Revision of Aerophilus Szépligeti (Hymenoptera, Braconidae, Agathidinae) from Eastern North America, with a Key to Nearctic Species North of Mexico

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ABSTRACT. The Nearctic species of Aerophilus Szépligeti, 1902, are revised with an emphasis on the fauna of the eastern USA. The generic name Lytopylus Foster, 1862, is shown to have been misapplied to the group revised here and it is replaced by Aerophilus. The following genera are synonymized with Aerophilus: Neomicrodus Szépligeti, 1908, syn. n.; Aerophilopsis Viereck, 1913, syn. n.; Aerphilina Enderlein, 1920, syn. n.; Ioxia Enderlein, 1920, syn. n.; Hormagathis Brues, 1926, syn. n.; Obesomicrodus Papp, 1971, syn. n.; Facilagathis van Achterberg and Chen, 2004, syn. n. The type species of Lytopylus (L. azigos Viereck, 1905) fits the generic concept of Austroearinus Sharkey, 2006; the latter is therefore synonymized with Lytopylus, and all species included in Austroearinus are transferred to Lytopylus as new combinations. Agathellina Enderlein, 1920, and Ditropa Enderlein, 1920, are synonymized with Lytopylus, syn. n. A list of all new combinations is included.

Thirty-five species of Aerophilus are treated, with 16 described as new (i.e., A. arthousevansi, A. chapmani, A. davidsmithi, A. hopkinsensis, A. jiberndoni, A. klastos, A. kowlesae, A. minys, A. munya, A. pookae, A. rayfisheri, A. reginae, A. robertcourtneyi, A. szepligeti, A. terrynoyeri, A. tommurrayi). The senior author (M.J.S.), is the sole authority of these species. All 19 previously described species have new combinations (i.e., A. abdinalis, A. acicularis, A. acrobasidis, A. bakeri, A. binominatus, A. buttricki, A. calcaratus, A. cissicornis, A. difficilis, A. erythrogaster, A. niger, A. ninanae, A. nucicola, A. perforator, A. reticulatus, A. rugareolatus, A. tenues, A. usitatus, A. wyomingensis). Several new synonyms are proposed (i.e., Agathis aripes Cresson is synonymized under Agathis nigripes Cresson, Bassus pini Muesebeck is synonymized under Aerophilopsis erythrogaster Viereck, and Agathis wyomingensis Viereck is removed from synonymy with Agathis nigripes Cresson).

An illustrated key, image plates, and distribution maps are included for each species. The revision is primarily based on newly collected material from Kentucky, Virginia, and West Virginia, for which molecular data were available. A phylogenetic analysis of Aerophilus, based on 28S and cytochrome c oxidase subunit I (COI), with representatives from all major biomes, is included. Another tree, based solely on COI data is included to show species divergences, which was used in conjunction with morphological data to delimit species.

INTRODUCTION

Agathidinae are a moderately diverse subfamily of Braconidae with about 1,200 described species (Yu et al., 2015), and many times that number are yet to be named. Larvae are parasitoids of lepidopteran caterpillars of a multitude of families. Most agathidinae genera, including Aerophilus caterpillars of a multitude of families. Most with about 1,200 described species (Yu et al., 2015), and many genera seem to be restricted to one or a few closely related families of Lepidoptera. The collective set of Aerophilus species attack a wide range of host families. Even within the small sample of 10 rare species of Aerophilus represented in the revision of Costa Rican species (Sharkey et al., 2011), five host families are attacked (i.e., Crambidae, Elachistidae, Pyralidae, Thyrididae, and Tortricidae). However, all of these are leaf-feeding and leaf-feeding small caterpillars. Members of Aerophilus are conspicuous in not using species of caterpillars that feed exposed on leaf surfaces (e.g., butterflies and moths). Individual species of Aerophilus tend to be host specific. Of the 10 species treated from Costa Rica, all but one, A. jessiehillae, are host specific (i.e., each attacks only one host species). And even the hosts of A. jessiehillae are very closely related to each other. The results of the phylogenetic analyses (fig. 1 in Sharkey et al., 2011) show that host family is constrained by phylogenetic history, with sister species of Aerophilus sharing the same host family in every case (three). Several species of Aerophilus have been employed in biological control attempts. Aerophilus rufipes (as Bassus diversus) was introduced into the eastern USA from Japan to combat the oriental fruit moth, Grapholita molesta (Busck), Tortricidae, over a period of a number of years in the 1930s (Allen and Yetter, 1949). Despite initial signs of success it does not appear to have become established. Aerophilus rufipes was also imported to California in the 1990s to control the codling moth, Cydia pomonella L., Tortricidae. However it too failed to become established (Mills, 2005). Aerophilus acrobasidis has been used in the biocntrol of Acrobasis maxcorella (the pecan nut casebearer) and Cydia carya (the hickory shuckworm) (Ellington et al., 1995; Romero et al., 2001) with unknown results.

Although this revision is primarily based on newly collected material from Kentucky, Virginia, and West Virginia, all Nearctic species are included in the key. There are two principal reasons for the emphasis on eastern species. The first is that there are very few if any species with distributions that span the USA or Canada from east to west, therefore including both faunas would pointlessly complicate the key. The second reason for the emphasis on eastern species is that many species are difficult to separate on morphological grounds and molecular data from fresh specimens was necessary. Intensive Malaise trap collecting has been conducted over the past decade in Kentucky by members of the Sharkey lab at the University of Kentucky and
by Dr. David Smith and colleagues in Virginia and West Virginia. Therefore, we have a fair representation of some eastern species, especially those at mid-latitudes, for which molecular data were obtained.

The previously described western species are included in the key, but they are clearly noted as being western, so they can be quickly passed over in most cases. There are many more undescribed western species, some of which are included in the cladograms (Figs. 1 and 2), and a separate revision on these is in preparation (Sharkey and Chapman, in prep.). The species with the widest east–west distribution confirmed here is *A. rayfisheri*, which occurs in North Dakota and Kentucky. It is likely that a good number of species are midwestern with this magnitude of range. Other species such as *A. nigripes* have a wider published distribution; however, in these cases the species identifications are suspect.

Six of the new eastern species are represented by singletons, and several more species are known from fewer than four specimens. These data suggest, despite adding 16 species to the eastern fauna, that there are many more eastern species yet to be discovered.

New World members of *Aerophilus* may be distinguished from other agathidines by the almost universal presence of longitudinal striae on the third metasomal median tergite, at least in some transverse depressions, and by the structure of the propodeal foramen (i.e., a relatively wide space between the metasomal and hind coxal foramina and a strong transverse carina connecting the dorsal margins of the coxal foramina). A key to the Nearctic genera of Agathidinae is provided in Sharkey and Chapman (2015); unfortunately, in this key, the name *Lytopylus* must be replaced by *Aerophilus* and *Austroearinus* must be replaced by *Lytopylus* to conform to the corrections made here. The sister group to *Aerophilus* is *Braunsia* Kriechbaumer, which is restricted to the Old World and is mostly tropical or subtropical (Sharkey et al., 2006; Sharkey and Chapman, 2015).

Muesebeck (1927) revised the species of *Aerophilus* (as members of *Bassus*) in his revision of the species of Agathidinae north of Mexico. He treated 16 nominal species in this revision and described several more in subsequent publications (Muesebeck, 1932, 1940). No Nearctic species has been described since 1940. Because Muesebeck’s (1927) key includes what are now considered other genera (i.e., *Alabagrus*, *Agathis* s.s., *Aphelagathis*, *Lytopylus*, *Pneumagathis*, *Therophilus*, and *Neotblipsis*), it is unduly complicated; it is also missing the species described since 1927. Simbolotti and van Achterberg (1992) included the six species of *Aerophilus* from the western Palearctic under the umbrella of *Bassus*. Sharkey (1996) included two species from Japan, and Sharkey et al. (2009) recorded two species occurring in Thailand. Van Achterberg and Long (2010) recorded two species for Vietnam, one under *Lytopylus* and one under *Facilagathis*. Farahani et al. (2014) described a new species from Iran and included a key to the West Palearctic species of *Aerophilus* (as *Lytopylus*). Sharkey et al. (2011) revised the 10 species reared in Costa Rica, as *Lytopylus*. One species has been recorded from Australia (Stevens et al., 2010). *Aerophilus* is diverse in Africa (where it has never been revised) and throughout the New World. The genus is not species-rich in Eurasia or in the Australian and Oriental regions, and it is in unknown in Pacifica. For a world distribution of the *Aerophilus* specimens we have included in our Symbiota database, see our map online (http://bit.ly/1M9DhqM).

Figure 1 *Lytopylus azygos*, holotype: A. lateral habitus, B. tarsal claw, C. forewing, D. dorsal mesosoma, E. lateral mesosoma, F. propodeum showing sculpture and narrow sclerite between metasomal and hind coxal foramina.

Figure 2 *Lytopylus azygos*: A. dorsal metasoma, B. anterior head.
MORPHOLOGICAL TERMS

Morphological terms are from Sharkey and Wharton (1997) and are matched to the Hymenoptera Anatomy Ontology (HAO; http://glossary.hymao.org; Yoder et al., 2010). Anatomical concepts in HAO are provided to enable readers to confirm their understanding of the anatomical structures being referenced. To find out more about a given structure, including images, references, and other metadata, simply search for the anatomical structure at hand and select the best match from the list that appears (e.g., typing “frons” returns a list of 11 possible matches). In electronic versions of this paper, terms are hyperlinked to the ontology the first time they appear, either in the text, key, or subsequent species descriptions.

