74–1.06); antennomere 5 ≤4.5X longer than wide (A5L/A5W = 3.88–4.83); antennomere 9 approximately 3.2X longer than wide (A9L/A9W = 2.89–3.41); antennomere 10 approximately 3X longer than wide (A10L/A10W = 2.53–3.33); antennomere 11 approximately 3.6X longer than wide (A11L/A11W = 3.25–4.07). Antennal formula: 0.114–0.149:0.022–0.029:0.081–0.106:0.107–0.137:0.104–0.128:0.088–0.101:0.088–0.102:0.076–0.089:0.077–0.092:0.067–0.082:0.081–0.098. **Pronotum**: Width subequal to length (PW/PL = 0.93–1.09), about 87% of elytral width (PW/ELW = 0.72–0.98), and about 40% of elytral

length (PL/ELL = 0.31–0.45). Pronotal width across apical sulcus very narrow (PAS/PW = 0.58–0.84). Pronotal height across posterior tubercles tall (PD/ELW = 0.48–0.68). **Sternum**: Prosternum moderately short (PSL/PL = 0.23–0.60). Mesocoxal process wide (MSD/ELW = 0.27–0.31). Metasternum short (LMT/ELW = 0.59–0.68). **Elytra**: Elytra short (ELL/ELW = 2.07–2.37), dehiscing from about basal third to half (ELD/ELL = 0.21–0.49). **Legs**: Protarsus with protarsomere 1 almost 2X as long as wide (Pt1L/Pt1W = 1.78–2.19), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.57–0.73); protarsomere 2 emarginate, length subequal to width (Pt2L/Pt2W = 0.77–1.14); protarsomere 3 symmetrical, lobes subequal, inner margins sub-parallel basally and diverging apically, slightly longer than wide (Pt3L/Pt3W = 1.04–1.27); protarsomere 5 subequal in length to protarsomeres 1 and 2 combined. Mesotrochanter truncate. Mesofemur short (MSL/ELW = 0.84–1.13), apical club length just under half the mesofemur length (MSCL/MSL = 0.42–0.50), apical club about 2X as long as wide (MSCL/MSCW = 1.85–2.24). Mesotarsomere 1 about 2.5X as long as wide (Ms1L/Ms1W = 2.13–2.64), about 3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.67–0.90); mesotarsomere 2 truncate, length subequal to width (Ms2L/Ms2W = 0.78–1.19); mesotarsomere 3 slightly longer than wide (Ms3L/Ms3W = 1.00–1.24); mesotarsomere 5 slightly shorter than mesotarsomeres 1 and 2 combined. Metafemur relatively short and stout (MTL/ELW = 1.61–1.79), apical club just over 1/3 length of metafemur (MTCL/MTL = 0.30–0.46), apical club ≤2.4X as long as wide (MTCL/MTCW = 2.00–2.40). Metatarsomere 1 about 3.3X as long as wide (Mt1L/Mt1W = 2.89–3.67), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.83–1.13); metatarsomere 2 truncate, slightly longer than wide (Mt2L/Mt2W = 1.05–1.42); metatarsomere 3 slightly longer than wide (Mt3L/Mt3W = 1.04–1.58); metatarsomere 5 slightly longer than metatarsomere 1, with a moderately long projection extending from the apex ventrally. **Abdomen**: First abdominal sternite long (ASL/ELW = 0.75–0.92), almost as long as next two segments combined; segment 4 about 2/3 as long as segment 3. Segment 5 slightly longer than segment 4, with truncate apical margin, and similar punctation and sculpture, punctures sparser.

Hosts. *Carya* sp. (hickory), *Ceanothus* sp., *Ceanothus americanus* L. (New Jersey tea), *Cornus drummondii* C. A. Mey (roughleaf dogwood), *Prunus caroliniana* Aiton (Carolina laurel cherry), and *Quercus* sp. (oak) (Yanega 1996; Linsley and Chemsak 1997; Vlasak and Vlasakova 2002).

Flower and Associated Vegetation Records. *Cornus foemina* Mill. (stiff dogwood), *Cornus racemosa* Lam. (Northern swamp dogwood), *Cornus stricta* Lam. (southern swamp dogwood), *Prunus* sp. (cherry), *Spiraea* sp. (meadowsweet), *Viburnum* sp., *Viburnum rafinesqueanum* Schult. (downy arrowwood).

Remarks. As in most North American *Callimoxys* species, there is a noticeable north to south geographic cline in phenotypic characters, with southern populations tending to be larger, more darkly colored, and the punctation and microsculpture coarser, deeper, and closer. Three specimens (2 males, 1 female) from Missouri had typical pronotal coloration for the species, however, the legs were entirely black, punctation coarser and more contiguous, narrow interocular distance, and other morphometric measures were borderline between *C. sanguinicollis* and *C. pinorum*, and may indicate a hybrid population.

Callimoxys pinorum Casey, 1924, new status

(Figs. 1, 5A, 6B, 7C–D, 8C–D, 10C, 12)

Callimoxys pinorum Casey, 1924: 261.

Material Examined. 10 females, 6 males.

Holotype. Male (USNM), examined; labeled "Southern Pines, A.H. Manee, NC, TYPE USNM 36013, CASEY bequest 1925, *pinorum* Csy".

Type Locality. Southern Pines, North Carolina.

Diagnosis. This species is separated from other *Callimoxys* species by the following combination of characters: pronotum orange in both sexes; metatibiae dark, black, or if bicolored, lighter areas restricted to basal 1/5; dorsal interocular distance moderately wide; head proportionally narrower than pronotal width; pronotal punctures contiguous over entire surface, punctures reticulate with sharp, linear edges, with very fine granulate to alutaceous microsculpture between and within punctures, pronotal surface appearing dull; elytra short, dehiscing near middle; wings dark, heavily pigmented, especially in apical third and near veins RA3+4, r4, and rp-mp2; punctation of episterna and abdominal sternites coarse and contiguous; modified metatibial punctures larger and coarser, dagger-like; males with moderately elongate metafemoral club; median lobe of aedeagus apically blunt with ventral lobe short, apex longer than basal apophyses; internal sac spicules capitate, variable in size, oriented in transverse oblique rows.

Redescription. Male. Similar to *C. sanguinicollis* except as in the following: **Length**: 8.5–10.5 mm (n = 6). **Color**: Antennae dark brown to black. Pronotum and proepisterna orange, procoxae black. Elytra dark brown to black, often with scutellum, humeri, and apices darker. Metatibia entirely dark brown to black, or if slightly bicolored, pale areas limited to basal 1/5. Tarsomeres dark brown, often

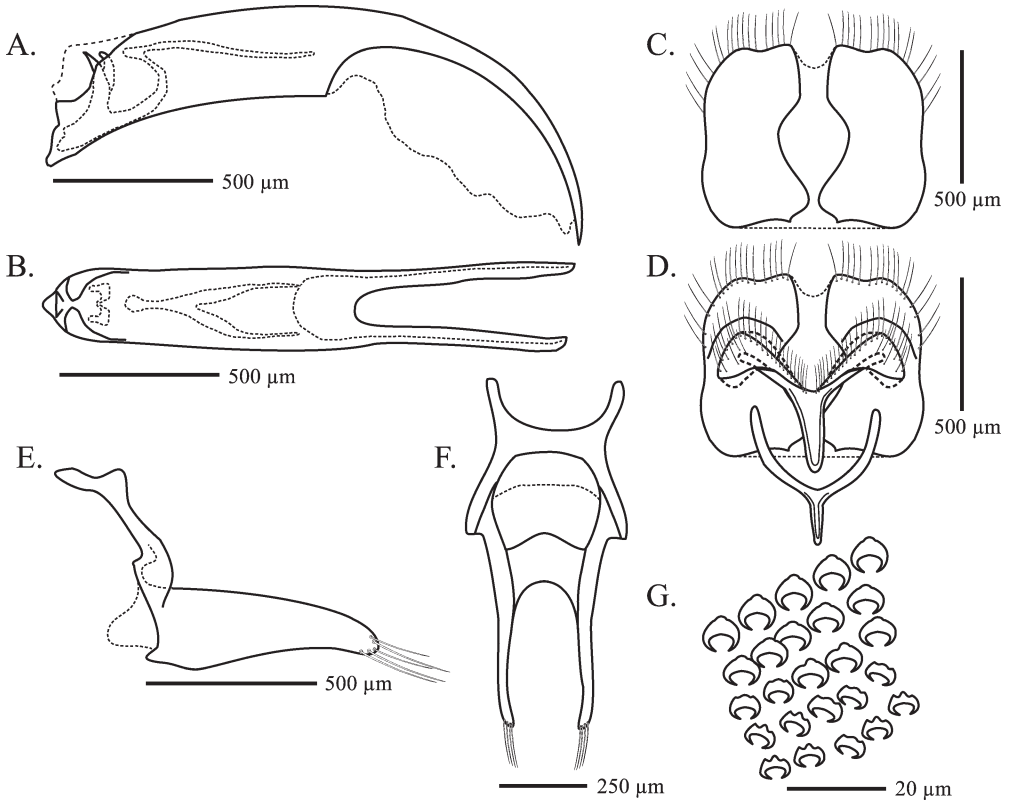

Fig. 12. Genitalic structures of male *Callimoxys pinorum*. A) Median lobe of aedeagus, lateral view, B) Median lobe, dorsal view, C) Tergite VIII, D) Sternite VIII and spiculum ventrale, ventral view, E) Tegmen, lateral view, F) Tegmen, dorsal view, G) Basolateral spicules of internal sac.

