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Agrilus (s. str.) *betulanigrae* MacRae (Coleoptera: Buprestidae: Agrilini), a new species from North America, with comments on subgeneric placement and a key to the *otiosus* species-group in North America

TED C. MACRAE
Monsanto Company, 700 Chesterfield Parkway West, Chesterfield, Missouri 63017, U.S.A.
email: ted.c.macrae@monsanto.com

Abstract

Agrilus (s. str.) *betulanigrae* **n. sp.** is described from southeastern Missouri in eastern North America. The species is described, photographs of the holotype and male genitalia are presented, and comparisons are made to related species. Comments on the subgeneric placement of species in the *Agrilus otiosus* species-group, to which *A. betulanigrae* belongs, and a key to males of the Nearctic species are also presented.

Key words: Coleoptera, Buprestidae, Agrilini, Nearctic, *Agrilus*, new species, higher classification, key

Introduction

The large, cosmopolitan buprestid genus *Agrilus* Curtis, 1825 is represented in the United States and Canada by 171 species (Bellamy & Nelson 2002) plus 10 non-nominate subspecies. Of these, 57 are known to occur in Missouri (MacRae 1991; MacRae & Nelson 2003). Further collecting in Missouri has revealed a previously unknown species of *Agrilus* breeding in dead branches of river birch, *Betula nigra* L. This species belongs to the *Agrilus otiosus* species-group (Knull 1920, Fisher 1928), bringing to 14 the total number of Nearctic species currently recognized in this group. It is described herein to make the name available for two catalogue projects currently in progress (i.e., North America north of Mexico, G. H. Nelson; and World, C. L. Bellamy). The new species would seem to be assignable to the subgenus *Arquagrilus* (Alexeev 1998); however, as discussed below, the application of Alexeev's subgeneric concepts to the Nearctic fauna is problematic. As a

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result, I consider this species, as well as the other members of the *otiosus* species-group in North America, as belonging to *Agrilus* (s. str.). Since many of the species in this group were unknown when Fisher (1928) presented a key to the North American species of *Agrilus*, a key to males of the known members of the *otiosus* species-group in North American is presented below. Larval host genera, when known, are also indicated in the key.

Measurements were made from the center of the frons to the elytral apex (length) and across the humeri (width) using a mini-scale. Holotype label data (enclosed within "quotation marks") are cited verbatim, with a forward slash " / " separating data from individual labels and added or expanded information presented in [square brackets] (em. = emerged, h = handwritten, p = printed, dia. = diameter). Dates are formatted: day.month (Roman numerals).year (e.g., 1–7.V.2001), and collection abbreviations follow the widely used coden system (Arnett *et al.* 1993).

Agrilus (s. str.) *betulanigrae* n. sp.

Holotype (male)

"USA: MO [Missouri]: Carter Co. Ozark National Scenic Riverway, Big Spring cpgd, T27N R1E S31 (SE¼), TCMacRae [p] / [field journal #] 01-24e: em. 1-7.V.2001 ex. [2–4 cm dia.] fallen dead branch Betula nigra coll. 14.IV.2001 [p] / HOLOTYPE Agrilus betulanigrae [p] ♂ [h] MacRae [p] [red label]".

The holotype will be deposited in the United States National Museum, Washington, DC.

Diagnosis

Narrowly elongate, subcylindrical (Fig. 1); upper surface moderately shining, head bright metallic blue, aeneous on vertex, pronotum aeneous on disc, blue on sides, elytra black with aeneous reflections, faint cupreous reflections on apices, ventral surface dark aeneous blue, more strongly shining than above; faintly setose. Males of *A. betulanigrae* are distinguished by their bent, subquadrately expanded genitalia (Figs. 2–3). Females can only be identified in association with males.

Description

Measurements: length: 3.75 mm; width: 0.90 mm.

Head: frontovertex shallowly convex with faint median longitudinal sulcus extending from epistoma to vertex, lower part of sulcus broader; surface finely granulose, rather coarsely punctate dorsally, punctures forming vague concentric circles on each side of midline, more sparsely and evenly distributed on front, moderately clothed on ventral half and along ocular margins with long, silvery white pubescence; epistoma strongly transverse, anterior margin broadly but not deeply, arcuately emarginate; eyes large, strongly oblong, slightly more broadly rounded dorsally than ventrally, inner margins straight.