Museum acronyms found in the “Specimens Examined” sections of this paper are taken from “Abbreviations for Insect and Spider Collections of the World” (Evenhuis, 2014). Host records for each species were taken from Taxapad (Yu et al., 2015). All species are treated with a diagnosis and distributional data. For previously published species, the states and provinces from which they are recorded are listed; however, due to the degree of misidentifications that are present in collections, only those specimens determined by M.J.S. are included in the linked distribution maps. These records are stored in the Symbiota database (Gries et al., 2014) under the Hymenoptera Institute Collection (HIC). The maps were generated by conducting a map search for each species on the SCAN portal (Symbiota Collections of Arthropods Network; http://symbiota4.acis.ufl.edu/scan_portal/), querying only specimens in the HIC. This generates a map URL that contains a search query for the taxon at hand in the HIC database. Mouse over any data point on the maps to access the details of each record (including images if present). These are not static maps; therefore, as georeferenced specimens are added to the HIC Symbiota database, they will automatically be added to the map in real time. Also, because these data are public, anyone can generate a map search for any taxon in our Symbiota database: From the Symbiota link above, under the Search menu, select Map Search. This will open a new tab with a map that has an Open icon at the top left, which opens a dialog box with many options for searching any or all of the databases in the Symbiota network. If one wishes only to search within the HIC database, select only HIC under the Collections tab.

All species are illustrated with color photos using a JVC digital camera mounted on a Leica MZ16 microscope and Auto-Montage® stacking software. Species descriptions are of the holotype, and variation is given in parentheses.

DNA EXTRACTION, PCR, AND SEQUENCING

DNA was extracted from individual legs with the Qiagen DNeasy Blood and Tissue Kit using the animal tissue protocol (Qiagen Inc., Chatsworth, California, USA). The mitochondrial cytochrome c oxidase subunit I (COI) gene was amplified with the COI primer pairs LepF1 and LepR1 (~655 bp between the primers; Hebert et al., 2004), and when this fragment did not amplify, we employed LepF1 and Crem155R (Tucker et al., 2015) to amplify a smaller fragment (~135 bp). We also sequenced the D2–D3 regions of 28S using the primer pairs 28SD2F (Belshaw and Quicke, 1997) and D3R (Harry et al., 1996). PCR was conducted using Takara reagents for COI, with each reaction consisting of 1X buffer, 0.3 mM nucleotides, 0.4 µM of each primer, 0.625 U Takara Ex Taq, ddH2O, and 1–3 µL template DNA in a total reaction volume of 25 µL. The thermal cycling protocol had an initial denaturation period at 95 °C for 2.5 min, followed by 40 cycling steps which denatured at 95 °C for 30 s, annealed at 44 °C for 30 s and extended at 68 °C for 45 s, with a final extension step of 72 °C for 7 min. For 28S, PCR reactions consisted of Qiagen 1X buffer, 4 mM MgSO4, 0.3 mM dNTP, 0.4 µM of each primer, 0.625 U Qiagen Taq, ddH2O, and 1–3 µL template DNA with a total reaction volume of 25 µL. Thermal cycling was as above except annealing at 53 °C, extending for 70 s, and a total of 35 cycles. PCR products were outsourced for Sanger sequencing either by the Advanced Genetic Technologies Center (University of Kentucky, Lexington, Kentucky, USA) or Beckman Coulter Genomics (Danvers, Massachusetts, USA) using labeled dideoxynucleotides with ABI 3730 BigDye Terminator mix v. 3.0 or with ABI PRISM 3730xl, BigDye Terminator mix v. 3.1 (Applied Biosystems, Foster City, California, USA).

DNA ASSEMBLY AND PHYLOGENETIC ANALYSIS

Bidirectional sequences were aligned and edited using Geneious Pro (v. 6.1.5; Drummond et al., 2009) and multiple alignments were assembled using the default settings on the MAFFT server (http://www.ebi.ac.uk/Tools/msa/mafft/; v. 7; Katoh et al., 2006). We conducted maximum likelihood (ML) analyses on two data sets: COI (655 nt, 110 operational taxonomic units [OTU]) and a concatenated (using MacClade v. 4.08; Maddison and Maddison, 2005) COI+28S (1,161 nt, 127 OTU) data set using Garli (v. 2.01; Zwickl, 2006). The data were partitioned by gene region and codon position for 28S+COI (total of four partitions) and by codon position for COI (three partitions). We applied the most complex model available (GTR+I+G; Rodriguez et al., 1990) to each partition as per recommendations of Huelsenbeck and Rannala (2004) for likelihood-based analyses. Garli applies separate parameter estimates to each partition. For both data sets, a 200-replicate ML analysis was conducted using the default settings. Nodal support was assessed by conducting a 500-replicate ML bootstrap analysis (Felsenstein, 1985) on each data set using the default settings, with three independent search replicates per bootstrap replicate. The COI analyses (Supp. Figs. 1 and 2; summarized in Fig. 3) was used to help make decisions regarding species delimitation, as 28S is not variable enough to reliably separate closely related lineages, whereas the analyses of the COI+28S data set (Supp. Figs. 3 and 4; summarized in Fig. 4) was conducted to find the best estimate of phylogeny.

A Bayesian inference (BI) phylogenetic analysis was also conducted on the COI+28S data set with MrBayes (v. 3.1.2; Huelsenbeck and Ronquist, 2001; Ronquist and Huelsenbeck, 2003). As in the Garli analyses, the data were partitioned by gene region and codon position. To allow each partition to have its own set of parameter estimates, revmat, tratio, statefreq, shape, and pinvar were all unlinked during the analyses. To obtain the most accurate branch length estimates possible, the option prset ratepr = variable (which assigns a separate branch length parameter for each partition) was employed as per the recommendations of Marshall et al. (2006). Two independent, simultaneous BI searches were run for 100 million generations, saving a tree every 1,000 generations, with four search chains each. The average standard deviation of split frequencies fell below 0.02 just before 80 million generations. The 20,000 post-burn-in trees from each run (40,000 total), determined by examination of the log probability of observing the data by generation plot with Tracer (v. 1.5; Rambaut and Drummond, 2009), were used to calculate the majority rule consensus tree using PAUP* (v. 4.0B10; Swoford, 2003). The tree of highest posterior probability from the Bayesian analysis is shown in Supplemental Figure 5, and the majority rule consensus tree is shown in Supplemental Figure 6. The data sets analyzed herein are available from the authors upon request.
RESULTS

NOMENCLATORIAL CONSIDERATIONS

The senior author (M.J.S.) recently had the opportunity to view the type of Lytopylus Forster, 1862, Lytopylus azygos Viereck, 1905, Förster (1862) did not include any species under Lytopylus, therefore the type species by monotypy became the first included species, in this case L. azygos. Unfortunately this species does not conform to the generic concept that has been applied to it in recent years (Sharkey et al., 2009, 2011; van Achterberg, 2011). Rather, it fits the concept of Austroearinus proposed by Sharkey et al. (2006). This necessitates the synonymy of Austroearinus under Lytopylus n. syn. Furthermore, two other nominal genera fit my (M.J.S.) concept of Austroearinus that must be synonymized under Lytopylus, namely, Ditropia Enderlein, 1920, n. syn. and Agathellina Enderlein, 1920, n. syn. Figure 1 is a plate of the type species of Lytopylus. The type is missing both the head and metasoma; therefore, Figure 2 is included to show these body parts in what I (M.J.S.) believe to be a conspecific specimen. Characters consistent with the concept of Austroearinus are: sessile second submarginal cell, that is, lacking a petiole (Fig. 1C); notauli not impressed (Fig. 1D); propodeum with sculpture confined to the midline posteriorly (Fig. 1F); terga of metasoma smooth except for pair of longitudinal carinae on first median tergite (Fig. 2A); interantennal space with a weak medial depression (Fig. 2B); sclerite between metasomal and coxal foramina narrow.

The oldest name that applies to the old (misinformed) concept of Lytopylus is Aerophilus Szépligeti, 1902. All species recently described under Lytopylus are transferred to Aerophilus. The new combinations for both Aerophilus and Lytopylus are presented below.

Aerophilus Szépligeti, 1902

TYPE SPECIES. Aerophilus brullei Szépligeti, 1902 (by monotypy).


Aerophilopsis Viereck, 1913, syn. n. Type species: Bassus erythrogaster Viereck, 1913.


Hormagathis Brues, 1926, syn. n. Type species: Hormagathis mellea Brues, 1926.


Neomicrodus Szépligeti, 1908, syn. n. Type species: Neomicrodus boliviensis Szépligeti, 1908.


NEW COMBINATIONS (alphabetized by epithet)

Microdus astioles Nixon, 1950, to Aerophilus astioles

Bassus barbieri Simpson and van Achterberg, 1992, to Aerophilus barbieri.

Metriosoma bicarinatum Enderlein, 1920, to Aerophilus bicarinatum.

Aerophilina bicristata Enderlein, 1920, to Aerophilus bicristatus.

Neomicrodus boliviensis Szépligeti, 1908, to Aerophilus boliviensis.

Lytopylus bradzlotnicki Sharkey, 2011, to Aerophilus bradzlotnicki.

Metriosoma brasiliense Enderlein, 1920, to Aerophilus brasiliense.

Lytopylus brevitarsus van Achterberg, 2011, to Aerophilus brevitarsus.

Lytopylus colleenhtitchcockae Sharkey, 2011, to Aerophilus colleenhtitchcockae.