with segment 1 slightly paler at base. **Head**: Narrow across eyes (HW/PW = 0.93–0.98). Interocular distance moderately wide (ID/HW = 0.29–0.30). Clypeus evenly punctate and setose, some specimens less punctate apically. Neck moderately wide (NW/HW = 0.51–0.71). Genae very short (GL/FH = 0.15–0.20). Eye narrow (TEL/EH = 0.66–0.79); upper eye lobe moderately long (UEL/TEL = 0.45–0.58), lower eye lobe triangular, moderately short (LEL/ELW = 0.19–0.29), height > length (LEH/LEL = 1.11–1.29), with long posterior sinuation (TEL/LEL = 1.26–1.47) and large postocular temple, lower eye lobes ventrally short (VEL/PGC = 0.28–0.31). **Antennae**: Overall length reaching elytral apex, ≤3/4 of total body length (TAL/TL = 0.67–0.75). Antennomere 1 length ≥3X width (A1L/A1W = 3.06–3.18); antennomere 3 longer, >2/3 length of antennomere 1 (A3L/A1L = 0.68–0.85); antennomeres 4 and 5 subequal to antennomere 1 (A4L/A1L = 0.90–1.10; A5L/A1L = 0.78–1.15); antennomere 5 ≤5X longer than wide (A5L/A5W = 4.10–5.00); antennomere 9 approximately 3.2X longer than wide (A9L/A9W = 3.05–3.44); antennomere 10 approximately 3X longer than wide (A10L/A10W = 2.89–3.33); antennomere 11 approximately 4X longer than wide (A11L/A11W = 3.68–4.27). Antennal formula: 0.111–0.143:0.019–0.025:0.090–0.097:0.109–0.128:0.111–0.128:0.090–0.099:0.088–0.097:0.080–0.090:0.081–0.090: 0.071–0.075:0.090–0.096. **Pronotum**: Width subequal to length (PW/PL = 0.95–1.05), about 90% of elytral width (PW/ELW = 0.86–0.94), about 40% of elytral length (PL/ELL = 0.36–0.41). Pronotal width across apical sulcus very narrow (PAS/PW = 0.72–0.80), with apical sulcus moderately impressed. Pronotal height across posterior tubercles tall (PD/ELW = 0.55–0.59). Pronotal disk punctation irregularly shaped, reticulate, deep, contiguous over entire pronotum, area between and within punctures granulate to alutaceous. Pronotum laterally with an elongate, longitudinally oriented, strongly protuberant tubercle. **Sternum**: Prosternum moderately short (PSL/PL = 0.26–0.52). Mesocoxal process moderately wide (MSD/ELW = 0.25–0.28). Metepisternal punctation double; smaller and larger punctures, both moderately deep, contiguous, finely

reticulate. Metasternum short (LMT/ELW = 0.51–0.69), punctation double; smaller and larger punctures, both moderately deep, contiguous, finely reticulate. **Elytra**: Elytra short (ELL/ELW = 2.29–2.52) leaving ±3 apical abdominal tergites exposed, dehiscing from about basal third to near middle (ELD/ELL = 0.22–0.44). **Scutellum**: Bilobed. **Wings**: Wing infuscate, increasingly darker from base to apical 1/3, darkly infuscate along veins RA1+2, RA3+4, r4, MP1+2 and rp-mp2; veins r3 and RP moderately developed; vein r4 with anterior terminus translucent. **Legs**: Protibial pubescence double; golden, long, thin erect seta, on most of protibia, and golden, shorter, stouter, semi-erect seta on underside and at the apex. Protarsus about 2/3 length of protibia; protarsomere 1 filiform, about 2X as long as wide (Pt1L/Pt1W = 1.94–2.24), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.57–0.75); protarsomere 2 emarginate and evenly widened apically, length subequal to width (Pt2L/Pt2W = 0.91–1.07); protarsomere 3 strongly bilobed, slightly asymmetrical, posterior lobe ≥ length of anterior lobe, slightly longer than wide (Pt3L/Pt3W = 1.06–1.36). Mesofemur short (MSL/ELW = 0.96–1.18), pedicel relatively thin, with apical club just under half the length of mesofemur (MSCL/MSL = 0.42–0.49), apical club about 2X as long as wide (MSCL/MSCW = 1.96–2.20); punctation dense on pedicel, under- and topside of femur, to impunctate centrally on anterior and posterior club faces, each puncture bearing a golden, long, thin erect seta. Mesotibia with strong, transverse microsculpture. Mesotarsus about 3/4 length of mesotibia; mesotarsomere 1 filiform and narrow, about 2.5X as long as wide (Ms1L/Ms1W = 2.21–2.87), about 3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.74–0.80); mesotarsomere 2 emarginate, length subequal to width (Ms2L/Ms2W = 0.93–1.32). Mesotarsomere 3 slightly longer than wide (Ms3L/Ms3W = 1.00–1.25). Metafemur relatively short and stout (MTL/ELW = 1.79–2.11), pedicel stout, with apical club just over 1/3 length of the metafemur (MTCL/MTL = 0.30–0.48), apical club about 2.5X as long as wide (MTCL/MTCW = 2.32–2.59). Metatibia with outer margin bearing ±2 rows of modified punctures with the anterior margins greatly elongate and asperate, forming long, coarse teeth. Metatarsomere 1 filiform and narrow, about 3.8X as long as wide (Mt1L/Mt1W = 3.62–4.00), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.98–1.15; metatarsomere 2 truncate, slightly longer than wide (Mt2L/Mt2W=1.08–1.28); metatarsomere 3 slightly longer than wide (Mt3L/Mt3W = 1.11–1.29); metatarsomere 5 shorter than metatarsomere 1. **Abdomen**: First abdominal sternite long (ASL/ELW = 0.75–0.93); segment 4 subequal in length to segment 3, very broadly emarginate to transverse. Segment 5 shorter than segment 4, apical margin broadly emarginate to transverse. Sternite punctation close to contiguous with moderately to densely impressed transverse microsculpture. **Genitalia**: Tergite VIII broad, sinuate laterally; apical margin sinuate with fine, scattered, medium pubescence. Sternum VIII with basal arm long and broad, subequal to or slightly longer than lateral arms, apex broadly rounded. Spiculum ventrale with basal arms short and broad, 1/3 length to as long as the lateral arms, apex broadly rounded. Tegmen with apical apophyses relatively wide basally and gradually narrow apically, in lateral view. Median lobe apex longer than basal apophyses, and strongly curved overall. Spicules of the internal sac capitate, variable in size, and oriented into transverse oblique rows.

Female. Similar to male except as follows: **Length**: 8.5–14.0 mm (*n* = 10). **Head**: Narrow across eyes (HW/PW = 0.78–0.91). Interocular distance moderately wide (ID/HW = 0.33–0.38). Neck moderately wide (NW/HW = 0.56–0.78). Genae very short (GL/FH = 0.18–0.25). Eye narrow (TEL/EH = 0.61–0.76); upper eye lobe moderately long (UEL/TEL = 0.45–0.58), lower eye lobe moderately short (LEL/ELW = 0.14–0.21), height > length (LEH/LEL = 1.12–1.43), with long posterior sinuation (TEL/LEL = 1.26–1.62) and large postocular temple, lower eye lobes ventrally short (VEL/PGC = 0.18–0.30). **Antennae**: Overall length reaching elytral apex, shorter than 3/4 of total body length (TAL/TL = 0.54–0.71). Antennomere 1 length ≥3X width (A1L/A1W = 2.94–3.41). Antennomere 3 longer, ≥2/3 length of antennomere 1 (A3L/A1L = 0.68–0.82); antennomeres 4 and 5 slightly shorter than antennomere 1 (A4L/A1L = 0.81–1.02; A5L/A1L = 0.73–1.10); antennomere 5 <4.5X longer than wide (A5L/A5W = 3.47–4.44); antennomere 9 about 3X longer than wide (A9L/A9W = 2.83–3.55); antennomere 10 ≤3X longer than wide (A10L/A10W = 2.39–3.05); antennomere 11 <4X longer than wide (A11L/A11W = 2.76–3.87). Antennal formula: 0.116–0.151:0.020–0.025:0.088–0.104:0.106–0.129:0.111–0.129:0.090–0.099:0.087–0.099:0.077–0.091:0.079–0.092:0.070–0.084:0.084–0.096. **Pronotum**: Width ≥ length (PW/PL = 1.00–1.18), about 90% of elytral width (PW/ELW = 0.83–0.97), about 40% of elytral length (PL/ELL = 0.32–0.42). Pronotal width across apical sulcus very narrow (PAS/PW = 0.71–0.77). Pronotum height across posterior tubercles tall (PD/ELW = 0.51–0.58). **Sternum**: Prosternum moderately short (PSL/PL = 0.20–0.55). Mesocoxal process moderately wide (MSD/ELW = 0.24–0.30). Metasternum short (LMT/ELW = 0.59–0.67). **Elytra**: Elytra short (ELL/ELW = 2.12–2.45), dehiscing from about basal third to half (ELD/ELL = 0.22–0.45).

Legs: Protarsomere 1 filiform, about 2X as long as wide (Pt1L/Pt1W=1.82–2.31), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.59–0.70); protarsomere 2 emarginate and evenly widened apically, length ≤ width (Pt2L/Pt2W = 0.81–1.08); protarsomere 3 slightly longer than wide (Pt3L/Pt3W = 1.04–1.23). Mesofemur short (MSL/ELW = 0.81–1.12), apical club just under half the length of mesofemur (MSCL/MSL = 0.42–0.53), apical club about 2X as long as wide (MSCL/MSCW = 1.85–2.13). Mesotarsomere 1 filiform and narrow, <2.5X as long as wide (Ms1L/Ms1W = 2.06–2.82), about 3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.62–0.81); mesotarsomere 2 emarginate, length subequal to width (Ms2L/Ms2W = 0.86–1.22); mesotarsomere 3 slightly longer than wide (Ms3L/Ms3W = 1.04–1.30). Metafemur moderately short and stout (MTL/ELW = 1.63–1.90), apical club just over 1/3 length of the metafemur (MTCL/MTL = 0.29–0.44), apical club <2.5X as long as wide (MTCL/MTCW = 2.07–2.38). Metatarsomere 1 filiform and narrow about 3.5X as long as wide (Mt1L/Mt1W = 3.07–3.94), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.78–1.12); metatarsomere 2 truncate, slightly longer than wide (Mt2L/Mt2W = 0.96–1.44); metatarsomere 3 slightly longer than wide (Mt3L/Mt3W = 1.04–1.45); metatarsomere 5 shorter than tarsomere 1. **Abdomen**: First abdominal sternite long (ASL/ELW = 0.81–0.93). Segment 5 shorter than segment 4, apical margin broadly emarginate to transverse.

Hosts. Unknown.

Flower and Associated Vegetation Records. *Cornus foemina*.

Remarks. The taxonomic history of this species is somewhat confusing. The only reference to this species we could find subsequent to the original description by Casey was Linsley (1963), who included this species as a synonym of *C. sanguinicollis sanguinicollis.* However, he placed a question mark in front of the species name suggesting that he was either unsure of this species status or had not actually examined the specimen.

This species is unique among *Callimoxys* species as the pronotum is colored completely orange to red in both sexes, which was never observed in *C. sanguinicollis*. The holotype tends to be lighter colored, pronotum less densely punctured, and abdominal sternite punctation and microsculpture less coarse and dense than is typical of more southern specimens (as in figures). Unfortunately, Casey's type specimen of *C. pinorum* has suffered dermestid damage but enough of the terminal abdominal segments are present to identify the specimen as male, although the genitalic structures are missing. This species is difficult to separate from *C. sanguinicollis*, however, the narrower interocular distance, pronotal coloration and punctation, generally larger body size, and coarser punctation of the sterna and legs are typical. This species is relatively rare, collected only from the southeastern and gulf states.

Callimoxys fuscipennis (LeConte, 1861), new status

(Figs. 1, 5B, 6C, 6H, 7E–F, 8E–F, 10D, 13)

Stenopterus fuscipennis LeConte, 1861: 356
Callimoxys fuscipennis Leng 1886: 30

Material Examined. 983 females, 1,500 males.

Holotype. Female (MCZ), examined; labeled "S. Mateo, type 3891, *Callimoxys fuscipennis*, MCZT_3891".

Type Locality. San Mateo, California.

Diagnosis. This species is separated from other *Callimoxys* species by the following combination of characters: gena long; eye oriented obliquely; eye deeply sinuate posteriorly; lower eye lobe moderately long and laterally flat; pronotum with shallow subapical sulcus, slightly longer than wide, with a single pair of moderately elevated, longitudinal, dorsolateral tuberosities; elytra long, dehiscing in basal third; abdominal punctation almost contiguous, pubescence dense, often obscuring surface; apical margin of tergite VIII deeply emarginate to almost bilobed; median lobe of aedeagus pointed with ventral lobe long; tegmen apical apophyses laterally narrow and gradually converging toward apex.