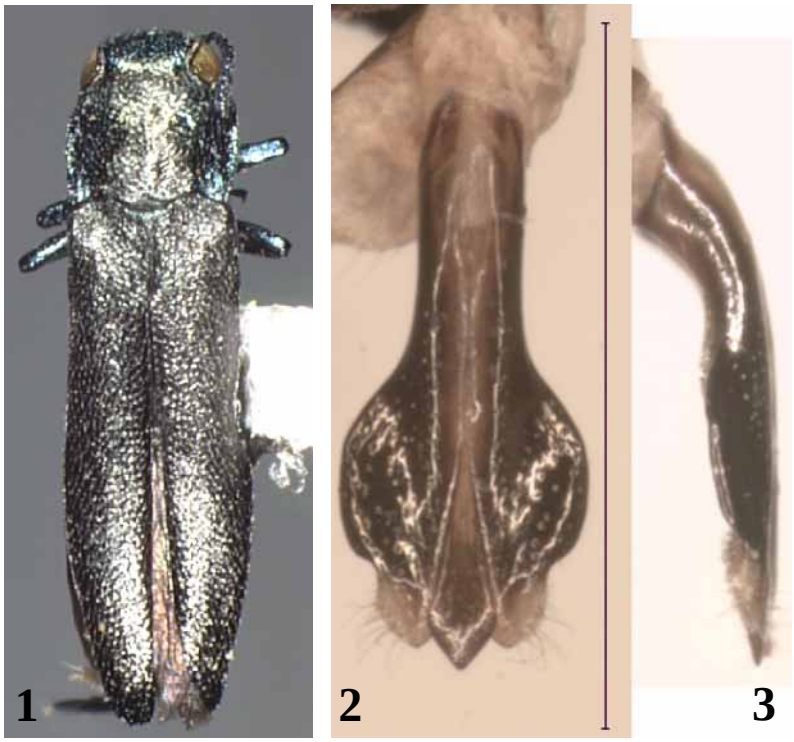

FIGURE 1–3. *Agrilus betulanigrae* MacRae, n. sp., holotype male (lines = 1 mm). **1**) Habitus; **2**) genitalia (dorsal view); **3**) lateral view.

Antennae: extending nearly to posterior margin of pronotum when laid alongside, inconspicuously setose; antennomere 2 fusiform; 3 narrower and subequal in length to 2; 4-10 serrate, slightly longer than wide except 10 which is as long as wide; 11 oblong.

Pronotum: 1.25 times wider than long, posterior margin slightly narrower than anterior margin of elytra, widest along apical half, sides diverging from posterior margin to near middle, then subparallel; posterolateral angles quadrate; in lateral view marginal and submarginal carinae feebly sinuate, narrowly separated anteriorly, becoming contiguous just before posterior angle; anterior margin sinuate, broadly, arcuately produced medially; posterior margin transversely bisinuate, arcuately emarginate anterior to scutellum; disc moderately convex, with two round, feeble, longitudinally arranged median depressions and rather broad, oblique depressions along lateral margins; prehumeral carinae short, feeble, nearly obsolete; surface coarsely, transversely rugose, less distinctly so anteriorly and laterally, with numerous fine punctures between the rugae.

Scutellum: narrowly quadrate in front, triangular behind, strongly transversely carinate, about as long as wide, surface reticulate.

Elytra: subequal in width at base and beyond middle, lateral margins shallowly emarginate in between, apices narrowly, separately rounded, finely serrate; disc somewhat flat-

tened, each elytron with a broad, moderately deep basal depression and an indistinct longitudinal costa, sutural margin recessed behind scutellum and strongly elevated posteriorly; surface densely imbricate-punctate, more shallowly, irregularly so near apices; minutely, sparsely setose.