Agathis ebula Nixon, 1950, to Aerophilus ebula.

Agathis burmensis Bhat and Gupta, 1977, to Aerophilus burmensis (junior synonym of Agathis ebula).

Ioxia faceta Enderlein, 1920, to Aerophilus facetus.

Microdus femoratus Cameron, 1887, to Aerophilus femoratus.

Metriosoma flavicalcar Enderlein, 1920, to Aerophilus flavicalcar.

Microdus fortipes Reinhard, 1867, to Aerophilus fortipes.

Lytopylus gregburtoni Sharkey, 2011, to Aerophilus gregburtoni.

Microdus infumatus Granger, 1949, to Aerophilus infumatus.

Lytopylus jessicadimauroae Sharkey, 2011, to Aerophilus jessicadimauroae.

Lytopylus jessiehillae Sharkey, 2011, to Aerophilus jessiehillae.

Microdus melanocephalus Cameron, 1887, to Aerophilus melanocephalus.

Hormagathis mellea Brues, 1926, to Aerophilus mellea.

Lytopylus mingfangi Sharkey, 2011, to Aerophilus mingfangi.

Obesomicrodus niger Papp, 1971, to Aerophilus niger.

Cremnops nigrobalteatus Cameron, 1911, to Aerophilus nigrobalteatus.

Bassus pastrnai Blanchard, 1952, to Aerophilus pastrnai.

Lytopylus persicus Farahani and Talebi, 2014, to Aerophilus persicus.

Agathis philippinensis Bhat and Gupta, 1977, to Aerophilus philippinensis.

Microdus pilosus Tobias, 1976, to Aerophilus pilosus (this species fits well with the concept of Aerophilus, with the exception of a shorter distance between the hind coxal cavities and the metasomal foramen.)

Microdus rugulosus Nees, 1834, to Aerophilus rugulosus.

Lytopylus rebeccaeshapleyae Sharkey, 2011, to Aerophilus rebeccaeshapleyae.

Lytopylus rohpriengle Sharkey, 2011, to Aerophilus rohpriengle.

Microdus romani Shustakov, 1940, to Aerophilus romani.

Bassus ater Chou and Sharkey, 1989, to Aerophilus ater (junior synonym of Microdus romani).

Microdus Rufipes Nees, 1812, to Aerophilus Rufipes.

Microdus amurenensis Shustakov, 1940, to Aerophilus amurenensis (junior synonym of Microdus Rufipes).

Bassus diversus Muesebeck, 1933, to Aerophilus diversus (junior synonym of Microdus Rufipes).

Bransia germanica Enderlein, 1904, to Aerophilus germanicus (junior synonym of Microdus Rufipes).

Lytopylus sandraberriosa Sharkey, 2011, to Aerophilus sandraberriosa.

Microdus sculptilis Tobias, 1986, to Aerophilus sculptilis.


Bassus tayrona Campos, 2007, to Aerophilus tayrona.

Lytopylus vaughntani Sharkey, 2011, to Aerophilus vaughntani.

REINSTATED ORIGINAL COMBINATIONS

Aerophilus brullei Szépligeti, 1902 (from Bassus).

Aerophilus lamelliger Granger, 1949 (from Bassus).
Aerophilus sulcatus Granger, 1949 (from Bassus)
Aerophilus lucidus Granger, 1949 (from Bassus)
Aerophilus rufus Granger, 1949 (from Bassus)
Aerophilus speciosicornis Granger, 1949 (from Bassus)
Aerophilus sulcatus Granger, 1949 (from Bassus)

Lytopylus Föster, 1862

TYPE SPECIES. Lytopylus azygos Viereck, 1905, by monotypy, first included species.

Austroearinus Sharkey, 2006, syn. n. Type species: Bassus rufofemoratus Muesebeck, 1927.
Austroearinus chrysokeras Sharkey, 2006, to Lytopylus chrysokeras
Agathellina columbiana Enderlein, 1920, to Lytopylus columbiana
Austroearinus melanopodes Sharkey, 2006, to Lytopylus melanopodes
Bassus rufofemoratus Muesebeck, 1927, to Lytopylus rufofemoratus
Ditropia strigata Enderlein, 1920, to Lytopylus strigata
Orgilus unicolor Schrottky, 1902, to Lytopylus unicolor. Note: Orgilus unicolor was renamed Agathis unicoloratus when it was transferred to Agathis by Shenefelt (1970) due to preoccupation of unicolor in the genus Agathis by Cameron (1908).
Species Delimitation

The ML tree in Figure 3 is based solely on COI and was generated to assist in the delimitation of species and not to represent a phylogenetic hypothesis. We used ML instead of neighbor joining because with ML, mutations are more accurately modeled, with rare mutations contributing more to branch lengths than common ones. We did not employ any particular branch length to determine species status. Rather, we preferred a total-evidence approach using both morphology and COI differences to come to species decisions.

My (M.J.S.) first pass at delimiting species was strictly morphological, and I then tested these concepts with molecular, primarily COI, data. Although many morphospecies concepts were corroborated (e.g., *A. perforator*) with these data, others were falsified with both lumping and splitting errors. The cladogram in Figure 3 shows the ML distance generated from COI data. Clade A represents specimens of what I determined to be *A. calcaratus*. The triangle in clade A represents nine specimens, and the length of the triangle is related to the COI differences among the specimens. For more exact detail of distances between specimens, refer to supplemental Figure 1, the tree of highest log-likelihood from 200 ML replicates, which includes all terminals with COI data. There is considerable molecular variation within this concept of *A. calcaratus*, for example, more variation than there is across all three species in clade B of Figure 3. The specimens within *A. calcaratus* are morphologically homogeneous, and there are no large differences in COI when all specimens are considered, i.e., no gaps that might indicate separate species. Conversely, specimens of *A. jdherndoni* vary considerably morphologically yet there is a continuum in this variability and few sequence differences. In this case it would have been very difficult to decide on species limits without the addition of COI data.

Phylogenetic Considerations

Figure 4 is the best ML tree based on COI and 28S sequence data in which redundant terminals have been compressed. In
supplemental documentation we have included uncompressed trees from three analyses: Supplemental Figure 3, 200 replicate ML search for the tree of highest log-likelihood; Supplemental Figure 4, ML bootstrap tree from 500 replicates; Supplemental Figure 5, Bayesian tree of highest posterior probability; Supplemental Figure 6, Bayesian majority rule consensus tree. We selected a suite of species of *Braunsia* as the outgroup because the genus has been shown to be the sister group of *Aerophilus* (Sharkey et al., 2006; Sharkey and Chapman, 2015).

Clade A of Figure 4 is the only branch containing Old World (Africa and Europe) species; it also contains some Nearctic species. Although lacking strong support values, all but one of the nine species have the relatively rare condition of metasomal median tergites 1–3 with completely striate sculpture. The exception is specimen H2201 from The Republic of Congo (Supp. Fig. 3), which has these tergites unusually smooth. The six species comprising clade B (Fig. 4) are quite uniform, in that none have elongate genae; all are bicolored with the abdomen (including propodeum) reddish and the head and thorax black; all have obvious notauli; none have heavily striate metasomal terga; and all but one have the propodeum evenly areolate, as in Figure 24D. There are no obvious morphological synapomorphies for this group, as all of the aforementioned character states are common throughout the genus.

Clade C is not well supported, and there is an heterogeneous mix of morphological character states in the group. Of particular interest is the presence of *A. perforator* in this clade. *A. perforator* and its probable sister species, *A. pookae*, for which we do not have molecular data, are unique in that they are small, have heavily striate metasomal terga 1–3, and very elongate genae (Fig. 30). The long branch leading to *A. perforator* coupled with low support at node C suggests that it may be misplaced in the phylogeny. Running the analysis without *A. perforator* increases the ML bootstrap value of node E from 53 to 72.

Clade D (Fig. 4), although not highly supported by molecular data, is supported by one morphological character state (i.e., the genae and mouthparts of all members are very elongate). With reference to the mouthparts, the most easily measured character state is the length of the penultimate labial palpomere, which unlike most members of the genus, is more than half the length of the apical palpomere in this clade. This group is largely confined to the western USA and northwestern Mexico, although some species are found in the east, for example, *A. rayfisheri*. The long mouthparts are thought to be adaptations associated with deep nectaries, which are common in dry habits where shallow nectaries are more at risk of desiccation (Jervis, 1998). Long genae and associated long mouthparts are a reoccurring theme in the evolution of the Agathidinae. This character state is almost universal in *Agathis, Disophrys,* and *Cremnops* and rare or absent in other genera. Within *Aerophilus* these character states are found only in Nearctic species.

There are no obvious morphological synapomorphies for clades E, D, and F. Members of clade G are quite variable in most characteristics, but none has an elongate gena and mouthparts, and the notauli are weak or absent in all.