Redescription. Male. Similar to *C. sanguinicollis* except for the following: **Length**: 7–11 mm (n = 32). **Color**: Pronotum usually solid black, rarely with part of dorsal tubercles lighter. Pro- and mesofemur variably colored from wholly dark brown or black to club dark and pedicel lighter. Pro- and mesotibia in most specimens brown to black with basal 1/4 yellow, to wholly dark; tarsi bicolored light brown with apex darker to entirely light brown**.** Metatibia yellow, some specimens with apical 1/3 light brown. **Head**: Moderately broad across eyes (HW/PW = 0.90–1.00). Interocular distance wide (ID/HW = 0.27–0.33). Labrum truncate to broadly emarginate, setae in one apical and one sub-basal row, sub-basal row partial in some specimens; clypeus evenly but sparsely punctate, some specimens slightly less punctate medially than laterally. Neck moderately wide (NW/HW = 0.53–0.75). Clypeus and genae long (GL/FH = 0.28–0.37). Apical portion of gula with large, shallow punctures, occasionally appearing somewhat rugulose. Eyes oriented obliquely, eye moderately wide (TEL/EH = 0.70–0.86); upper eye lobe short (UEL/TEL = 0.42–0.53), lower eye lobe short (LEL/ELW = 0.19–0.30), height subequal to length (LEH/LEL = 0.99–1.21), with long posterior sinuation (TEL/LEL = 1.27–1.62), lower eye lobes ventrally long (VEL/PGC = 0.51–0.77).

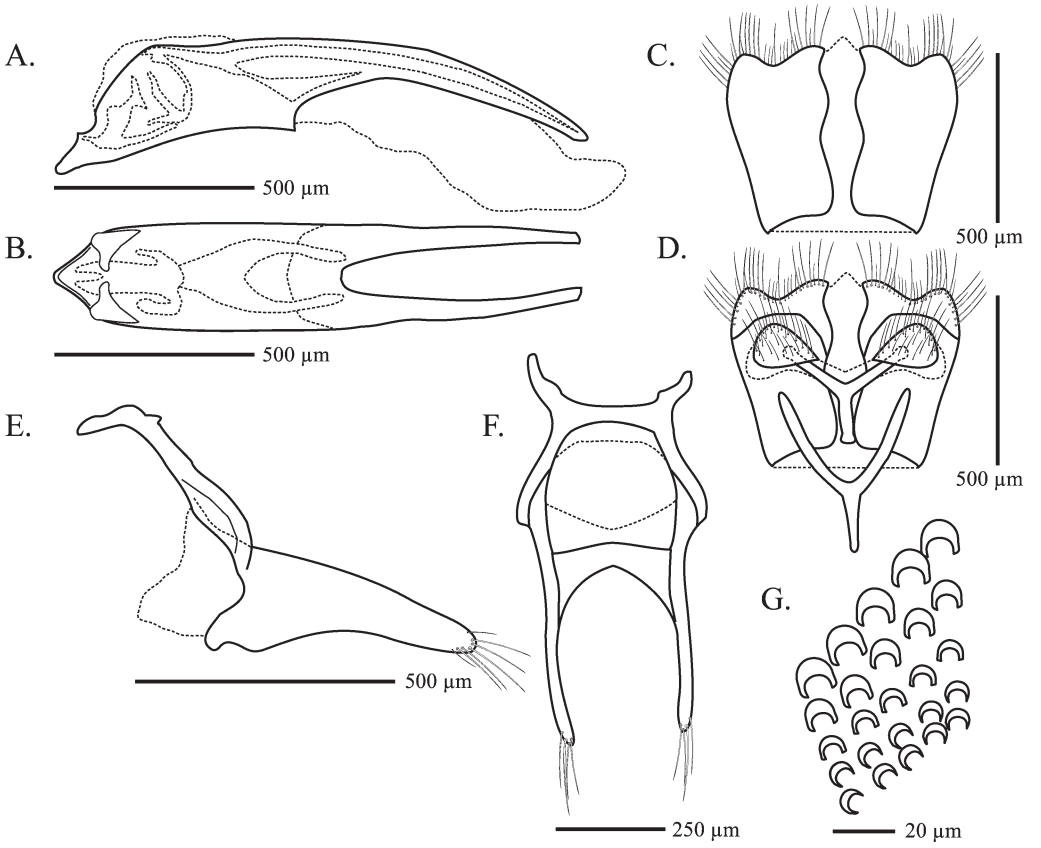

Fig. 13. Genitalic structures of male *Callimoxys fuscipennis*. A) Median lobe of aedeagus, lateral view, B) Median lobe, dorsal view, C) Tergite VIII, D) Sternite VIII and spiculum ventrale, ventral view, E) Tegmen, lateral view, F) Tegmen, dorsal view, G) Basolateral spicules of internal sac.

Antennae: Overall length reaching apex of elytra, ≥3/4 of total body length (TAL/TL = 0.66–0.92). Antennomere 1 length about 3X width (A1L/A1W = 2.83–3.33); antennomere 3 long, ≥3/4 length of antennomere 1 (A3L/A1L = 0.68–1.07); antennomeres 4 and 5 subequal to antennomere 1 (A4L/A1L = 0.83–1.24; A5L/A5W = 0.77–1.24); antennomere 5 ≥4.5X longer than wide (A5L/A5W = 4.50–5.73); antennomere 9 >3.5X longer than wide (A9L/A9W = 3.63–4.67); antennomere 10 ≥3.2X longer than wide (A10L/A10W = 3.21–4.20); antennomere 11 >4X longer than wide (A11L/A11W = 4.07–5.08). Antennal formula: 0.092–0.137:0.019–0.024:0.074–0.099:0.095–0.122:0.106–0.132:0.090–0.106:0.093–0.106:0.087–0.098:0.085–0.097:0.077–0.089:0.087–0.104. Apical 4 antennomeres ovoid in cross section at mid-length. **Pronotum**: Width shorter than length (PW/PL = 0.90–0.98), much narrower than base of elytra (PW/ELW = 0.76–0.86), and about 1/3 length of elytra (PL/ELL = 0.31–0.34). Subapical collar reduced. Pronotal width across apical sulcus moderately broad (PAS/PW = 0.74–0.84), with apical sulcus shallowly impressed. Length of basal transverse marginal depression subequal in length to apical depression. Dorsally with 1 pair of sublateral tubercles, moderately elevated and rounded; some specimens with a linear, median, basally punctate, elevated area between tubercles, sometimes narrowed to form a keel. Pronotal height across posterior tubercles short (PD/ELW = 0.40–0.55). Pronotum laterally with longitudinally oriented slightly protuberant tubercle. Posteroventral area of pronotum with rugose carina fused to posterior portion of the lateral tubercle, or separated from it by a shallow groove and forming the margin of the tubercle. **Sternum**: Prosternum short (PSL/PL = 0.21–0.44), subapical collar slightly elevated. Mesocoxal process moderately wide (MSD/ELW = 0.16–0.24), apex slightly to deeply emarginate.

Metepisternal punctation double; smaller and larger punctures, both shallow, evenly impressed to apical margin slightly raised, slightly transverse to circular, separated by 0.5–1.0X diameter of puncture throughout; pubescence white to golden, double, with longer erect hairs and smaller depressed hairs that partially obscure surface. Metasternum short (LMT/ELW = 0.57–0.71), punctures medium to small, moderately deep, oval to transverse, separated by ≥1X puncture diameter. **Elytra**: Elytra moderately long (ELL/ELW = 2.50–2.82) leaving ±2 apical abdominal tergites exposed, dehiscing from basal 1/3 (ELD/ELL = 0.16–0.40), apical half narrow, apex rounded to pointed; pubescence in basal 1/3 erect to semi-erect, dense. **Scutellum**: Emarginate to bilobed, with dense, long, white, depressed pubescence. **Wings**: Wings infumate, slightly darker from base to apical 1/3, darkly infumate along veins RA1+2, RA3+4, r4, MP1+2 and rp-mp2; veins r3 and RP greatly developed; vein r4 dark along entire length. **Legs**: Protrochanter strongly pointed. Profemur with apical club ≥half the length of the profemur, punctation double, with large and small, moderately deep, circular punctures. Protarsomere 1 filiform, ≤1.8X as long as wide (Pt1L/Pt1W = 1.29–1.85), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.57–0.71); protarsomere 2 goblet-shaped, sides widened abruptly beyond base, length ≤3/4 width (Pt2L/Pt2W = 0.68–0.86); protarsomere 3 bilobed, symmetrical, lobes equal length but posterior lobe slightly thicker, length subequal to width (Pt3L/Pt3W = 0.90–1.09). Mesofemur short (MSL/ELW = 0.92–1.49), with apical club less than half length of mesofemur (MSCL/MSL = 0.38–0.48), apical club ≥2X as long as wide (MSCL/MSCW = 1.96–2.34), club punctation dense on anterior club face, punctation double, with large and small, moderately deep, circular punctures. Mesotarsomere 1 filiform, about 2.3X as long as wide (Ms1L/Ms1W = 1.88–2.92), about 3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.66–0.86); mesotarsomere 2 goblet-shaped, sides widened abruptly beyond base, length ≤ width (Ms2L/Ms2W = 0.76–1.00); mesotarsomere 3 bilobed, asymmetrical, anterior lobe slightly longer and thicker, length subequal to width (Ms3L/Ms3W = 0.96–1.30). Metafemur moderately long (MTL/ELW = 1.78–2.02), pedicel long, with apical club just over 1/3 length of the metafemur (MTCL/MTL = 0.31–0.48), apical club ≥2X as long as wide (MTCL/MTCW = 2.05–2.43), pedicel with large and small transverse, shallow to moderately deep, relatively sparse punctures; club usually with punctation coarser and denser on anterior club face**,** with large and small transverse and circular punctures with elevated anterior margins that range from shallow to deep on anterior and posterior club faces. Metatarsomere 1 filiform, >3X as long as wide (Mt1L/Mt1W = 3.13–4.00), slightly longer than metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 1.03–1.30); metatarsomere 2 triangular, sides widened evenly beyond base, slightly longer than wide (Mt2L/Mt2W = 1.05–1.50); metatarsomere 3 bilobed, asymmetrical, anterior lobe longer and thicker, length subequal to width (Mt3L/Mt3W = 0.96–1.17). **Abdomen**: First abdominal segment moderately short (ASL/ELW = 0.66–0.82), distinctly shorter than next two segments combined; segment 4 about 3/4 length of segment 3. Segments 1–4 densely punctate and pubescent, surface of sternum obscured. Segment 5 shorter than segment 4, broadly trapezoidal, apical margin broadly sinuate with margin elevated, punctation and sculpture similar to previous segments; dense field of long posteriomedially directed hairs laterally, forming a line or brush of transverse setae along posterior sternal margin; microsculpture transverse laterally effaced medially. **Genitalia**: Tergite VIII apically broad, lateral margins slightly sinuate; apical margin emarginate to bilobed, with a combination of long and short pubescence. Sternite VIII and spiculum ventrale with basal arms short, ≤length of lateral arms, apex broadly rounded to truncate. Posterior ring of tegmen with lateral arms narrow basally in lateral view. Tegmen apical apophyses moderately wide basally and evenly converge towards apex, in lateral view. Median lobe with apical region ≤length to the basal apophyses; the apex oriented obliquely appearing elongate and pointed in lateral view, ventral lobe much longer and more angulate than dorsal lobe; ventral lobe elongate and pointed in dorsal view. Spicules of the internal sac capitate, variable in size, and oriented into transverse oblique rows.