Ventral surface: prosternum sparsely clothed with inconspicuous appressed setae, prosternal process slightly converging between coxae, acute at apex, prosternal lobe declivous, subtruncate, feebly emarginate at middle, surface reticulate, finely punctate; posterior coxae densely, coarsely punctate, moderately setose, posterior margin broadly, arcuately emarginate, upper angle perpendicular; abdominal ventrites finely, rather densely punctate, becoming faintly rugose on basal ventrites, sparsely clothed with fine, recumbent setae that become longer apically, ventrites 1 and 2 feebly flattened medially, suture between nearly obsolete; last ventrite sparsely, coarsely punctate, broadly rounded at apex.

Legs: femora subfusiform; tibiae straight, slender, armed with a small tooth on inner apical margin; metatarsus about as long as metatibia, metatarsomere 1 equal in length to remainder of metatarsus; tarsal claws similar on all legs, cleft near middle, outer tooth acute at apex, inner tooth broader and turned inward, nearly contiguous with opposite tooth.

Male genitalia (Figs. 2–3): in lateral view bent sharply downward in basal half; parameres subquadrately expanded in apical half, angled obliquely downward laterad, narrowed suddenly before apex, apices transluscent, bearing long, curved, silky setae; tip of median lobe subacute.

Female

Differs from male in being more robust, front of head broader, more convex, cupreous with aeneous tinge on upper frons and vertex, more sparsely clothed with long white pubescence on lower half and along ocular margins; outer antennomeres slightly wider than long; pronotum aeneous with faint cupreous reflections, especially laterally; elytra aeneous black; beneath black with faint cupreous reflections; abdominal ventrites 1 and 2 convex medially; tibiae unarmed on inner apical margin; metatarsus shorter than metatibia.

Variation

Coloration was rather constant in the four males examined, while in females some variation was noted in the intensity of the cupreous and aeneous reflections on the head and pronotum. The prehumeral carinae vary from weak but distinct to nearly obsolete, and the pronotal depressions are more scarcely indicated in some specimens. The prosternal lobe is usually feebly emarginate medially but is a little more distinctly so in some specimens. Males measured 3.75–4.85 × 0.90–1.15 mm (mean = 4.35 × 1.02 mm, n = 4) and females 4.40–4.95 × 1.05–1.20 mm (mean = 4.70 × 1.13 mm, n = 8).

Material examined

In addition to the holotype, 3 male and 8 female paratypes: same data as holotype (3 ♂♂, 3 ♀♀); same data as holotype except em. 8–15.V.2001 (1 ♀); same locality, em. 1–7.VI.2002 (2 ♀♀), 8–15.VI.2002 (1 ♀), and 23–30.VI.2002 (1 ♀) *ex* 2–4 cm dia. fallen dead branch *B. nigra* coll. 6.IV.2002, T. C. MacRae. Paratypes deposited in the following collections: GHNC, HAHC, TCMC, USNM. In addition to the type series, three females were examined from two additional localities in the state: MISSOURI: Butler Co., Big Cane Conservation Area, 3.5 mi S of Neelyville, T22N R5E S35: em. 23–30.IV.2001 *ex* 1–3 cm dia. fallen branches *B. nigra* coll. 8.IV.2001 (2 ♀♀), T. C. MacRae; Clark Co., vic. SW corner Rose Pond Conservation Area, T64N R6W S23 (SC1/9), em. 24-31.V.2002 *ex* fallen branch *B. nigra* coll. 7.IV.2002 (1 ♀), T. C. MacRae (all deposited TCMC). These females almost certainly represent *A. betulanigrae* based on larval host but were not designated paratypes since no male specimens were associated with them.

Type locality

The type locality is a National Park Service campground in a mesic bottomland forest along one of the larger, spring-fed, gravel-bottomed rivers dissecting the Ozark Plateau in southeastern Missouri. Dominant woody plant species in this natural community include *Acer saccharum* L., *Carya cordiformis* (Wangenh.) K. Koch, *Celtis occidentalis* L., and *Quercus alba* L., with *Diospyros virginiana* L. and *Juglans nigra* L. also being characteristic (Nelson 1985).