**KEY TO THE SPECIES OF ** *AEROPHILUS* **OF THE USA AND CANADA WITH AN EMPHASIS ON EASTERN FAUNA**

1. A. Hind coxa in lateral view entirely melanic........................................................................................................................................................................... 2
   B. Hind coxa in lateral view entirely pale .............................................................................................................................................................. 11
   C. Hind coxa in lateral view bicolored, melanic and pale .............................................................................................................................. 35

Couplet 1

2(1)  A. Gena elongate, distance between eyes twice the distance from eyes to apex of clypeus or less, measured along the midline of the face........................................................................................................................................................................... 6
   B. Gena not elongate, distance between eyes more than 2.5 times distance from eyes to apex of clypeus, measured along the midline of the face ....................................................................................................................................................... 3

Couplet 2
3(2) A. First metasomal median tergite usually mostly covered with longitudinal striae, rarely striae restricted to area between pair of longitudinal carinae. AA. Mesoscutellum usually, partly or entirely pale (yellow to orange); if entirely melanic, then hind femur mostly or entirely melanic.......................................................................................................................4

B. First metasomal median tergite mostly smooth or otherwise sculptured, longitudinal striae, if present, weak and irregular. BB. Mesoscutellum entirely melanic; hind femur pale (yellow to orange).......................................................................................................................5

4(3) A. Raised areas of median metasomal tergite 2 smooth; striae, if present, restricted to troughs of transverse depressions. BB. Notauli smooth without crenulae, or with one or two crenulae restricted to extreme anterior at border of mesoscutum.......................................................................................................................A. minys n. sp. (in part)

B. Raised areas of median metasomal tergite 2 mostly longitudinally striate or granulate, except sometimes for posterior margin. AA. Notauli with crenulae extending well along its length, present at least in anterior 1/3 (Texas) ........................................................................................................................................A. aciculatus (Ashmead)

Note: *A. rufipes*, a European species, will key here. It has been introduced into the western USA to control the codling moth (Mills, 2005) but does not seem to have become established. It can be distinguished from all Nearctic species by its predominantly black color.

5(3) A. Notauli well impressed. Hind trochanter mostly or entirely melanic.................................................A. davidsmithi n. sp.

B. Notauli barely perceptible or weakly impressed. Hind trochanter mostly or entirely pale ....A. binominatus (Muesebeck)

6(2) A. Notauli barely perceptible or entirely absent.....................................................................................................................7

B. Notauli impressed...............................................................................................................................................................9
Couplet 6

7(6) A. Propodeum with a well-defined median areola, and extensively sculptured; first metasomal median tergite wider, slightly wider than long, and with more sculpture ................................................................. *A. rayfisheri* n. sp.

B. Propodeum lacking a well-defined median areola and with less sculpture; first metasomal median tergite narrower, slightly longer than wide, and with less sculpture .................................................................................. 8

Couplet 7

8(7) The images below are of the holotypes of the respective species

A. Mesoscutum black (Colorado) ................................................................. *A. bakeri* (Muesebeck)

B. Mesoscutum pale (Wyoming) ................................................................. *A. wyomingensis* (Viereck)

Couplet 8

9(6) A. First metasomal median tergite usually mostly covered with longitudinal striae ......................................................... 10

B. First metasomal median tergite mostly smooth or otherwise sculptured, longitudinal striae, if present, weak and irregular (western species) ........................................................................................................................................ *A. nigripes* (Cresson)

Couplet 9
10(9)  
A. Mesoscutum entirely melanic ......................................................................................................................... *A. tommurrayi* n. sp.
B. Mesoscutum entirely pale ................................................................................................................................. *A. crassicornis* (Muesebeck)

Couplet 10

11(1)  
A. Head color mostly pale, black dorsally ............................................................................................................ 12
B. Head color entirely pale, orange to yellow ......................................................................................................... 16
C. Head color mostly or entirely black, usually with some pale color on eye orbits, gena and clypeus .... 21

Couplet 11

12(11)  
A. Gena elongate, distance between eyes twice the distance from eyes to apex of clypeus or less, measured along the midline of the face .................................................................................................................. 13
B. Gena not elongate, distance between eyes more than 2.5 times distance from eyes to apex of clypeus, measured along the midline of the face ................................................................................................. 14

Couplet 12

13(12)  
A. Pair of carinae on first median tergite long and strong, extending past midpoint of tergite. Anterior three raised areas of syntergite 2+3 partly smooth or weakly striate. AA. Ovipositor shorter................. *A. perforator* (Provancher) (in part)
B. Pair of carinae on first median tergite short and weak, extending to midpoint of tergite. Anterior three raised areas of syntergite 2+3 entirely striate. BB. Ovipositor longer............................................................................... *A. pookae* n. sp.
Couplet 13

14(13)  A. First metasomal median tergite about as long as posterior width................................................................. 15
        B. First metasomal median tergite clearly longer than posterior width......................................................... *A. reginae* n. sp. (in part)

Couplet 14

15(13)  A. Ratio of malar space to eye height smaller (0.3–0.4). AA. First median tergite mostly covered with fine striae .......................................................................................................................... *A. minys* n. sp. (in part)
        B. Ratio of malar space to eye height greater (0.5–0.6). BB. First median tergite mostly smooth with several weak, smooth, wide striae ............................................................................................................. *A. buttricki* (Viereck) (in part)

Couplet 15

16(11)  A. Notauli absent or barely perceptible and always lacking sculpture................................................................. 17
        B. Notauli impressed, with or without sculpture .................................................................................................. 19
17(16)  A. Second median tergite sculptured in raised areas; first median tergite about as wide as long................................. 18
  B. Second median tergite smooth in raised areas; first median tergite longer than wide (Arizona).......................................................... A. tenuiceps (Muesebeck)

Couplet 17

18(17)  A. Second + third syntergite smoothly and uniformly striate........................................................ A. robertcourtneyi n. sp.
  B. Second + third syntergite finely striogranulate with striae more apparent in and near transverse depressions .............. A. reticulatus (Muesebeck)

Couplet 18

19(16)  A. Second median tergite striate in raised areas; first median tergite clearly longer than posterior width...................... 20
  B. Second median tergite smooth in raised areas; first median tergite about as long as posterior width. (image is of holotype) A. buttricki (Viereck) (in part)

Couplet 19

20(19)  A. First median tergite relatively finely striate and straight laterally .................................. A. abdominalis (Muesebeck)
  B. First median tergite relatively coarsely striate and angled laterally ................................................. A. klastos n. sp.
21(11) A. Mesoscutellum entirely melanic.................................................................................................................................... 22
B. Mesoscutellum partly or entirely pale (yellow to brownish orange) ............................................................................ 33

Couplet 21

22(21) A. Notauli barely perceptible or weakly impressed (at least indiscernible in posterior half) ........................................ 23
B. Notauli well impressed.................................................................................................................................................. 25

Couplet 22

23(22) A. Gena shorter and tapering sharply toward mandibles................................................................................................. 24
B. Gena longer and not tapering as sharply toward mandibles............................................................................................ A. rugareolatus (Viereck)

Couplet 23

24(23) A. Hind trochanter mostly or entirely melanic; forefemur almost entirely melanic with a pale (yellow to orange) patch apicomedially .................................................................................................................. A. erythrogaster (Viereck) (in part)
B. Hind trochanter mostly or entirely pale; forefemur entirely pale......................................................................................... A. stoelbae n. sp. (in part)
25(22) A. Second median tergite completely striate in raised areas ......................................................... *A. chapmani* n. sp.

B. Second median tergite partly or entirely smooth in raised areas .......................................................... 26

**Couplet 25**

26(25) A. Middle lobe of mesoscutum bulging and elevated above lateral lobes .................................... *A. difficilis* (Muesebeck)

B. Middle lobe of mesoscutum not bulging and not elevated above lateral lobes ........................................................... 27

**Couplet 26**

27(26) A. Propodeum with distinct areolae; antenna with more than 30 flagellomeres .............................................................. 29

B. Propodeum without distinct areolae, with more rugose sculpture; antenna with less than 30 flagellomeres .............. 28

**Couplet 27**

28(27) A. Hind trochanter mostly or entirely melanic ................................................................. *A. erythrogaster* (Viereck) (in part)

B. Hind trochanter mostly or entirely pale ................................................................. *A. jdherndoni* n. sp.
29(27) A. Hind trochanter mostly or entirely melanic................................................................................................................. 30

B. Hind trochanter mostly or entirely pale ................................................................................................................................... 31

Couplet 29

30(29) A. Antenna with 36 or more flagellomeres .................................................................................... A. malus n. sp. (in part)

B. Antenna with 35 or fewer flagellomeres ...................................................................................... A. calcaratus (Cresson)

Note: these two species are very similar morphologically and this couplet may not be sufficient to distinguish them.

31(29) A. Forefemur entirely melanic........................................................................................................ A. malus n. sp. (in part)

B. Forefemur melanic basally, pale (yellow to orange) apically, often with more pale color than shown below ........ 32

Couplet 31

32(31) A. Notauli smooth without crenulae or with one or two crenulae restricted to extreme anterior at border of mesoscutum .............................................................................................................. A. arthurevansi n. sp.

B. Notauli with crenulae extending well along its length, present at least in anterior 1/3 ................. A. usitatus (Gahan)

Couplet 32

33(21) A. Gena elongate, distance between eyes twice the distance from eyes to apex of clypeus or less, measured along the midline of the face............................................................... A. perforator (Provancher) (in part)

B. Gena not elongate, distance between eyes more than 2.5 times distance from eyes to apex of clypeus, measured along the midline of the face ................................................................................ 34
Couplet 33

34(33)  A. Mesonotum and tegula entirely pale, reddish brown (California) ................................................. *A. mucicola* (Muesebeck)

B. Mesonotum dark brownish orange, tegula variable but not black (Texas) ............................... *A. acrobasidis* (Cushman)

C. Mesonotum mostly pale (yellow to orange); tegula black .......................................................... *A. minys* n. sp. (in part)

Couplet 34

35(1)  A. Anterior lobe of median tergite 2 completely striate in raised areas ................................................................. 36

B. Anterior lobe of median tergite 2 partly or entirely smooth in raised areas ................................................. 37

Couplet 35

36(35)  A. Propodeum melanic, first median tergite with finer striae ............................................................... *A. stoelbae* n. sp. (in part)

B. Propodeum pale, first median tergite with coarser striae ............................................................... *A. terrymoyeri* n. sp.
37(35) A. Gena elongate, distance between eyes twice the distance from eyes to apex of clypeus or less, measured along the midline of the face ................................................................. A. perforator (Provancher) (in part)

B. Gena not elongate, distance between eyes more than 2.5 times distance from eyes to apex of clypeus, measured along the midline of the face ........................................................................................................ 38

Couplet 37

38(37) A. Metasomal terga black and pale ........................................................................... A. reginae n. sp. (in part)

B. Metasomal terga all pale ........................................................................................................ 39

Couplet 38

39(38) A. Mesoscutellum entirely melanic; hind femur pale (yellow to orange) ......................... A. kowlesae n. sp.