Female. Similar to male, except as follows: **Length**: 9–12.5 mm (*n* = 31). **Color**: Pronotum orange with apical and basal margins black in most specimens, some specimens completely orange, rarely completely black. **Head**: Narrow across eyes (HW/PW = 0.84–0.93). Interocular distance moderately wide (ID/HW = 0.30–0.39). Labrum truncate to broadly emarginated, setae in one apical and one sub-basal row, sub-basal row partial in some specimens; clypeus evenly but sparsely punctate, some specimens slightly less punctate medially than laterally. Neck wide (NW/HW = 0.59–0.76). Front and genae long (GL/FH = 0.31–0.42). Apical portion of gula not rugulose. Eyes oriented obliquely, eye moderately wide (TEL/EH = 0.72–0.82); upper eye lobe short (UEL/TEL = 0.41–0.47); lower eye lobe short (LEL/ELW = 0.17–0.27), height subequal to length (LEH/LEL = 0.96–1.20), with long posterior sinuation (TEL/LEL = 1.28–1.58), lower eye lobes ventrally long (VEL/PGC = 0.50–0.63). **Antennae**: Overall length almost reaching apex of elytra, ≤2/3 of total body length (TAL/TL =

0.57–0.70). Antennomere 1 length about 3X width (A1L/A1W = 2.69–3.33); antennomere 3 short, ≤3/4 length of antennomere 1 (A3L/A1L = 0.66–0.77); antennomere 4 shorter than antennomere 1 (A4L/A1L = 0.81–0.97); antennomere 5 subequal to antennomere 1 (A5L/A5W = 0.78–1.09); antennomere 5 ≥4.3X longer than wide (A5L/A5W = 4.35–5.57); antennomere 9 ≥3X longer than wide (A9L/A9W = 2.9–3.58); antennomere 10 about 3X longer than wide (A10L/A10W = 2.63–3.29); antennomere 11 about 3.5X longer than wide (A11L/A11W = 3.05–4.20). Antennal formula: 0.111–0.144:0.020–0.027:0.078–0.110:0.101–0.137:0.112–0.130:0.088–0.102:0.087–0.099:0.074–0.090:0.077–0.092:0.067–0.084:0.079–0.097. **Pronotum**: Width subequal to length (PW/PL = 0.94–1.08), much narrower than base of elytra (PW/ELW = 0.75–0.88), and about 1/3 length of elytra (PL/ELL = 0.30–0.33). Pronotal width across apical sulcus moderately broad (PAS/PW = 0.78–0.87). Pronotal height across posterior tubercles short (PD/ELW = 0.45–0.54). Pronotal microsculpture absent on most of dorsal surface. **Sternum**: Prosternum short (PSL/PL = 0.21–0.44). Mesocoxal process moderately wide (MSD/ELW = 0.19–0.27). Metasternum moderately short (LMT/ELW = 0.53–0.77). **Elytra**: Elytra moderately long (ELL/ELW = 2.52–2.86), dehiscing from basal 1/3 (ELD/ELL = 0.15–0.37). **Legs**: Profemur with transverse microsculpture somewhat effaced on petiole, absent on club. Protarsomere 1 filiform, ≤1.7X as long as wide (Pt1L/Pt1W = 1.15–1.73), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.54–0.70); protarsomere 2 length ≥2/3 width (Pt2L/Pt2W = 0.61–0.90); protarsomere 3 length subequal to width (Pt3L/Pt3W = 0.85–1.11). Mesofemur short (MSL/ELW = 0.89–1.22), with apical club usually less than half length of mesofemur (MSCL/MSL = 0.40–0.61), apical club ≥2X as long as wide (MSCL/MSCW = 1.86–2.60), transverse microsculpture somewhat effaced on petiole, absent on club. Mesotarsomere 1 filiform, about 2X as long as wide (Ms1L/Ms1W = 1.83–2.25), ≥3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.73–0.91); mesotarsomere 2 length < width (Ms2L/Ms2W = 0.67–0.94); mesotarsomere 3 length subequal to width (Ms3L/Ms3W = 0.96–1.19). Metafemur moderately long (MTL/ELW = 1.63–1.97), apical club just over 1/3 length of the femur (MTCL/MTL = 0.30–0.47), apical club ≥2X as long as wide (MTCL/MTCW = 1.86–2.59), transverse microsculpture somewhat effaced on petiole, absent on club. Metatarsomere 1 filiform, ≥3X as long as wide (Mt1L/Mt1W = 3.00–4.06), slightly longer than metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.98–1.34); metatarsomere 2 slightly longer than wide (Mt2L/Mt2W = 1.05–1.41); metatarsomere 3 slightly longer than wide (Mt3L/Mt3W = 1.00–1.23). **Abdomen**: First abdominal segment short (ASL/ELW = 0.68–0.80). Segment 5 apical margin broadly sinuate with margin elevated.

Hosts. *Ceanothus* sp., *Ceanothus crassifolius* Torr. (hoaryleaf ceanothus), based on specimen label data. *Ceanothus thyrsiflorus* Eschsch. (blueblossom), *Ceanothus integerrimus* Hook. & Arn. (deer brush), *Lithocarpus densiflora* (Hook. and Arn) (tanoak), *Quercus* sp., *Quercus agrifolia* Nee (California live oak), *Quercus douglasii* Hook. and Arn (blue oak), *Quercus kelloggii* Newberry (California black oak), *Toxicodendron diversiloba* (Torr. and A. Gray) Greene (Pacific poison oak) (Linsley and Chemsak 1997).

Flower and Associated Vegetation Records. *Achillea millefolium* L. (yarrow), *Adenostoma fasciculatus* Hook. and Arn. (chamise), *Arctostaphylos* sp. (manzanita), *Calochortus* sp. (lily), *Ceanothus* sp., *Ceanothus cordulatus* Kellogg (mountain whitethorn), *C. crassifolius*, *Ceanothus incanus* Torr. A. Gray (coast whitethorn), *C. integerrimus*, *Ceanothus parviflorus* (S. Wats.) (littleleaf ceanothus), *Ceanothus velutinus* Dougl. ex. Hook. (snowbrush), *Cercocarpus betuloides* Nutt. (California mountain mahogany), *Conium maculatum* L. (poison hemlock), *Cornus glabrata* Benth. (brown dogwood), *Cornus nuttallii* Audobon (Pacific dogwood), *Crataegus* sp. (hawthorn), *Eriogonum* sp. (wild buckwheat), *Heracleum lanatum* Michx. (cow parsnip), *Holodiscus discolor (*Pursh) Maxim. (ocean spray), *Pinus jeffreyi* Balf. (Jeffrey pine), *Phacelia* sp. (phacelia), *Physocarpus* sp. (ninebark), *Prosopis* sp. (mesquite), *Prunus demissa* (Nutt.) Torr. (choke cherry), *Prunus emarginata* (Dougl. ex. Hook.) Eaton (bitter cherry), *Ptelea crenulata* (hoptree), *Quercus garryana* Douglas ex. Hook. (Garry oak), *Rhamnus* sp. (buckthorn), *Rhamnus californica* Eschsch. (California buckthorn), *Rhus* sp. (sumac), *Toxicodendron* sp. (poison oak), based on specimen label data.

Remarks. This species is clearly distinct from *C. sanguinicollis*, and is more similar to the European *C. gracilis*. The shape of abdominal tergite VIII, the narrower tegmen, and the different shape of the median lobe are unique to this species.

LeConte's type specimen of *C. fuscipennis* from San Mateo is atypical in that it is a female with a wholly black pronotum, the head and prothorax narrow, the metathorax and abdomen wide, and the apical margin of abdominal segment 4 with a small median process. We agree with an assertion made by Casey (1924) that *C. fuscipennis* tends to be structurally variable throughout its geographic range, with pronotal and femur coloration, thoracic and abdominal pubescence, and length of mesofemoral club showing variation. These differences, however, showed no clear phenotypic patterns, and often individuals within the same series varied. This species seems to have a very diverse host range and many

different flower records. Genetic examination from a range of locations may indicate several cryptic species. This species ranges from northern Washington, south into Mexico, and although the host plants for this species range into southern British Columbia, we could not confirm the presence of this species in Canada (Bousquet 1991).

Callimoxys ocularis Hammond and Williams, new species

(Figs. 1, 5C, 6D, 6J, 7G–H, 8G–H, 9A, 9C, 10E, 14)

Material Examined. 127 females, 159 males.

Holotype. "IOWA, Polk Co.,/W. Saylorville Lk./June 15, 17, 1984/Schief'rst'n & Wappes" [1 male (USNM)]. A red label was added to the specimen with the following: "HOLOTYPE/Callimoxys/ocularis/Hammond & Williams, 2011".

Paratypes. Male labeled: "IOWA, Polk Co.,/W. Saylorville Lk./June 15, 17, 1984/ Wappes & Schief'rst'n" (USNM); Male labeled: "IOWA, Polk Co.,/W. Saylorville Lk./June 15, 17, 1984/ Schief'rst'n & Wappes" (FSCA); 2 females labeled: "IOWA, Polk Co.,/W. Saylorville Lk./June 15, 17, 1984/Wappes & Schief'rst'n" (FSCA); Female labeled: "IOWA, Polk Co.,/W. Saylorville Lk./ June 21–30, 1984/R.H. Schieferstein" (USNM); Female labeled: "IOWA, Polk Co./W. Saylorville Lk./June 20, 1984/ Schief'rst'n & Wappes" (FSCA). A yellow label was added to each specimen with the following: "PARATYPE/Callimoxys/ocularis/ Hammond & Williams, 2011".

Type Locality. West Saylorville Lake, Polk County, Iowa.