Hosts

The type series was reared from small, fallen dead branches of river birch, *Betula nigra* L. This plant is widely distributed across the eastern United States and is the only species of *Betula* found in the middle and southern latitudes of the country. In Missouri, it grows naturally throughout the state in alluvial ground along streams and borders of gravel bars (Steyermark 1963) and is a dominant species in the wet bottomland forests of the southeastern lowlands (Nelson 1985). The trees with which the type series was associated may have been planted. Other *Agrilus* spp. that have been associated with *Betula* in North America include *A. acutipennis* Mannerheim, *A. anxius* Gory, *A. cyanescens* (Ratzeburg), *A. obsoletoguttatus* Gory, *A. olivaceoniger* Fisher, and *A. pensus* Horn (Knull 1922, Fisher 1928, Bright 1987). Of these, only *A. pensus* has been reared from *B. nigra* (Fisher 1928, Knull 1930, MacRae and Nelson 2003). No other member of the *otiosus* species-group has previously been associated with *Betula*.

Comparisons

Males of *A. betulanigrae* will key to *A. frosti* Knull (Fisher 1928, Wellso et al. 1976, MacRae 1991); however, they can be immediately distinguished from this and all other congeners by their distinctively bent genitalia with subquadrately expanded parameres that

are suddenly narrowed apically. Gayle Nelson kindly compared a male paratype with the unique holotype of *A. hazardi* Knull and confirmed they are not the same species. Females lack distinguishing morphological characters that allow them to be separated from females of related species.

Etymology

The specific epithet, a compound noun in the genitive case, is derived from *Betula nigra*, from which the type series was reared.

Comments on subgeneric placement of the otiosus species-group

A general discussion of the problem of subgeneric classification in the genus *Agrilus* is beyond the scope of this paper; however, the discovery of another species in the *otiosus* species-group (Knull 1920, Fisher 1928) warrants consideration of recent subgeneric assignments affecting some of its known members. As currently understood, the *otiosus* species-group constitutes a homogeneous assemblage of species in eastern North America characterized by having antennomeres 4-10 serrate, the tarsal claws with the inner tips nearly touching, and the male metatibiae armed with a distinct tooth on the inner apical margin (Fisher 1928). Species within this group exhibit little morphological divergence from each other, although males of the species can be distinguished with relative ease due to their distinctive genitalia and the presence of secondary sexual characters. Females lack such characters and present a rather uniform facies across the group, preventing conclusive identification except by association with males. The species also appear to be rather selective in their larval host preferences and can often be more easily separated by host plant than by morphology. The *otiosus* species-group almost certainly represents a monophyletic group within *Agrilus*, although it remains to be determined whether this warrants subgeneric consideration. Additional North American species of *Agrilus* such as *A. arcuatus* (Say) and relatives, *A. masculinus* Horn, etc., appear to be closely related to the *otiosus* species-group but differ by the males lacking the metatibial tooth. Curiously, Alexeev (1998), in characterizing three existing and 14 new subgenera of *Agrilus*, assigned some members of the *otiosus* species-group (i.e., *A. cliftoni* Knull, *A. frosti* Knull, *A. juglandis* Knull, *A. otiosus* Say, and *A. transimpressus* Fall) to the subgenus *Arquagrilus* Alexeev (1998:424) and others (*A. defectus* LeConte and *A. geminatus* (Say)) to the subgenus *Quercagrilus* Alexeev (1998:428). A few additional North American species were also assigned to these and other subgenera as well. Alexeev based his subgeneric classification almost exclusively on ultrastructure of the male genitalia, primarily in Palearctic species, despite earlier admonitions against separating subgenera in this enormous, cosmopolitan genus based on limited character sets or restricted biogeographical perspectives (Obenberger 1957, Bellamy 1996). With respect to the Nearctic fauna, his examination and placement of a relatively small number of the species in formal subgenera, while leaving