B. Mesoscutellum often partly or entirely pale (yellow to orange); if entirely melanic then hind femur mostly or entirely melanic ........................................................................................................... 40

Couplet 39
40(39) A. First metasomal median tergite wider than long. AA. Hind femur with extensive melanic color .............................................. 41
B. First metasomal median tergite longer than posterior width. BB. Hind femur entirely pale (Arizona, California) (image of holotype).............................................................................................................. A. ninanae (Muesebeck)

Couplet 40

41(40) A. Notauli well impressed; sternaulus deep with some fovea; antenna with more than 30 flagellomeres ......................... .............................................................................................................. A. hopkinsensis n. sp.
B. Notauli relatively weak and shallow; sternaulus shallow and smooth; antenna with fewer than 28 flagellomeres........... ......................................................................................................................... A. minys n. sp. (in part)

Couplet 41

SYSTEMATICS

Descriptions are of the holotype with variation given in parentheses.

*Aerophilus abdominalis* (Muesebeck, 1927) n. comb.

*Figures 5*

*Bassus abdominalis* Muesebeck, 1927:35–36. Other combinations: *Agathis*.

**DIAGNOSIS.** Face not elongate; notauli impressed and sculptured; first metasomal median tergite longitudinally rugosostriate; body almost entirely yellow except for small areas of the mesosoma, the flagellum, and extremities of some legs; very similar to *A. klastos* but distinguished by characters given in the key and wings less infuscate in *A. abdominalis*.

**DESCRIPTION.** Length 5.0 mm. Ovipositor length 3.9 mm. Flagellomere number 32 (31–32). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5. Notauli well impressed and completely pitted. Propodeum entirely rugose and lacking cells. Forewing hyaline. First metasomal median tergite clearly longer than posterior width. First median tergite entirely striogranulate; pair of carinae extending to midlength. Median syntergite 2+3 longitudinally striate, except posterior half of tergite 3 smooth.

**MATERIAL EXAMINED AND DISTRIBUTION.** Holotype female: Louisiana, C.F. Baker (USNM type 28681). Other material examined: southeast Texas (FSCA), Oklahoma (FSCA), Georgia (HIC), Louisiana (HIC), Kentucky (HIC). Published state records: Arizona, Florida, Louisiana, Michigan, Missouri, South Dakota, Texas. For a map of the examined material see http://bit.ly/1PSUefd.


**DIAGNOSIS.** Second median tergite completely striate in raised areas; hind coxa in lateral view entirely melanic; notauli with crenulae extending over entire length or almost so; face not elongate.

**DESCRIPTION.** Length 5.3 mm. Ovipositor length 4.3 mm. Flagellomere number undetermined (broken on holotype and not recorded in the original description). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5. Notauli
well impressed and completely pitted. Propodeum rugose medially, smooth laterally, with poorly defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely striate; pair of carinae extending to midlength. Median syntergite 2+3 longitudinally striate, except posterior third of tergite 3 smooth.

MATERIAL EXAMINED AND DISTRIBUTION. Lectotype female: Texas, coll. Belfrage (USNM type 2956). Other material examined: Texas (FSCA). Published state records: Arizona, Texas. For a map of the examined material see http://bit.ly/1MWOACC.

Aerophilus acrobasis (Cushman, 1920) n. comb.

Figure 7

DIAGNOSIS. Notauli weakly impressed, barely perceptible; hind femur entirely pale; antenna with more than 30 flagellomeres; face not elongate; hind trochanter mostly or entirely pale concolorous with coxa and femur.

DESCRIPTION. Length 5.0 mm. Ovipositor length 4.3 mm. Flagellomere number 34. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli barely perceptible and lacking pits. Propodeum mostly smooth with weak smooth rugae, cells not present. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly smooth with weak smooth striae; pair of carinae extending past midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions.

HOSTS. Batrachedridae: Batrachedra curvilineella, Acrobasis caryae, Acrobasis caryae (Carya illinoinensis), Acrobasis caryivorella, Acrobasis caryivorella (Carya illinoinensis), Acrobasis evanescentella, Acrobasis exsulella, Acrobasis juglandis, Acrobasis nuxvorella (Carya illinoinensis), Acrobasis stigmella. Tortricidae: Choristoneura fumiferana, Choristoneura fumiferana, Choristoneura occidentalis, Cudonigera houstonana, Cydia ingens, Rhyacionia frustrana, Rhyacionia frustrana (Pinus taeda), Rhyacionia rigidana. This species has been used in the biocontrol of Acrobasis nuxvorella (the pecan nut casebearer) and Cydia carya (the hickory shuckworm) (Ellington et al., 1995; Romero et al., 2001).

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: Texas, Brownwood, 2.vii.1918, A.I. Fabis, Quaintance 16787, parasite of Acrobasis SR, 4-vii-1918 (USNM type 22867). Published state records: Canada: Ontario. USA: Arkansas, Colorado, Florida, Georgia, Kansas, Maryland, Mississippi, New Mexico, North Carolina, Oregon, South Carolina, Texas, Virginia. For a map of the examined material see http://bit.ly/1M3tJBb.

Figure 6 Aerophilus aciculatus, holotype: A. lateral habitus; B. dorsal mesoscutum showing pitted notauli; C. forewing; D. dorsolateral metasoma; E. anterior head; F. lateral head; G. lateral mesosoma; H. propodeum and angled view of median tergite 1; I. median tergites 1–3, partially obscured by wing (the latter is out of focus).
length of malar space to eye height, viewed laterally, 0.4. Notauli well impressed without pits (or with pits extending up to 1/2 length). Propodeum smooth except for well-defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely smooth; pair of carinae extending well past midpoint of tergite. Median syntergite 2+3 smooth with a few striae in second transverse groove.

ETYMOLOGY. Named in honor of one of the collectors of the type series, Arthur Evans.


Aerophilus bakeri (Muesebeck, 1927) n. comb.

Figure 9

Bassus bakeri Muesebeck, 1927:42. Other combinations: Agathis.

DIAGNOSIS. This is the only species with an elongate face with the body of the mesosoma and the hind legs entirely melanic.

DESCRIPTION. Length 5.4 mm. Ovipositor length 5.4 mm. Flagellomere number 22. Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli weakly impressed and lacking pits. Propodeum mostly smooth posteriorly and laterally, rugose anteriorly with anterior margins of irregular weak median cell indicated. Forewing hyaline. First metasomal median tergite slightly longer than posterior width. First median tergite smooth with pair of longitudinal carinae extending past midlength. Median syntergite 2+3 smooth with weak striae in second transverse depression medially.


Aerophilus binominatus (Muesebeck, 1958) n. comb.

Figure 10

Agathis binominata Muesebeck, 1958:26. Originally described as Microdus bicolor Provancher, 1880:179, which was pre-occupied by Microdus bicolor Brullé, 1846:483. Due to this homonymy, Muesebeck (1958) changed the name to binominata. Other combinations: Bassus.

DIAGNOSIS. First metasomal tergite mostly melanic, remaining tergites pale; face not elongate; raised areas of median tergite 2 smooth, lacking striae.

DESCRIPTION. Length 3.6 mm. Ovipositor length 3.0 mm. Flagellomere number 29. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5. Notauli barely perceptible and lacking pits. Propodeum smooth laterally, rugose medially, median cell not defined, posterior transverse carina well defined. Forewing hyaline. First metasomal median tergite slightly longer than posterior width. First median tergite mostly smooth with a few weak striae medially; pair of carinae extending past midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions, striae more pronounced medially.


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**Figure 7** Aerophilus acrobasidis, holotype: A. lateral habitus, B. dorsal habitus, C. wings, D. lateral head, E. anterior head, F. dorsal head and mesoscutum, G. propodeum, H. lateral head and mesosoma, I. dorsal metasoma.
**Coleotechnites coniferella**; **Coleotechnites piceaella**. **Pyralidae**: *Dioryctria banksiella*.


**Figure 8 Aerophilus arthurevansi**: A. anterior head, B. lateral habitus, C. wings, D. dorsal habitus.

**Aerophilus buttricki** (Viereck, 1917)

**Figure 11**

*Bassus* (Lytopylus) *buttricki* Viereck, 1917. Other combinations: *Agathis*.

**DIAGNOSIS.** Similar to *A. miniis* but distinguished by characters in the key; hind coxa in lateral view entirely pale; first metasomal median tergite about as wide as long and mostly
Figure 9 *Aerophilus bakeri*, holotype: A. lateral habitus, B. dorsal habitus, C. lateral head and mesosoma, D. wings, E. anterior head, F. dorsal head and thorax, G. dorsal view of right half of tergites 1–3.