Diagnosis. This species is separated from other *Callimoxys* species by the following combination of characters: gena moderate in length; eye oriented vertically; eye shallowly sinuate posteriorly; lower eye lobe large and globose, and ventrally long; pronotum with shallow apical collar, longer than wide; elytra moderately long, dehiscing in basal third; femora bicolored, yellow basally, apical club medium to dark brown, with a transverse line of demarcation between colors, meso- and metafemoral

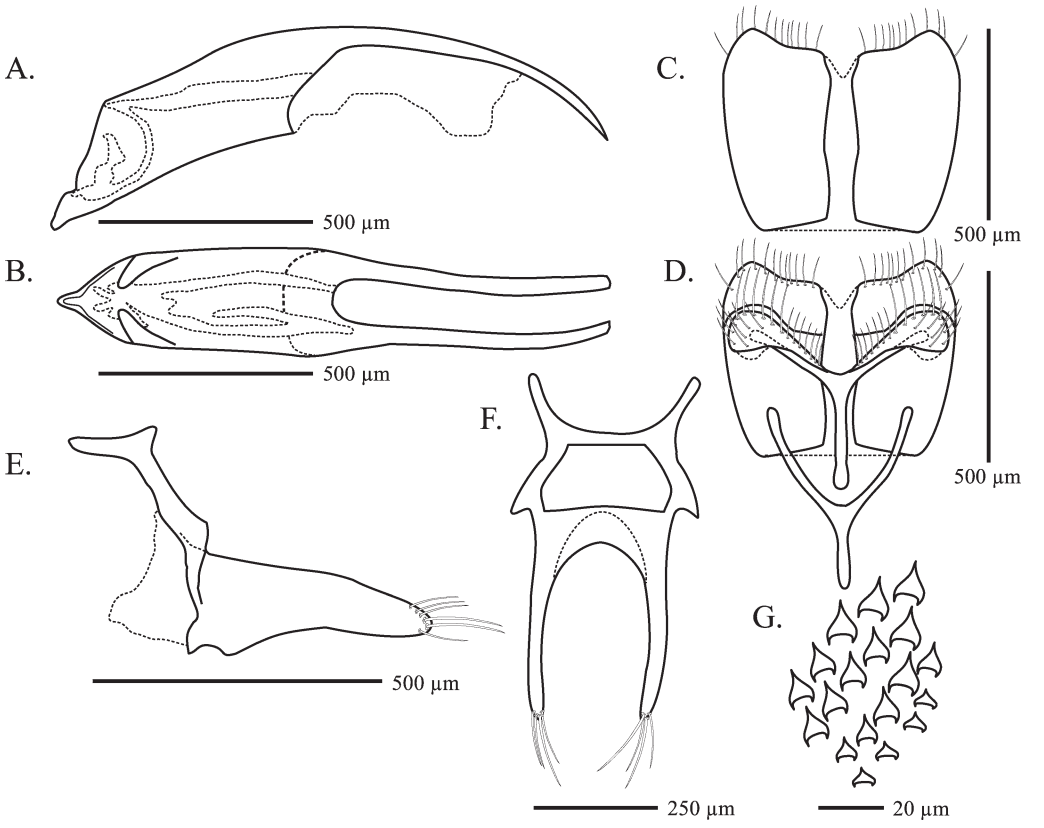

Fig. 14. Genitalic structures of male *Callimoxys ocularis*. A) Median lobe of aedeagus, lateral view, B) Median lobe, dorsal view, C) Tergite VIII, D) Sternite VIII and spiculum ventrale, ventral view; E) Tegmen, lateral view, F) Tegmen, dorsal view, G) Basolateral spicules of internal sac.

clubs short and globose; abdominal sterna with a combination of long, erect and short, recumbent setae medially, and a dense field of medium to long posteromedially directed setae laterally, punctures large and well-separated, with little to no microsculpture, sterna glossy; pro- and mesotarsus with second tarsomere triangular, gradually widened from base; third tarsomere asymmetrical on all legs, asymmetry increasing from anterior to posterior; apical margin of tergite VIII laterally produced; median lobe of aedeagus apically sharp with ventral lobe long and pointed; tegmen apical apophyses laterally evenly tapering towards apex.

Description. Male. Similar to *C. sanguinicollis* except as in the following: **Length**: 6.5–9mm (n = 26). **Color**: Dark brown to black except for the following: some apical antennomeres light brown in some specimens; elytra light to dark brown, with scutellum, humeri, and apices darker in some specimens; pro-, meso- and metafemur usually bicolored with sharp distinct line of demarcation between yellow pedicel and dark brown apical club, often with yellow extending onto the club, rarely entirely black; pro- and mesotibia and tarsi ranging from entirely yellow, to bicolored with base pale and apex light to dark brown, to entirely dark brown; metatibia yellow with apical 1/5 light to dark brown; metatarsus ranging from entirely yellow to bicolored yellow to light brown basally with apices darker. **Head**: Broad across eyes (HW/PW = 1.03–1.14). Interocular distance narrow (ID/HW = 0.20–0.27). Labrum truncate to slightly arcuate, setae mainly restricted to apical margin; clypeus sparsely punctuate medially. Neck moderately wide (NW/HW = 0.54–0.67). Clypeus short, genae moderately long (GL/FH = 0.16–0.25). Apical portion of gula punctate, with large circular, contiguous to slightly separated, moderately deep punctures, some specimens slightly transversely rugose. Setae absent in dorsal eye invagination, some specimens with one or two on antennal socket. Eyes oriented vertically, eye broad (TEL/EH = 0.78–0.85); upper eye lobe short (UEL/TEL = 0.45–0.51), lower eye lobe oblong triangular, long (LEL/ELW = 0.24–0.41), height subequal to length (LEH/LEL = 0.90–1.09) with posterior sinuation shallow (TEL/LEL = 1.09–1.32) and postocular temple small, lower eye lobes ventrally long (VEL/PGC = 0.54–1.00). **Antennae**: Overall length surpassing elytral apex, >3/4 of total body length (TAL/TL = 0.78–0.94). Antennomere 1 length about 3X width (A1L/A1W = 2.50–3.40); antennomere 3 ≥3/4 length of antennomere 1 (A3/A1L = 0.69–0.83); antennomere 4 subequal to antennomere 1 (A4/A1L = 0.91–1.05); antennomere 5 slightly longer than antennomere 1 (A5L/A1L = 0.87–1.20); antennomere 5 ≥5X longer than wide (A5L/A5W = 4.80–6.80); antennomere 9 >3.5X longer than wide (A9L/A9W = 3.69–4.85); antennomere 10 ≥3.5X longer than wide (A10L/A10W = 3.46–4.38); antennomere 11 >4X longer than wide (A11L/A11W = 4.21–5.15). Antennal formula: 0.010–0.120:0.018–0.025:0.073–0.095:0.095–0.120:0.104–0.125:0.096–0.106:0.095–0.104:0.088–0.100:0.089–0.098:0.078–0.089:0.094–0.107. Apical antennomeres ovoid in cross section at midlength. **Pronotum**: Width shorter than length (PW/PL = 0.88–1.00), much narrower than base of elytra (PW/ELW = 0.77–0.87), and about 1/3 length of elytra (PL/ELL = 0.30–0.35). Subapical collar reduced. Pronotal width across apical sulcus wide (PAS/PW = 0.76–0.89), with apical sulcus very shallow. Length of basal transverse marginal depression slightly narrower medially than apical depression. Dorsally with 2 pairs of sublateral tubercles; anterior pair smaller and ovoid coalescing with posterior pair, posterior pair slightly elevated and broadly rounded; often with a broad, median, basally elevated area between posterior tubercles. Pronotal height across posterior tubercles moderately tall (PD/ELW = 0.43–0.57). Pronotal disk punctation large, circular, moderately deep with punctures contiguous to separated by ~0.5X puncture diameter, with no microsculpture, surface appearing glossy between punctures. Posteroventral area of pronotum with a rugose carina between posterior margin and lateral tubercle which is not elevated higher than posterior margin, and is complete to upper margin of coxal cavity. **Sternum**: Prosternum long (PSL/PL = 0.23–0.51), apical collar slightly elevated. Mesocoxal process narrow (MSD/ELW = 0.17–0.24). Metepisternal punctation double; smaller and larger punctures, both shallow to moderately deep, evenly impressed, circular to transverse, anterior margins elevated, contiguous to separated by 0.5X diameter of puncture. Metasternum long (LMT/ELW = 0.63–0.80), punctures ranging from medium to small, moderately shallow, evenly impressed to anterior margins slightly elevated, circular to oval, separated by 1–2X puncture diameter on disk, contiguous at margins. Pubescence very sparse to moderately dense, with fine, long semi-erect to erect hairs and/or shorter depressed hairs. **Elytra**: Elytra moderately long (ELL/ELW = 2.50–2.92) leaving ±2 apical abdominal tergites exposed, dehiscing from basal third to nearly half (ELD/ELL = 0.18–0.44), apical half moderately narrow with apex pointed. **Wings**: Wings infumate, slightly darker from base to apical 1/3, darkly infumate along veins RA1+2, RA3+4, r4, MP1+2 and rp-mp2; veins r3 and RP slightly developed; vein r4 translucent at anterior terminus. Anal lobe veins Ap3 and AA4 tubular at base, dissolving into the membrane distally, with heavily pigmented stripe along leading edge. **Legs**: Procoxa transversely globose. Protrochanter pointed. Profemur short, with apical club greater than half length of profemur; punctation small, shallow,

circular, ranging from moderately dense on pedicel and underside of profemur, to moderately sparse on apical club faces, with anterior face of club denser in punctation than posterior face, each puncture bearing a white, long, thin erect seta. Protarsomere 1 filiform, about 2X as long as wide (Pt1L/Pt1W = 1.69–2.50), about 2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.56–0.79); protarsomere 2 triangular, sides slightly arcuate, length usually shorter than width (Pt2L/Pt2W = 0.72–1.15); protarsomere 3 bilobed, asymmetrical, anterior lobe slightly elongate, inner margins sub-parallel basally and diverging apically, slightly longer than wide (Pt3L/Pt3W = 0.95–1.25); protarsomere 5 longer than protarsomeres 1 and 2 combined, with a short blunt projection extending from apex ventrally. Mesotrochanter pointed. Mesofemur long (MSL/ELW = 0.95–1.42), pedicel relatively thin, with apical club under half the length of mesofemur (MSCL/MSL = 0.41–0.47), apical club >2X as long as wide (MSCL/MSCW = 2.24–2.80); punctation on pedicel small, slightly transverse, each bearing either a moderately long to long golden setae, punctation on anterior club face double, with a combination of larger circular to slightly transverse punctures bearing a longer semi-erect golden setae intermingled with small transverse punctures bearing a short golden depressed setae, punctation on posterior club face sparser, with a combination of larger slightly transverse punctures bearing a longer, finer, semi-erect golden setae intermingled with small transverse punctures bearing a short, fine golden, depressed setae. Mesotibia slightly shorter than to subequal to mesofemur. Mesotarsomere 1 filiform and narrow, about 2.4X as long as wide (Ms1L/Ms1W = 2.00–3.10), ≤3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.63–0.79); mesotarsomere 2 truncate, triangular with sides slightly arcuate, length usually shorter than width (Ms2L/Ms2W = 0.81–1.08); mesotarsomere 3 bilobed, asymmetrical, anterior lobe elongate, inner margins sub-parallel basally and diverging apically, longer than wide (Pt3L/Pt3W = 1.10–1.27); mesotarsomere 5 slightly longer than mesotarsomeres 1 and 2 combined. Metacoxa transverse. Metafemur long and narrow (MTL/ELW = 1.81–2.25), pedicel narrow, apical club just over 1/3 length of the metafemur (MTCL/MTL = 0.34–0.46), apical club usually ≤2.5X as long as wide (MTCL/MTCW = 2.21–2.69); punctation on pedicel small, slightly transverse, each bearing either a moderately long to long golden setae, punctation on anterior club face mostly of large, sparse, circular to slightly transverse punctures, with apical margins elevated, bearing a long, golden, semi-erect seta; punctation on posterior club face of medium sized, sparse, circular to oval, punctures, with apical margins elevated, bearing a long, golden semi-erect seta. Moderately deeply impressed transverse microsculpture on pedicel, somewhat effaced but visible on club. Metatibia subequal in length to metafemur. Outer margin of metatibia bearing 2 irregular rows of modified punctures with the anterior margins greatly elongate and asperate forming moderately long, coarse teeth each bearing a long fine golden setae; remaining punctures a mixture of small, transverse, shallow and slightly larger asperate punctures. Metatarsus about 1/3 length of metatibia. Metatarsomere 1 filiform and narrow, about 3.4X as long as wide (Mt1L/Mt1W = 2.72–3.91), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.88–1.16); metatarsomere 2 truncate, triangular, length subequal to width (Mt2L/Mt2W = 0.88–1.31); metatarsomere 3 strongly bilobed asymmetrical, anterior lobe elongate, inner margins sinuate, convergent basally and divergent apically, longer than wide (Mt3L/Mt3W = 1.11–1.32); metatarsomere 5 subequal in length to metatarsomere 1, with a short blunt projection extending from the apex ventrally. **Abdomen**: First abdominal segment moderately long (ASL/ELW = 0.62–0.92), shorter than next two segments combined; segment 4 about 3/4 as long as segment 3, broadly emarginate at medial apex. Punctation of segments 1–4 range in size from large to small punctures, circular to transverse, most with anterior edges slightly raised, separated by >3X puncture diameter, each bearing a long, fine, erect to sub-erect white seta. Sternites with shallowly impressed, transverse, sparse, microsculpture, glossy. Segment 5 slightly shorter than segment 4, laterally convergent towards apex, with apical margin broadly emarginate in middle, punctation small and sparse with transverse microsculpture. **Genitalia**: Tergite VIII broad, rounded laterally, apical margin slightly sinuate with lateral margin slightly extended, with fine scattered short to medium pubescence. Sternite VIII with basal arm long, subequal to or slightly longer than lateral arms, apex blunt to rounded. Spiculum ventrale with basal arm about 3/4 to subequal to lateral arms, apex rounded. Posterior ring of tegmen with lateral arms narrow basally in lateral view; apical apophyses relatively wide basally narrowing evenly from apical 1/3 to apex, in lateral view. Median lobe apex shorter in length than basal apophyses; the apex oriented horizontally appearing elongate and pointed in lateral view, ventral lobe much longer and more angulate than dorsal lobe; ventral lobe elongate and sharply pointed in dorsal view. Spicules of the internal sac triangular aciculate, variable in size, and oriented into transverse oblique rows.