the majority of species in that fauna outside such definition, is at best premature (Bellamy & Hespenheide 2002). More specific to the *otiosus* species-group, the partitioning of its members among multiple subgenera seems highly untenable given the suite of shared morphological characters exhibited by the group. To this point, *Engyaulus* Waterhouse, containing the distinctive *pulchellus* species-group (Nelson & Westcott 1991), is the only subgenus of *Agrilus* credibly established for species in the New World (Bellamy 1996). For the present, *A. betulanigrae* and the above mentioned members of the *otiosus* species-group should be regarded as belonging to *Agrilus* (s. str.). This is not intended to advocate a closer relationship of these species to *A. viridis* (L.) (type species of *Agrilus*) than to *A. pratensis* Ratzeburg or *A. angustulus* (Illiger) (type species of *A.* (*Arquagrilus*) and *A.* (*Quercagrilus*), respectively), but rather to preserve the integrity of the *otiosus* species-group, long recognized by North American workers, until a more comprehensive subgeneric assessment of the Nearctic fauna can be conducted.

Key to males of the *Agrilus otiosus* species-group in North America

1 Antennomeres with long white setae beneath; Hosts: *Fagus*, *Quercus* .... *A. crinicornis* Horn

- Antennomeres without long white setae beneath 2

2 Fifth abdominal ventrite fimbriate at apex; Host: *Quercus* ..... *A. defectus* LeConte

- Fifth abdominal ventrite not fimbriate 3

3 Prosternum conspicuously pubescent 4

- Prosternum not conspicuously pubescent 8

4 Genitalia with parameres parallel, not expanded medially 5

- Genitalia with parameres distinctly expanded medially 6

5 Pronotum with prehumeral carinae distinct; apical prosternal margin distinctly emarginate; genitalia with parameres very narrow apically; Host: *Juglans* .... *A. cliftoni* Knull

- Pronotum with prehumeral carinae obsolete; apical prosternal margin truncate or only slightly emarginate; genitalia with parameres slightly widened at apex; Host: *Quercus* *A. geminatus* (Say)

6 Front of head densely clothed with white hairs behind epistoma, nearly concealing suface; genitalia with parameres not transparent apically; pronotum bicolored dorsally; Hosts: *Carya*, *Juglans*, *Sassafras* ..... *A. otiosus* Say

- Front of head sparsely clothed with white hairs behind epistoma; genitalia with parameres transparent apically; pronotum not bicolored dorsally 7

7 Genitalia with apex of median lobe obtuse; parameres angularly expanded near middle and densely punctured on ventral surface; Host: *Carpinus* .... *A. ohioensis* Knull

- Genitalia with apex of median lobe acute; parameres slightly expanded before api-

ces, not densely punctured on ventral surface; Host: adults collected on *Corylus* .. .. *A. atricornis* Fisher

8 Second abdominal ventrite transversely concave, causing the abdomen to be bent downward in lateral view; Host: *Juglans* ..... *A. transimpressus* Fall

- Second abdominal ventrite not transversely concave, at most slightly concave near middle or with a deep longitudinal median channel 9

9 Genitalia with fleshy lobes at apex of parameres that protrude beyond apex of median lobe; first two abdominal ventrites channeled medially; Host: *Ostrya* .... *A. osburni* Knull

- Genitalia without protruding fleshy lobes at apex of parameres; first two abdominal ventrites convex, feebly flattened, or slightly concave medially 10

10 Apical prosternal margin broadly emarginate 11

- Apical prosternal margin broadly rounded or feebly emarginate 12

11 Genitalia with parameres elongate, subparallel, tips not transluscent; fifth antennomere about as long as wide; Host: *Diospyros* ..... *A. diospyroides* Knull

- Genitalia with parameres arcuately expanded near middle, tips transluscent; fifth antennomere nearly twice as long as wide; Host: unknown ..... *A. hazardi* Knull

12 First two abdominal ventrites convex medially; genitalia with parameres subangularly expanded near middle, parallel toward apex; Host: *Juglans* .... *A. juglandis* Knull

- First two abdominal ventrites feebly, longitudinally flattened medially; genitalia with parameres expanded in apical half, parallel toward apex or not 13

13 Genitalia in lateral view bent sharply downward in basal half; parameres subquadrately expanded in apical half, angled obliquely downward laterad, narrowed suddenly before apex; Host: *Betula* ..... *A. betulanigrae* MacRae **n. sp.**