Figure 10 *Aerophilus binominatus*, specimens identified by Muesebeck (USNM): A. lateral habitus showing most common coloration, B. lateral habitus showing color variation, C. forewing, D. hindwing, E. anterior head, F. lateral head and mesosoma, G. dorsal propodeum and tergite 1, H. dorsal metasoma.
Figure 11  *Aerophilus buttricki*, holotype: A. lateral habitus, B. dorsal habitus, C. forewing, D. hindwing, E. lateral head, F. anterior head, G. tergite 1, H. dorsal head and thorax, I. propodeum, J. lateral head and mesosoma, K. dorsal metasoma.

Figure 12  *Aerophilus calcaratus*, holotype: A. lateral habitus, B. dorsal habitus, C. wings, D. anterior head, E. lateral head, F. apex of hind tibia, G. dorsal head and thorax, H. propodeum and tergite 1, I. dorsal metasoma.
smooth, except for the two longitudinal carinae; face not elongate.

DESCRIPTION. Length 4.4 mm. Ovipositor length 5.0 mm. Flagellomere number 23–27 (according to Muesebeck, 1927), broken on holotype. Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli well impressed and lacking pits. Propodeum smooth with well-defined cells, some rugae in median cell and elsewhere. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly smooth with a few thick smooth striae; pair of carinae extending well past midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions, striae weak and only present medially in posterior-most transverse depression.


Aerophilus calcaratus (Cresson, 1873) n. comb.

Figures 12, 13

Microdus calcaratus Cresson, 1873:45. Other combinations: Agathis, Bassus, Therophilus.
DIAGNOSIS. Cells of propodeum well-defined; median syntergite 2+3 mostly smooth with striae in some transverse depressions; middle lobe of mesoscutum not bulging and not elevated above lateral lobes (contrasting with A. difficilis); antenna with 35 or fewer flagellomeres; mesoscutellum entirely melanic; hind femur pale (yellow to orange); hind trochanter mostly or entirely melanic; first metasomal median tergite mostly smooth.

DESCRIPTION. Length 6.1 mm. Ovipositor length 5.0 mm. Flagellomere number 31–35 (32–38, according to Muesebeck, 1927). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli well impressed with pits in anterior 1/3. Propodeum smooth with well-defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite smooth with a hint of irregularities medially at midlength; pair of carinae extending past midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions, striae weak and only present medially in posterior two transverse depressions.


MATERIAL EXAMINED AND DISTRIBUTION. Holotype female, Delaware (ANSP type 1724). Other material examined: Arkansas (HIC), Kentucky (HIC), Maryland (HIC), Tennessee (HIC), West Virginia (HIC), Virginia (HIC), Florida (FSCA), Georgia (FSCA). A specimen from Savannah, Georgia, and deposited in the FSCA (H12026) was collected from gall on Celtis sp. (hackberry) 22.iii.1958. Specimens were collected throughout the year, with the earliest records from January in Florida. In Kentucky, Virginia, and West Virginia where Malaise traps have been run from April to November for many years in multiple localities, the temporal data suggest two generations,
with the first peaking in May–June and the second in August–September. However, specimens are found in all months from May to October in these three states. Published state records: Canada: Ontario. USA: widespread throughout the Eastern States, from Maine to Florida and west to Texas, with one record from Arizona. Most records are somewhat suspect, due to the many species similar to *A. calcaratus*. For a map of the examined material see [http://bit.ly/1M3v7nn](http://bit.ly/1M3v7nn).

*Aerophilus chapmani* Sharkey n. sp.

**Figure 14**

**DIAGNOSIS.** Second median tergite completely striate in raised areas; mesoscutum melanic, face not elongate; forefemur entirely melanic; hind coxa in lateral view entirely pale.

**DESCRIPTION.** Length 5.4 mm. Ovipositor length unknown, the sole known specimen is the holotype male. Flagellomere number 32. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.3. Notauli well impressed with pits extending over 3/4 of length. Propodeum sculptured with irregular carinae but lacking distinct cells. Forewing infuscate. First metasomal median tergite slightly longer than posterior width. First median tergite entirely striate; pair of carinae extending past midlength of tergite. Median syntergite 2+3 longitudinally striate except posterior half of tergite 3 smooth.

**ETYMOLOGY.** Named in honor of Dr. Eric Chapman, research associate in the Department of Entomology at the University of Kentucky, for his many years of assistance and advice.

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*Aerophilus crassicornis* (Muesebeck, 1927) n. comb.

**Figure 15**

*Bassus crassicornis* Muesebeck, 1927:43. Other combinations: *Agathis*.

**DIAGNOSIS.** Very similar to *A. rayfisheri* but differing in that the notauli are completely absent in *A. rayfisheri*. *Aerophilus crassicornis* is the only species with an elongate face in combination with the first metasomal median tergite predominantly striate (the latter also shared by some *A. rayfisheri*) and distinctly impressed notauli.

**DESCRIPTION.** Length 8.0 mm. Ovipositor length 8.4 mm. Flagellomere number 27. Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.8. Notauli well impressed and lacking pits. Propodeal cells complete but irregular and with internal rugae. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite irregularly striate in posterior 2/3, smooth anteromedially; pair of longitudinal carinae weak and reaching midlength of tergite. Median syntergite 2+3 mostly smooth with striae in anterior two transverse depressions.

**MATERIAL EXAMINED AND DISTRIBUTION.*** Holotype female: Florida, Gulfport, 6.ii.(year?) (USNM type 28683).
DIAGNOSIS. Hind coxa in lateral view entirely melanic; mesoscutellum entirely melanic; hind femur pale (yellow to orange); face not elongate.

DESCRIPTION. Length 4.9 mm. Ovipositor length 3.2 mm. Flagellomere number 31. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli well impressed with a few weak pits anteriorly. Propodeum rugose medially smooth laterally with poorly defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely smooth with hint of some irregularities at midlength; pair of

Figure 16  *Aerophilus davidsmithi*, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
carinae extending past midlength. Median syntergite 2+3 entirely smooth, with hint of longitudinal striae in second transverse depression.

**ETYMOLOGY.** Named in honor of Dr. David Smith who has been exchanging Malaise trap specimens with M.J.S. for many years, including the unique specimen of this species.

_Aerophilus difficilis_ (Muesebeck, 1927) n. comb.  
Figure 17

_Bassus difficilis_ Muesebeck, 1927:46. Other combinations:  
_Agathis_.

DIAGNOSIS. Cells of propodeum well defined; median syntergite 2+3 mostly smooth with striae in some transverse depressions; middle lobe of mesoscutum bulging and elevated above lateral lobes (unlike _A. calcaratus_); antenna with more than 35 flagellomeres; mesoscutellum entirely melanic; hind femur pale (yellow to orange); hind trochanter mostly or entirely melanic; first metasomal median tergite mostly smooth.

DESCRIPTION. Length 7.7 mm. Ovipositor length 7.1 mm. Flagellomere number 38. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli very well impressed with pits in anterior 1/3. Propodeum smooth with well-defined cells, some rugae in median cell and elsewhere. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly smooth with weak rugose sculpture medially at mid- 

Figure 19  _Aerophilus erythrogaster_, fresh specimen: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
DIAGNOSIS. Mesoscutellum entirely melanic; hind femur pale (yellow to orange); notauli weakly impressed; hind coxa in lateral view entirely pale; hind trochanter mostly or entirely melanic contrasting with pale coxa and femur; propodeal cells well defined.

DESCRIPTION. Length of male holotype 4.8 mm. Length of female (Fig. 17) 9.2 mm. Ovipositor length 11.8 mm. Flagellomere number (broken on holotype), 34 in female (Fig. 17). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.3. Notauli well defined with pits in anterior 1/3. Propodeum smooth with well-defined cells, some rugae in median cell and elsewhere. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly weakly striate; pair of carinae extending past midlength of tergite. Median syntergite 2+3 mostly smooth with striae in the three transverse depressions, striae prominent in the first depression and weak in posterior two.

HOSTS. Tortricidae: Epiblema strenuana, Rhyacionis comstockiana.

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: Virginia, Vienna, 17.05.1911, R.A. Cushman (USNM type 15276). Holotype of Bassus pini Muesebeck, female: “Bred, July 10, 1937, Bar Harbor, Maine, Pars Rhyacionis comstockiana” (USNM type 54124). Other material examined: Kentucky (HIC). Distribution. Widespread in the eastern USA, from Maine south to Louisiana and west to Kansas. For a map of the examined material see http://bit.ly/1OavgaP.
well impressed without pits (or with up to three pits anteriorly). Propodeum with irregular cells broken with irregular carinae and rugae, smoother laterally. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly smooth with several weak smooth striae at midlength, with pair of carinae extending to midlength. Median syntergite 2+3 mostly smooth except for all three transverse depressions with striae, weaker in posterior two depressions (sometimes striate anteromedially and anteriad first transverse depression).

**ETYMOLOGY.** Named in honor of James (J.D.) Herndon, former undergraduate student in my (M.J.S.) insect taxonomy class and at whose farm most specimens of this species were captured.