Female. Similar to male except as follows: **Length**: 6.5–11 mm (*n* = 33). **Color**: Pronotum orange. **Head**: Broad across eyes (HW/PW = 0.92–1.02). Interocular distance narrow (ID/HW = 0.25–0.33). Neck moderately wide (NW/HW = 0.56–0.74). Clypeus and genae moderately long (GL/FH = 0.20–0.31). Eyes oriented vertically, eye moderately

broad (TEL/EH = 0.68–0.84); upper eye lobe moderately long (UEL/TEL = 0.42–0.52), lower eye lobe large (LEL/ELW = 0.18–0.33), height subequal to length (LEH/LEL = 0.95–1.13) with posterior sinuation short (TEL/LEL = 1.15–1.42), lower eye lobes ventrally long (VEL/PGC = 0.46–0.69). **Antennae**: Overall length surpassing elytral apex, ≥70% of total body length (TAL/TL = 0.67–0.82). Antennomere 1 length ≥2.5X width (A1L/A1W = 2.47–3.52); antennomere 3 about 3/4 length of antennomere 1 (A3/A1L = 0.70–0.82); antennomere 4 slightly shorter than antennomere 1 (A4/A1L = 0.88–1.00); antennomere 5 subequal to antennomere 1 (A5L/A1L = 0.79–1.12); antennomere 5 ≥4.5X longer than wide (A5L/A5W = 4.45–5.60); antennomere 9 ≥3.5X longer than wide (A9L/A9W = 3.40–4.00); antennomere 10 >3X longer than wide (A10L/A10W = 3.06–3.85); antennomere 11 ≥3.5X longer than wide (A11L/A11W = 3.43–4.57). Antennal formula: 0.106–0.140:0.017–0.026: 0.081–0.100:0.102–0.127:0.110–0.131:0.092–0.105:0.089–0.102:0.082–0.095:0.082–0.095: 0.073–0.084: 0.084–0.101. **Pronotum**: Width slightly shorter than length (PW/PL = 0.95–1.03), much narrower than base of elytra (PW/ELW = 0.73–87), and ≤1/3 length of elytra (PL/ELL = 0.30–0.35). Pronotal width across apical sulcus wide (PAS/PW = 0.77–0.84). Pronotal height across posterior tubercles moderately tall (PD/ELW = 0.46–0.81). **Sternum**: Prosternum long (PSL/PL = 0.21–0.51). Mesocoxal process narrow (MSD/ELW = 0.18–0.22). Metasternum long (LMT/ELW = 0.63–0.78). **Elytra**: Elytra moderately long (ELL/ELW = 2.52–3.01), dehiscing from basal third to nearly half (ELD/ELL = 0.19–0.42). **Legs**: Protarsomere 1 about 2X as long as wide (Pt1L/Pt1W = 1.71–2.42), ≥2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.62–0.80); protarsomere 2 length shorter than width (Pt2L/Pt2W = 0.70–0.93); protarsomere 3 length subequal to width (Pt3L/Pt3W = 0.95–1.20). Mesofemur long (MSL/ELW = 0.90–1.28), apical club >1/3 the length of mesofemur (MSCL/MSL = 0.39–0.50), apical club about 2X as long as wide (MSCL/MSCW = 1.00–2.67). Mesotarsomere 1 about 2.4X as long as wide (Ms1L/Ms1W = 2.08–2.72), ≥2/3 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.66–0.88); mesotarsomere 2 length shorter than width (Ms2L/Ms2W = 0.79–1.00); mesotarsomere 3 longer than wide (Pt3L/Pt3W = 1.00–1.22). Metafemur long and narrow (MTL/ELW = 1.72–1.98), pedicel narrow, apical club just over 1/3 length of the femur (MTCL/MTL = 0.31–0.45), apical club ≤2.5X as long as wide (MTCL/MTCW = 2.07–2.61). Metatarsomere 1 about 3.5X as long as wide (Mt1L/Mt1W = 3.08–3.91), subequal in length to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.84–1.10); metatarsomere 2 length slightly longer than width (Mt2L/Mt2W = 1.00–1.33); metatarsomere 3 longer than wide (Mt3L/Mt3W = 1.11–1.42). **Abdomen**: First abdominal segment long (ASL/ELW = 0.71–0.97); segment 4 narrowly emarginate at medial apex. Segment 5 slightly longer than segment 4, trapezoidal in shape, with apical margin slightly emarginate in middle, punctation small and sparse with transverse microsculpture.

Hosts. Unknown.

Flower and Associated Vegetation Records. *Ceanothus americanus*, *Cornus* sp., *C. drummondii*, *Crataegus* sp., *Crataegus marshallii* Egglest. (parsley hawthorn); *Viburnum dentatum* L. (southern arrowwood); *Photinia fraseri* (red tipped photinia), *Spiraea* sp.

Etymology. The name *ocularis* refers to the extremely large and globose lower eye lobe found in the species.

Remarks. This species differs from *C. sanguinicollis* in that the eyes are extremely protuberant with little to no posterior sinuation, the antennae are as long as the body, and the elytra are more elongate. Overall, this species is lightly colored with most specimens having light brown to brown elytra and ventral surface; the head and pronotum are usually darker. All three femora are distinctly colored in that the dark coloration of the apical club ends abruptly, resulting in a sharp narrow vertical line of demarcation between the club and lightly colored pedicel, often the basal half of the club itself is also lightly colored. The only appreciable variation in this color pattern was observed in specimens from Alabama where the mesofemora were sometimes infuscate. The meso- and metafemoral clubs tend to be compact and globose. This species ranges from Ohio south to Texas.

Callimoxys nigrinis Williams and Hammond, new species

(Figs. 1, 5D, 6E, 6K, 7I–J, 8I–J, 9B, 9D, 10F, 15)

Material Examined. 21 females, 22 males.

Holotype. Male labeled: "USA, TX: Washington-Co/10 mi ne Brenham/IV-13-1986/Heffern & Wappes" (TAMU). A red label was added to the specimen with the following: "HOLOTYPE/Callimoxys/nigrinis/Williams & Hammond, 2011".

Paratypes. Male labeled: "USA, TX: Washington-Co/10 mi ne Brenham/IV-13-1986/Heffern & Wappes" (TAMU); Male labeled: USA, TX: GrimesCo/1 mi e Plantersville/III-28-1987/D.J. Heffern coll" (TAMU); Male labeled: USA, TX: GrimesCo/11 mi e Navasota/III-27-1983/D.J. Heffern coll"; Male labeled: TEXAS: Ellis Co./Red Oak/Red Oak Cemetery/IV-15-2004/J.C. Schaffner" (TAMU); 2 Males labeled: "TEXAS, WASHINGTON CO/2M E Independence/April 13, 1986/J.E. Wappes"

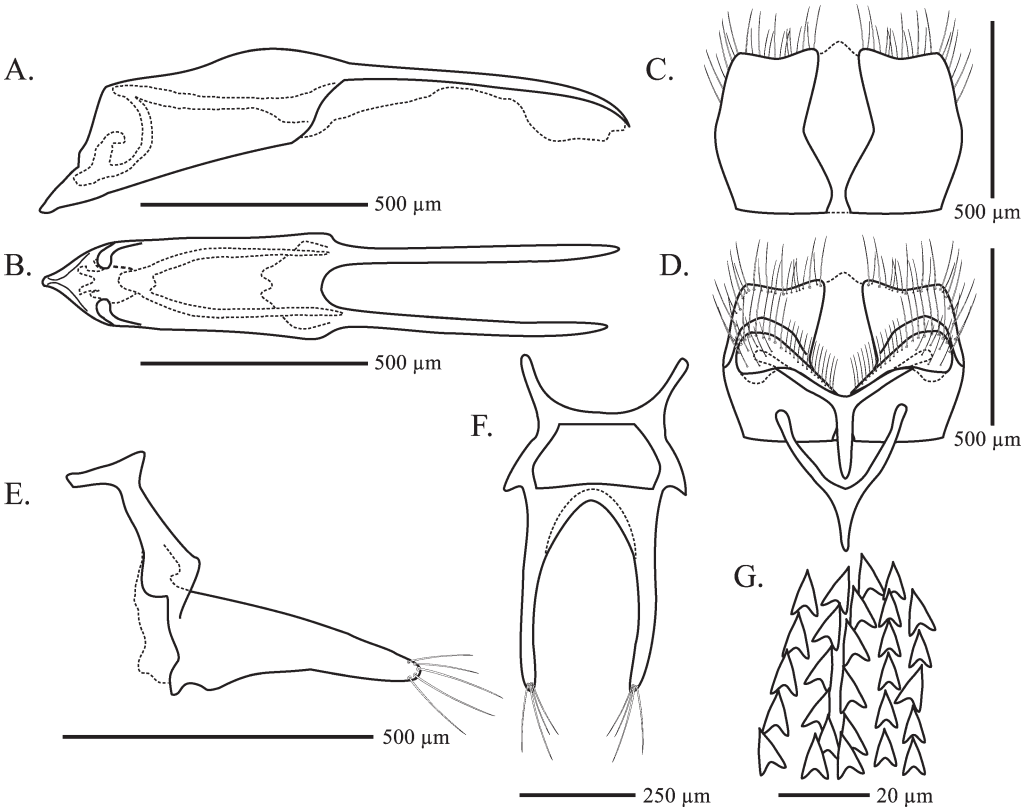

Fig. 15. Genitalic structures of male *Callimoxys nigrinis*. A) Median lobe of aedeagus, lateral view, B) Median lobe, dorsal view, C) Tergite VIII, D) Sternite VIII and spiculum ventrale, ventral view, E) Tegmen, lateral view, F) Tegmen, dorsal view, G) Basolateral spicules of internal sac.