- Genitalia in lateral view not bent sharply downward in basal half; parameres arcuately expanded in apical half, converging evenly toward apex; Host: *Quercus* .... *A. frosti* Knull

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References

Alexeev, A.V. (1998) K podrodovoi klassifikatsii zlatok roda *Agrilus* Curtis (Coleoptera, Buprestidae) fauny Palearktiki. *Entomologicheskoe Obozrenie*, 77(2), 367–383 [In Russian with English summary] [English translation: To the subgeneric classification of the buprestid genus *Agrilus* Curtis (Coleoptera, Buprestidae) of the Palaearctic fauna. *Entomological Review*, 78(4) (1998), 423–436].

Arnett, R.H., Samuelson, G.A. & Nishida, G.M. (1993) *The insect and spider collections of the world (2nd edition). Flora & Fauna Handbook No. 11*. Sandhill Crane Press, Inc., Gainesville, Florida, 310 pp.

Bellamy, C.L. (1996) Comments on the genus *Agrilus* Curtis, 1825: Where do we go and do we go together? (Coleoptera: Buprestidae: Agrilinae). *Elytron*, 9 (1995), 77–86.

Bellamy, C.L. & Hespenheide, H.A. (2002) The review of two Mexican species-groups of *Agrilus* (Coleoptera: Buprestidae: Agrilinae). *Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología*, 73(1), 37–51.

Bellamy, C.L. & Nelson, G.H. (2002) Buprestidae Leach 1815. *In*: Arnett, R.H., Thomas, M.C., Skelley, P.E. & Frank, J.H. [Eds.], *American Beetles, Volume 2. Polyphaga: Scarabaeoidea through Curculionoidea*. CRC Press, Boca Raton, pp. 98-112.

Bright, D. (1987) *Coleoptera. Buprestidae. The metallic wood-boring beetles of Canada and Alaska*. Minister of Supply and Services, Canada, Ottawa, 335 pp.

Fisher, W.S. (1928) A revision of the North American species of buprestid beetles belonging to the genus *Agrilus*. *United States National Museum, Bulletin No. 145*, 1–347.

Knull, J.N. (1920) Notes on Buprestidae with descriptions of new species (Coleop.). *Entomological News*, 31(1), 4–12.

Knull, J.N. (1922) Annotated list of the Buprestidae of Pennsylvania. *The Canadian Entomologist*, 54, 79–86.

Knull, J.N. (1930) Notes on Coleoptera—No. 2. *Entomological News*, 41(3), 82–86.

MacRae, T.C. (1991) The Buprestidae (Coleoptera) of Missouri. *Insecta Mundi*, 5(2), 101–126.

MacRae, T.C. & Nelson, G.H. (2003) Distributional and biological notes on Buprestidae (Coleoptera) in North and Central America and the West Indies, with validation of one species. *The Coleopterists Bulletin*, 57(2), 57–70.

Nelson, G.H. & Westcott, R.L. (1991) Review of the *pulchellus* group of *Agrilus* with descriptions of new species (Coleoptera: Buprestidae). *The Coleopterists Bulletin*, 45(2), 121–142.

Nelson, P.W. (1985) *The Terrestrial Natural Communities of Missouri*. Missouri Natural Areas Committee, Jefferson City, 197 pp.

Obenberger, J. (1957) Quelques considérations sur le sous-genre *Epinagrilus* V. Stepanov et sur les caractères du genre *Agrilus* Curtis général (Col. Bupr.). Úvaha o poddrudu *Epinagrilus* V. Stepanov a o znacích rodu *Agrilus* Curtis vûbec (Col. Bupr.). *Acta Entomologica Musei Nationalis Pragae*, 31, 77–89.

Steyermark, J.A. (1963) *The Flora of Missouri*. The Iowa State University Press, Ames, 1728 pp.

Wellso, S.G., Manley, G.V. & Jackman, J.A. (1976) Keys and notes on the Buprestidae (Coleoptera) of Michigan. *The Great Lakes Entomologist*, 9(1), 1–22.