**MATERIAL EXAMINED AND DISTRIBUTION.** Holotype female: Kentucky, Fayette Co., South Farm, 37.97217°N, 84.53633°W, 30.viii–4.ix.2002, Pitz and Seltmann, (HIC, specimen H1217). Paratypes. 42 females (no males.), Kentucky (39 females): Fayette, Jefferson, Owen, Hopkins, Harrison, and Breathitt counties, Virginia (3 females): Fairfax and William counties. Paratypes from both states were mostly captured between August and October. Exceptions are two specimens from KY captured between late March and early May and one specimen from Virginia captured between April and May. Since Malaise traps were run from May to late October in these localities it seems likely that there are two generations or that the adults overwinter. The later hypothesis seems unlikely since this is not known for any other temperate species of *Aerophilus*. Specimens are deposited in HIC and UKIC. For a map of the type material see http://bit.ly/1M00E6a.

*Aerophilus klastos* Sharkey n. sp.

**DIAGNOSIS.** Face not elongate; notaui impressed and sculptured; first metasomal median tergite longer than wide

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**Figure 21** *Aerophilus jdherndoni*, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
(posteriorly) and longitudinally rugosostriate; body almost entirely yellow except for flagellum and extremities of some legs; very similar to *A. abdominalis* but distinguished by characters given in the key and wings more infuscate.

**DESCRIPTION.** Length 7.0 mm. Ovipositor length 6.5 mm. Flagellomere number undetermined (broken after 32 in the sole specimen). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5. Notauli very deeply impressed and entirely pitted. Propodeum entirely rugose and lacking distinct cells. Forewing infuscate. First metasomal median tergite clearly longer than posterior width. First median tergite entirely striate with some granulate microsculpture laterally; pair of

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**Figure 22** *Aerophilus klastos*, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
carinae reaching midlength of tergite. Median syntergite 2+3 longitudinally striate with some granulate microsculpture.

**ETYMOLOGY.** From the Greek word for “broken in pieces,” a reference to the condition of the holotype.


**Aerophilus kowlesae** Sharkey n. sp.

**Figure 23** Aerophilus kowlesae, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal head and thorax, E. dorsal propodeum and metasoma.

**DIAGNOSIS.** Face slightly elongate; body of mesosoma and middle leg predominantly melanic; first median tergite predominantly striate.

**DESCRIPTION.** Length 4.1 mm. Ovipositor length 3.8 mm. Flagellomere number undetermined (broken on the only known
specimen). Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli absent anteriorly and posteriorly, or barely indicated there, well impressed at mid-length. Propodeum with irregular crenulae, smoother with punctures laterally, cells irregular and weakly indicated. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly striate except posterior margin and anteromedial area, with pair of carinae extending past midlength. Median syntergite 2+3 smooth except transverse grooves striate.

ETYMOLOGY. Named in honor of Katelyn Kowles, former graduate student in the Department of Entomology at the University of Kentucky and collector of the type specimen.


Aerophilus malus Sharkey n. sp.

Figure 24

DIAGNOSIS. Very similar to A. calcaratus; the only character that may separate them is the number of flagellomeres; antenna with more than 35 flagellomeres; propodeum with distinct areolae; forefemur entirely melanic; mesoscutellum entirely
DESCRIPTION. Length 6.5 mm. Ovipositor length 5.4 mm. Flagellomere number 36. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli well impressed with pits in anterior 1/3. Propodeum smooth except for well-defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly smooth with weak longitudinal striae across midlength and laterally, pair of carinae extending past midlength of tergite and diverging posteriorly. Median syntergite 2+3 mostly smooth except for all three transverse depressions with striae, striae weaker in posterior two depressions.

ETYMOLOGY. From the Greek *malon*, meaning more. In this case a reference to the extra flagellomeres that (may) distinguish this species from the more common *A. calcaratus*.

Figure 25 *Aerophilus minys*, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
Figure 26  *Aerophilus nigripes*, holotype: A. lateral habitus, B. dorsal habitus, C. wings, D. lateral head. E. anterior head, F. apex of hind tibia, G. dorsal head and mesoscutum, H. propodeum, I. metasomal tergites 1–3.

Figure 27  *Aerophilus ninanae*, holotype: A. lateral habitus, B. dorsal habitus, C. wings, D. lateral head, E. anterior head, F. tergites 1–2, G. dorsal head and mesoscutum, H. propodeum, I. lateral head and mesosoma, J. tergites 1–3.

*Aerophilus minys* Sharkey n. sp.

**Figure 25**

DIAGNOSIS. Similar to *A. buttricki* but distinguished by characters in the key; first metasomal median tergite mostly covered with longitudinal striae; mesoscutellum color mostly or entirely pale; mesonotum partly melanic, minimally melanic near wing sockets.

DESCRIPTION. Length 4.0 mm. Ovipositor length 3.7 mm. Flagellomere number 23 (22–26). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli barely perceptible and lacking pits. Propodeum with carinæ forming moderately regular cells, median cell with weak carinæ. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite mostly striate with smooth widely spaced, shallow striae, smooth anteromedially and posteromedially; pair of carinæ extending to midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions and striate anteromedially, anteriad first transverse depression.

ETYMOLOGY. From the Greek meaning small or short and referring to the size of specimens of this species.

*Aerophilus nigripes* (Cresson, 1865) n. comb.

**Figure 26**

Agathis nigripes Cresson, 1865:296. Other combinations: Bassus.

SYNONYMS. *Agathis nigriceps* Provancher, 1895:96 was synonymized by Muesebeck (1927) and is also recognized as a synonym here. *Agathis atripes* Cresson, 1865:296 n. syn.

DIAGNOSIS. Western species. Similar to *A. wyomingensis*, both of which have elongate faces. Unlike *A. wyomingensis*, *A. nigripes* has impressed notauli and has longer antenna with 32–34 flagellomeres, rather than the approximately 24 flagellomeres typical of *A. wyomingensis*. A number of undescribed western species further complicate the identity of both *A. nigripes* and *A. wyomingensis*.

DESCRIPTION. Length 5.3 mm. (5.0–7.2). Ovipositor length 6.9 mm. Flagellomere number undetermined (broken on type [32–33]). Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.7 (0.7–0.9). Notauli weakly impressed but distinct and lacking pits. Propodeum smooth posterolaterally, weakly rugose medially with weak smooth pits anteriorly, irregular median cell indicated (varying to almost entirely smooth with a narrow spindle-shaped median longitudinal cell). Forewing infuscate. First metasomal median tergite slightly longer than posterior width. First median tergite smooth with pair of carinæ extending to midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions and striate anteromedially, anteriad first transverse depression.

HOSTS. Pyralidae: *Homoeosoma electellum*. Tortricidae: *Phaneta bucephaloides*.

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: Colorado (ANSP type 1732.1). Synonyms: *Agathis atripes* Cresson, holotype male, Colorado (ANSP type 1731). *Agathis nigriceps* Provancher lectotype female: Los Angeles, California, Coquillett [The collector, Coquillett, may have had a very broad concept of Los Angeles] (ULQC). Published state records: Since the identification of this species and its synonym *A. atripes* are problematic, the published distribution means little; however, the name is recorded from a wide area in the western USA with a smattering of records in the central and eastern USA and two from western Canada, Alberta and Manitoba. For a map of the examined material see http://bit.ly/1RCRXtD.
Aerophilus ninanae (Muesebeck, 1927) n. comb.

Figure 27


DIAGNOSIS. Mesoscutellum pale; hind coxa in lateral view bicolored, melanic and pale; notaui well impressed; face not elongate.

DESCRIPTION. Length 6.8 mm. Ovipositor length 6.5 mm. Flagellomere number 36. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5. Notaui well impressed and lacking pits. Propodeal cells complete but irregular and with internal rugae. Forewing infuscate. First metasomal median tergite clearly longer than posterior width. First median tergite mostly weakly striate; pair of carinae extending past midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions.

HOSTS. Tortricidae: Cydia ninana.

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: Arizona, Huachuca, 27.06.1983 (USNM type 28688).
Published state records: Arizona, California. For a map of the examined material see http://bit.ly/1WkbePz.

*Aerophilus pookae* (Provancher, 1880) n. comb.  Figure 29


**DIAGNOSIS.** The smallest of those species with elongate faces, much smaller than the other species (*A. wyomingensis*, *A. nigripes*, *A. bakeri*, and *A. crassicornis*), a maximum of 4.1 mm versus a minimum of 5 mm. This is the most common and widespread eastern species.

**DESCRIPTION.** Length 4.1 mm. Ovipositor length 3.2 mm. Flagellomere number 25–29 (holotype not available). Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.7. Notauli barely perceptible and lacking pits. Propodeum rather neatly divided into cells with a few rugosities and some weak granulate microsculpture. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite finely striate except extreme base; pair of longitudinal carinae extending past midlength of tergite. Median syntergite 2+3 mostly finely striate except posterior half of tergite 3 smooth.


*Aerophilus pookae* Sharkey n. sp.  Figure 30

**DIAGNOSIS.** Face elongate; second median tergite completely striate in raised areas; head color mostly pale, black dorsally.

**DESCRIPTION.** Length 4.5 mm. Ovipositor length 4.8 mm. Flagellomere number 24. Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.7. Notauli barely perceptible and lacking pits. Propodeum rather neatly divided into cells with a few rugosities and some weak granulate microsculpture. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely rugosostriate with weak short pair of carinae not extending past midlength of tergite. Median syntergite 2+3 mostly finely striate except posterior half of tergite 3 smooth.

**ETYMOLOGY.** Named in honor of Victoria Pook, former student in the Department of Entomology, University of Kentucky.

Aerophilus rayfisheri Sharkey n. sp.

Figure 31

**DIAGNOSIS.** Face elongate; propodeum areolated; notauli barely perceptible; similar to *A. wyomingensis* and *A. nigripes* but propodeum more sculptured, gena not as elongate, first metasomal median tergite wider.