(USNM); Female labeled: "USA, TX: Washington-Co/10 mi ne Brenham/IV-13-1986/Heffern & Wappes" (TAMU); Female labeled: "Benchley,/IV-30-41. Tex.//D.J. & J.N./Knull Collrs.//J.N. Knull/Collection" (FMNH); Female labeled: "TEXAS, GRIMES CO/11 Mi. E. Navasota/March 27, 1986/J. E. Wappes" (USNM); Female labeled: "Tarrant Co, Tx/V-13-80/B-1300" (TAMU). A yellow label was added to each specimen with the following: "PARATYPE/Callimoxys/nigrinis/Williams & Hammond, 2011".

Type Locality. Brenham, Washington County, Texas.

Diagnosis. This species is separated from the other North American *Callimoxys* species by the following combination of characters: gena moderate in length; eye oriented vertically; eye shallowly sinuate posteriorly; lower eye lobe large and globose, and ventrally long; pronotum with shallow apical collar; longer than wide; elytra long, dehiscing from basal third to half; color entirely dark brown to black, except the petioles of femora in some specimens, when femora bicolored a sharp line of separation between light and dark absent; meso- and metafemoral clubs elongate, less globose; fore and middle leg with second tarsomere goblet-shaped, abruptly widened apicad of base; fore and middle leg with third tarsomere symmetrical, lobes subequal in length; hind leg with third tarsomere slightly asymmetrical, lobes unequal in length; abdominal sterna with short, curved, decumbent setae of uniform length medially, and a field of shorter, posteriomedially directed setae laterally; apical margin of tergite VIII laterally produced; median lobe of aedeagus apically sharp with ventral lobe long and pointed; tegmen apical apophyses laterally evenly tapering towards apex.

Description. Male. Similar to *C. sanguinicollis* except as in the following: **Length**: 6.5–8.5 mm (n = 16). **Color**: Dark brown to black, except as follows: antennomere 2 to antennal apex, light brown to black. Pro-, meso-, and metafemur in some specimens about 1/3 to all of petiole light brown to yellow, lighter area merged with darker areas gradually,

sharp line of color separation absent. **Head**: Broad across eyes (HW/PW = 1.01–1.19). Interocular distance narrow (ID/HW = 0.23–0.29). Labrum medially concave on apical margin to slightly arcuate, setae restricted to apical margin of pigmented area, with a few scattered setae on disc; clypeus sparsely punctate laterally, impunctate medially. Neck narrow (NW/HW = 0.49–0.65). Frons and genae moderately long (GL/FH = 0.18–0.22). Apical portion of gula punctate, with large circular, contiguous to slightly separated, moderately deep punctures. Setae absent in dorsal eye invagination, some specimens with one or two on antennal socket. Eyes oriented vertically, eye broad (TEL/EH = 0.75–0.89); upper eye lobe long (UEL/TEL = 0.46–0.53), lower eye lobe oblong triangular, large (LEL/ELW = 0.29–0.41), height subequal to length (LEH/LEL = 0.91–1.10), with posterior sinuation shallow (TEL/LEL = 1.07–1.26) and postocular temple small, lower eye lobes ventrally long (VEL/PGC = 0.53–0.80). **Antennae**: Overall length surpassing elytral apex, ≥3/4 of total body length (TAL/TL = 0.75–1.00). Antennomere 1 length about 3X width (A1L/A1W = 2.85–3.38); antennomere 3 about 3/4 length of antennomere 1 (A3/A1L = 0.64–0.82); antennomere 4 subequal to antennomere 1 (A4/A1L = 0.89–1.07); antennomere 5 slightly longer than antennomere 1 (A5L/A1L = 0.87–1.25); antennomere 5 ≥5X longer than wide (A5L/A5W = 4.90–8.44); antennomere 9 ≥3.5X longer than wide (A9L/A9W = 3.46–4.27); antennomere 10 ≥3.5X longer than wide (A10L/A10W = 3.33–4.27); antennomere 11 ≥4X longer than wide (A11L/A11W = 3.93–5.67). Antennal formula: 0.096–0.122:0.019–0.023:0.066–0.089:0.096–0.122:0.107–0.124:0.097–0.109:0.096–0.106:0.087–0.099:0.090–0.098:0.077–0.093:0.090–0.109. Apical antennomeres ovoid in cross section at midlength. **Pronotum**: Width shorter than length (PW/PL = 0.90–1.00), much narrower than base of elytra (PW/ELW = 0.75–0.86), and about 1/3 length of elytra (PL/ELL = 0.29–0.34). Subapical collar reduced. Pronotal width across apical sulcus wide (PAS/PW = 0.80–0.89), with apical sulcus very shallow. Length of basal transverse marginal depression slightly narrower medially than apical depression. Dorsally with 2 pairs of sublateral tubercles; anterior pair smaller and ovoid coalescing with posterior pair, posterior pair slightly elevated and broadly rounded; some specimens with a broad, median, triangular, basally elevated area between posterior tubercles. Pronotum height across posterior tubercles moderately tall (PD/ELW = 0.46–0.56). Pronotal disk punctation circular, large, moderately deep with punctures separated by 0.5–1X puncture diameter, without microsculpture to finely granulate between punctures, surface appearing glossy to slightly matte. Posteroventral area with rugose carina between posterior margin and lateral tubercle which is not elevated higher than posterior margin, and is complete to upper margin of coxal cavity. **Sternum**: Prosternum long (PSL/PL = 0.22–0.55), apical collar slightly elevated. Mesocoxal process narrow (MSD/ELW = 0.18–0.23). Metepisternal punctation double; smaller and larger punctures, both shallow, evenly impressed, circular, separated by 1.0–1.5X diameter of puncture. Metasternum long (LMT/ELW = 0.62–0.78), punctures ranging from medium to small, moderately shallow, evenly impressed, circular, separated by 1–>2X puncture diameter. Pubescence very sparse to moderately dense, with mixed semi-erect to erect longer hairs and shorter depressed hairs. **Elytra**: Elytra long (ELL/ELW = 2.46–3.02), leaving ±2 apical abdominal tergites exposed, dehiscing from basal third to nearly half (ELD/ELL = 0.20–0.43), apical half moderately narrow with apex pointed. **Wings**: Wings infumate, slightly darker from base to apical 1/3, darkly infumate along veins RA1+2, RA3+4, r4, MP1+2 and rp-mp2; veins r3 and RP greatly reduced or absent; vein r4 with anterior and posterior terminus translucent to absent. Anal lobe veins Ap3 and AA4 tubular at base, dissolving into the membrane distally, with heavily pigmented stripe along leading edge. **Legs**: Procoxa transverse and slightly globose. Protrochanter pointed. Profemur short, with apical club greater than half the length of the profemur; punctation small, shallow, transverse to elongate, moderately dense on pedicel and underside of profemur, moderately sparse on apical club faces, with anterior face of club denser in punctation than posterior face, each puncture bearing a white, long, thin erect seta. Protarsomere 1 filiform, ≤2X as long as wide (Pt1L/Pt1W = 1.50–2.20), ≤2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.50–0.73); protarsomere 2 goblet-shaped, sides arcuate, length < width (Pt2L/Pt2W = 0.71–0.93); protarsomere 3 bilobed, symmetrical, lobes subequal, inner margins sub-parallel basally and diverging apically, slightly longer than wide (Pt3L/Pt3W = 1.00–1.20); protarsomere 5 longer than protarsomeres 1 and 2 combined, with a short blunt projection extending from the apex ventrally. Mesotrochanter pointed. Mesofemur long (MSL/ELW = 1.00–1.28), pedicel thin, with apical club just under half the length of mesofemur (MSCL/MSL = 0.40–0.50), apical club ≥2.5X as long as wide (MSCL/MSCW = 2.28–3.11); punctation on pedicel small, slightly transverse, each bearing either a moderately long to long golden setae, punctation on anterior club face double, with a combination of larger slightly transverse punctures bearing a longer semi-erect golden setae intermingled with small transverse punctures bearing a short white depressed setae, punctation on posterior club face sparser, with a combination of larger slightly transverse punctures bearing a longer, finer, semi-erect golden setae intermingled with small transverse

punctures bearing a short, fine golden, depressed setae. Mesotibia slightly shorter to subequal to mesofemur, apex bearing 2 spurs subequal in length. Mesotarsus about 2/3 length of mesotibia. Mesotarsomere 1 filiform and narrow, about 2.3X as long as wide (Ms1L/Ms1W = 1.92–2.67), ≤3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.60–0.87); mesotarsomere 2 goblet shaped, length ≤ width (Ms2L/Ms2W = 0.69–1.08); mesotarsomere 3 bilobed, symmetrical, lobes subequal, inner margins sub-parallel basally and diverging apically, slightly longer than wide (Ms3L/Ms3W = 0.95–1.25); mesotarsomere 5 slightly longer than mesotarsomeres 1 and 2 combined. Metacoxa transverse. Metafemur moderately long and narrow (MTL/ELW = 1.82–2.05), pedicel narrow, apical club almost half the length of the metafemur (MTCL/MTL = 0.34–0.51); apical club ≥2.5X as long as wide (MTCL/MTCW = 2.33–2.94); punctation on pedicel small, slightly transverse, each bearing either a moderately long to long golden setae, punctation on anterior club face mostly large, sparse, circular to slightly transverse, with apical margins elevated, bearing a long, white, semi-erect seta; punctation on posterior club face small, sparse, transverse, with apical margins elevated, bearing a long, golden semi-erect seta. Microsculpture moderately impressed, transverse on pedicel, somewhat effaced but present on club. Metatibia slightly shorter to subequal in length to metafemur. Outer margin of metatibia bearing irregular rows of modified punctures with the anterior margins greatly elongate and asperate forming moderately long, coarse teeth each bearing a long fine golden setae; remaining punctures a mixture of small, transverse, shallow and slightly larger asperate punctures. Metatarsus about 1/3 length of metatibia. Metatarsomere 1 filiform and narrow, <4x as long as wide (Mt1L/Mt1W = 2.82–3.90), usually shorter than metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.85–1.15); metatarsomere 2 truncate, length subequal to width (Mt2L/Mt2W = 0.88–1.38); metatarsomere 3 strongly bilobed asymmetrical, anterior lobe elongate, inner margins sinuate, convergent basally and divergent apically, longer than wide (Mt3L/Mt3W = 0.95–1.39); metatarsomere 5 subequal in length to metatarsomere 1, with a short blunt projection extending from the apex ventrally. **Abdomen**: First abdominal segment short (ASL/ELW = 0.61–0.77), shorter than next two segments combined; segment 4 about 3/4 as long as segment 3, narrowly emarginate at medial apex. Punctures small, transverse medially, somewhat more circular laterally, with anterior edge slightly raised, separated by >3X puncture diameter. Setae short, fine, curved, decumbent to semi-erect, and similar in length medially, and minute, straight, appressed, and arranged in medio-posteriorly directed rows laterally. Microsculpture shallowly impressed, transverse, and shining medially and granular and matte laterally. Segment 5 slightly longer than segment 4, trapezoidal in shape, with apical margin slightly emarginate in middle, punctation small and obscure. **Genitalia**: Tergite VIII broad, rounded to angulate laterally, apical margin slightly sinuate with medial margin slightly extended, with fine, moderately dense medium to long pubescence. Sternite VIII with basal arm slightly shorter than or subequal to lateral arms, apex rounded. Spiculum ventrale with basal arm short, about half the length of lateral arms, apex round to pointed. Posterior ring of tegmen with lateral arms moderately wide basally in lateral view; apical apophyses relatively wide basally narrowing evenly from base to apex, in lateral view. Median lobe apex shorter in length than basal apophyses; the apex oriented horizontally appearing elongate and pointed in lateral view, ventral lobe much longer and more angulate than dorsal lobe; ventral lobe elongate and sharply pointed in dorsal view. Spicules of the internal sac triangular, uniform in size, and oriented into longitudinal rows.

Female. Similar to male, except as follows: **Length**: 7.0–10.0 mm (n = 16). **Color**: Pronotum orange. **Head**: Broad across eyes (HW/PW = 0.94–1.06). Interocular distance slightly narrow (ID/HW = 0.29–0.34). Neck narrow (NW/HW = 0.53–0.73). Clypeus and genae moderately long (GL/FH = 0.23–0.29). Eyes oriented vertically, eye broad (TEL/EH = 0.72–0.87); upper eye lobe short (UEL/TEL = 0.41–0.52), lower eye lobe large (LEL/ELW = 0.21–0.34), height subequal to length (LEH/LEL = 0.94–1.10), with posterior sinuation shallow (TEL/LEL = 1.11–1.30) and postocular temple small, lower eye lobes ventrally long (VEL/PGC = 0.42–0.68). **Antennae**: Overall length surpassing elytral apex, ≥70% of total body length (TAL/TL = 0.64–0.86). Antennomere 1 length about 3X width (A1L/A1W = 2.81–3.31); antennomere 3 ≤3/4 length of antennomere 1 (A3/A1L = 0.68–0.78); antennomere 4 < antennomere 1 (A4/A1L = 0.86–0.98); antennomere 5 subequal to antennomere 1 (A5L/A1L = 0.83–1.19); antennomere 5 about 5X longer than wide (A5L/A5W = 4.17–5.82); antennomere 9 <4X longer than wide (A9L/A9W = 3.00–3.86); antennomere 10 <3.5X longer than wide (A10L/A10W = 2.67–3.43); antennomere 11 ≤4X longer than wide (A11L/A11W = 3.05–4.00). Antennal formula: 0.111–0.133:0.022–0.027: 0.075–0.101:0.100–0.127:0.109–0.142:0.093–0.108: 0.088–0.101:0.080–0.092:0.083–0.092:0.069–0.085:0.080–0.099. **Pronotum**: Width shorter than length (PW/PL = 0.92–1.02), much narrower than base of elytra (PW/ELW = 0.77–0.86), <1/3 length of elytra (PL/ELL = 0.27–0.30). Pronotal width across apical sulcus wide (PAS/PW = 0.79–0.86). Pronotal height across posterior tubercles moderately

tall (PD/ELW = 0.45–0.55). **Sternum**: Prosternum long (PSL/PL = 0.21–0.54). Mesocoxal process narrow (MSD/ELW = 0.18–0.23). Metasternum long (LMT/ELW = 0.64–0.76). **Elytra**: Elytra long (ELL/ELW = 2.72–3.07), dehiscing from basal third (ELD/ELL = 0.19–0.40). **Legs**: Protarsomere 1 ≤2X as long as wide (Pt1L/Pt1W = 1.66–2.23), ≤2/3 length of protarsomeres 2+3 (Pt1L/Pt2L+Pt3L = 0.57–0.69); protarsomere 2 length ≤ width (Pt2L/Pt2W = 0.68–0.89); protarsomere 3 slightly longer than wide (Pt3L/Pt3W = 0.96–1.22). Mesofemur long (MSL/ELW = 0.89–1.29), pedicel thin, with apical club just under half length of mesofemur (MSCL/MSL = 0.41–0.52), apical club ≥2.5X as long as wide (MSCL/MSCW = 2.35–2.82). Mesotarsomere 1 about 2.3X as long as wide (Ms1L/Ms1W = 1.71–2.75), ≤3/4 length of mesotarsomeres 2+3 (Ms1L/Ms2L+Ms3L = 0.59–0.80); mesotarsomere 2 length ≤ width (Ms2L/Ms2W = 0.65–1.00); mesotarsomere 3 longer than wide (Ms3L/Ms3W = 1.05–1.40); mesotarsomere 5 slightly longer than tarsomeres 1 and 2 combined. Metafemur moderately long and narrow (MTL/ELW = 1.76–1.97), pedicel narrow, apical club just under half the length of the femur (MTCL/MTL = 0.33–0.48); apical club ≥2.5X as long as wide (MTCL/MTCW = 2.50–2.87). Metatarsomere 1 <4X as long as wide (Mt1L/Mt1W = 2.53–3.92), subequal to metatarsomeres 2+3 (Mt1L/Mt2L+Mt3L = 0.82–1.05); metatarsomere 2 length subequal to width (Mt2L/Mt2W = 0.93–1.21); metatarsomere 3 longer than wide (Mt3L/Mt3W = 1.09–1.38); metatarsomere 5 subequal in length to metatarsomere 1, with a short blunt projection extending from the apex ventrally. **Abdomen**: First abdominal segment long (ASL/ELW = 0.73–0.94). Segment 5 slightly longer than segment 4, trapezoidal in shape, with apical margin slightly emarginate in middle, punctation small and obscure.

Hosts. Reared from dead *P. caroliniana* in Texas, based on specimen label data.

Flower and Associated Vegetation Records. *Crataegus* sp., *V. dentatum*.

Etymology. The name *nigrinis* refers to the overall dark coloration of this species.

Remarks. This relatively rare species is the smallest of the *Callimoxys* species, and is found only in the south, from Texas to Florida, and may extend further south into northern Mexico. *Callimoxys nigrinis* is very difficult to separate from *C. ocularis*, especially when the legs are somewhat bicolored. However, the overall darker coloration, the more elongate and narrowed elytra, the more arcuate second tarsomere of the front and middle legs, the more deeply impressed and denser abdominal sternite microsculpture, and elongate and less globose meso- and metafemoral clubs help to distinguish this species.

Callimoxys gracilis (Brullé, 1832)
(Figs. 6F, 6I, 7K–L, 8K–L)

Stenopterus gracilis Brullé, 1832: 105.

Type Locality. Morée: forêt de Koubeh (Peloponese, Greece).

Diagnosis. This species is separated from other species of *Callimoxys* by the following combination of characters: pronotum black with metallic blue-green sheen (♂) or bicolored black and orange to red (♀); all legs brown to black; gena medium to long; clypeus with medially sparse setation; lower eye lobe shape triangular, long ventrally; setae of dorsal eye invagination absent; apical 3 antennomeres very long; pronotal length > width, dorsally with two elongate, strongly elevated tubercles with sparse punctation, with well-developed, median, carinate keel extending from anterior sulcus to posterior sulcus, laterally with a single flat tubercle; abdominal sternite pubescence of long erect setae plus short dense decumbent setae; metafemur gradually widened towards apex, punctures with strongly protuberant anterior margins, surface appearing coarsely roughened; aedeagus with long ventral lobe; internal sac spicule shape reduced aciculate, variable in size, oriented in transverse oblique rows.

Remarks. This species most resembles the North American *C. fuscipennis* in a reduction in the number of dorsal pronotal tubercles and development of a median, longitudinal keel rather than a partial tubercle. This species is widely distributed throughout the Palaearctic from central to southeastern Europe to northern Iran, and develops in deciduous shrubs such as *Acer* sp., *Prunus* sp., and *Crataegus* sp. For habitus photographs of male and female, see Sama (2002).

Callimoxys retusifer Holzschuh, 1999
(Fig. 6G)

Callimoxys retusifer Holzschuh, 1999: 27, fig. 37.
Callimoxys orientalis Niisato and Ohbayashi, 2004 *in* Ohbayashi *et al*. 2004: 464, figs. 13, 14, 19.

Type Locality. W Hubei province, Dashennongjia Nat. Res., Muyu, E slope, China.

Diagnosis. This species is separated from other species of *Callimoxys* by the following combination of characters: pronotum metallic black (♂) or orange to red (♀); all legs metallic black; abdomen dull orange to brown (♀); gena long; clypeus uniformly sparsely punctate and microsculptured; lower eye lobe oblong quadrate; male eye invagination concavity angled dorsally, appearing somewhat flattened; surface of eye invagination finely wrinkled, setae absent; apical 3 antennomeres very long; pronotum length > width, with obvious

transverse and longitudinal strigae interspersed with longitudinal arranged punctures on disk, pubescence double with long erect darkly colored setae and extremely short yellow to golden bristle-like, erect setae on lateral aspects, dorsally with 4 widely separated strongly elevated tubercles, with an elevated circular median posterior tubercle, laterally with a single moderately protuberant tubercle, lateroposterior pronotal carina curved and not reaching procoxal cavity; elytra long, covering entire abdomen, surface roughened between punctures; abdominal sternite pubescence of short, decumbent, dense setae; metafemur gradually widened towards apex, entire metafemur with a few scattered, larger, protuberant punctures, and densely covered with smaller contiguous punctures, surface appearing minutely roughened; aedeagus with extremely long ventral lobe; internal sac spicules triangular, uniform in size, forming longitudinal rows.

Remarks. Niisato and Ohbayashi (2005) synonymized *C. orientalis* with *C. retusifer* because they were unaware of Holzschuh's original description in 1999. Examination of both descriptions suggests that these are the same species. For habitus photo of *C. retusifer*, see Holzschuh (1999), and for detailed figures, see Ohbayashi *et al.* (2004).

This species is morphologically unique for *Callimoxys*. The shape and character of the eyes, pronotum, and elytra are different from any of the North American species. It is also the only species in the group that has long, erect to semi-erect, dark setae located on the pronotum and femora; all other species have only white, grey, or golden setae. Given these differences, the genitalia, however, are typical for *Callimoxys*. This species is only known from China.

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