**DESCRIPTION.** Length 6.7 mm. Ovipositor length 6.9 mm. Flagellomere number undetermined (both the holotype and sole paratype have incomplete antennae). Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.7. Notauli barely perceptible and lacking pits. Propodeum mostly roughly sculptured with irregular cells, median cell well defined. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely smooth with pair of carinae very pronounced and extending past midlength of tergite. Median syntergite 2+3 mostly smooth with some striae medially in anterior two transverse depressions.
Figure 32  *Aerophilus reginae*, holotype: A. lateral habitus, B. anterior head, C. wings, D. dorsal habitus.
ETYMOLOGY. Named in honor of Ray Fisher, former graduate student of M.J.S. and collector of the type specimen.


Aerophilus reginae Sharkey n. sp.

Figure 32

DIAGNOSIS. Face not elongate; wings hyaline; face yellow, occiput mostly melanic; first metasomal median tergite predominantly melanic; syntergite 2+3 partly to entirely yellow or tan colored with some more posterior terga partly or entirely melanic.

DESCRIPTION. Length 4.4 mm. Ovipositor length 5.5 mm. Flagellomere number 29 (28–29). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.3. Notauli barely perceptible. Propodeum with distinct cells, median cell narrow, some rugae in median cell and elsewhere. Forewing hyaline. First metasomal median tergite clearly longer than posterior width. First median tergite weakly rugosostriate over much of surface, smooth posterolaterally; pair of longitudinal carinae weak and extending to midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions.

HOSTS. Gelechiidae: Coleotechnites apicitripunctella, Coleotechnites gibsonella.

ETYMOLOGY. Named in honor of the junior author’s (G.I.d.C.) mother, Regina.

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: Kentucky, Harlan Co., Blanton Forest N.P., 36.86370°N,
Paratypes: 58 specimens, 36 females, 22 males. Canada: Ontario, Quebec, New Brunswick. USA: New York, Kentucky, North Carolina, Florida. Late April to late August. All paratypes except one from Kentucky are deposited in the CNC. For a map of the examined material see http://bit.ly/1NDuvnJ.

*Aerophilus reticulatus* (Muesebeck, 1932) n. comb.

Figure 33

*Bassus reticulatus* Muesebeck, 1932:332. Other combinations: *Agathis*.

**DIAGNOSIS.** Forefemur pale in apical 2/3, melanic in basal 1/3; raised areas of metasomal median syntergite 2+3 longitudinally striogranulate or granulate; propodeum areolate rugose with some granulae.

**DESCRIPTION.** Length 4.7 mm. Ovipositor length 5.1 mm. Flagellomere number 20, contrary to the Muesebeck’s (1932) description, which states 21 segments, indicating 19 flagellomeres (two female paratypes with 18 flagellomeres). Gena elongate; ratio of length of malar space to eye height, viewed laterally, 1.1. Notauli absent and lacking pits. Propodeum entirely rugosoreticulate with a deep irregular median longitudinal cell/depression. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely striate; pair of carinae short and blunt. Median syntergite 2+3 longitudinally striate except extreme apex smooth.

**ETYMOLOGY.** Named in honor of Mr. Robert Courtney, owner of the horse farm where the paratype was collected.


*Aerophilus robertcourtneyi* Sharkey n. sp.

Figure 34

**DIAGNOSIS.** Face slightly elongate; head color entirely pale, orange to yellow; hind femur entirely pale; similar to *A. abdominalis* and *A. klastos* but differs from those species in the smooth, barely perceptible notauli.

**DESCRIPTION.** Length 4.4 mm. Ovipositor length 4.0 mm. Flagellomere number 26 (26–27). Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli barely perceptible and lacking pits. Propodeum with distinct cells, cells are filled with smooth rugae. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely striate; pair of carinae weak and almost reaching midlength of tergite. Median syntergite 2+3 longitudinally striate except extreme apex smooth.

**ETYMOLOGY.** Named in honor of Mr. Robert Courtney, owner of the horse farm where the paratype was collected.


*Aerophilus rugareolatus* (Viereck, 1917) n. comb.

Figure 35

*Bassus* (*Lytopylus*) *rugareolatus* Viereck, 1917:228. Other combinations: *Agathis*.

**DIAGNOSIS.** Gena intermediate in length; hind femur entirely pale; head color mostly or entirely black, with some pale color on eye orbits or on gena; propodeum areolate rugose; metasoma entirely pale (according to Viereck, 1917).
DESCRIPTION. Length 4.8 mm. Ovipositor length unknown, the sole known specimen is the holotype male. Flagellomere number unknown. Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli very weakly impressed and lacking pits. Propodeum entirely rugosoreticulate with an irregular median cell. Forewing infuscate. Metasoma missing from holotype.


**Aerophilus stoelbae** Sharkey n. sp.

Figure 36

DIAGNOSIS. Small specimens 3.2–3.4 mm.; antenna with 22–24 flagellomeres; notauli barely impressed; metasomal median tergites 1–3 often mostly striate.
DESCRIPTION. Length 3.2 mm (3.2–3.4). Ovipositor length 3.0 mm (3.0–3.2). Flagellomere number 22 (22–24). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.5 (0.4–0.5). Notauli barely perceptible and lacking pits. Propodeum with carinae forming moderately regular cells, median cell with weak carinae. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite with weak shallow striae over half of surface (varying to entirely striate), smoother antero- and posteromedially; pair of longitudinal carinae extending to midlength of tergite (or slightly past). Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions and with weak smooth striae in anterior lobe of median tergite 2; sometimes striate anteromedially, anteriad first transverse depression and on first raised area (varying to entirely striate except posterior lobe of median tergite 3).

ETYMOLOGY. Named in honor of Stephanie Stoelb, former technician extraordinaire in the Department of Entomology, University of Kentucky.


**Aerophilus tenuiceps** (Muesebeck, 1927) n. comb.  
Figure 37

**Bassus tenuiceps** Muesebeck, 1927:47. Other combinations: *Agathis*.

DIAGNOSIS. Head, metasoma, and body of mesosoma entirely pale; notauli weakly impressed, barely perceptible; second median tergite smooth in raised areas.

DESCRIPTION. Length 5.7 mm. Ovipositor length 4.9 mm. Flagellomere number 32. Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.4. Notauli barely perceptible or weakly impressed. Propodeum with irregular cells, smooth weak rugae in cells. Forewing hyaline. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite weakly striate over much of surface, smooth posterolaterally; pair of carinae weak and extending to midlength of tergite. Median syntergite 2+3 mostly smooth with longitudinal striae in the three transverse depressions.

MATERIAL EXAMINED AND DISTRIBUTION. Holotype female: New Mexico, Wild Horse Canyon, Animas Mts. 5,000 ft. [1524 m] (USNM type 28687). Published state records: Arizona, New Mexico. For a map of the examined material see http://bit.ly/1XCkImp.
**Aerophilus terrymoyeri** Sharkey n. sp.  
*Figure 38*

**DIAGNOSIS.** Second median tergite completely striate in raised areas; gena slightly elongate.

**DESCRIPTION.** Length 4.6 mm. Ovipositor length 5.5 mm. Flagellomere number 30 (28–30). Gena slightly elongate; ratio of length of malar space to eye height, viewed laterally, 0.6. Notauli weakly impressed and lacking pits. Propodeum mostly smooth with well-defined cells, median cell with some rugae. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite entirely striate except anteromedially between longitudinal carinae; pair of longitudinal carinae extending to midlength of tergite. Median syntergite 2+3 longitudinally striate except posterior half of tergite 3 smooth.

**ETYMOLOGY.** Named in honor of Terry Moyer, manager of The Richardson Wildlife Foundation Reserve.


**Aerophilus tommurrayi** Sharkey n. sp.  
*Figure 39*

**DIAGNOSIS.** Face moderately elongate; head, body of mesosoma, and all coxae melanic; first metasomal median tergite entirely striate.

**DESCRIPTION.** Length 4.4 mm. Ovipositor length unknown, the sole known specimen is the holotype male. Flagellomere number 28. Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.7. Notauli well impressed with pits in anterior 1/3. Propodeum with irregular cells broken by irregular carinae and rugae. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width.
First median tergite entirely striate with pair of weak carinae not extending past midlength of tergite. Median syntergite 2+3 with all transverse depressions and anterior-most elevated area striate.

**ETYMOLOGY.** Named in honor of the collector of the type specimen.

**MATERIAL EXAMINED AND DISTRIBUTION.** Holotype female: Massachusetts, Groton, 42.60° N, 71.5667° W, 5.ix.2010, T. Murray (HIC, specimen H8496). For a map see http://bit.ly/1imXnFs.

*aerophilus usitatus* (Gahan, 1919) n. comb.

*Figure 40* Bassus *tenuiceps* Gahan, 1919:119. Other combinations: *Agathis*.

**DIAGNOSIS.** Propodeum entirely pale; transverse grooves of syntergite 2+3 all smooth; notauli with crenulae/pits in anterior 1/2 or more; first metasomal median tergite smooth except for pair of carinae; forefemur almost entirely melanic with a pale patch apically.

**DESCRIPTION.** Length 4.7 mm. Ovipositor length 3.5 mm. Flagellomere number undetermined (broken after flagellomere 14). Gena not elongate; ratio of length of malar space to eye height, viewed laterally, 0.2. Notauli well impressed with pits in anterior 1/2. Propodeum smooth with well-defined cells. Forewing infuscate. First metasomal median tergite about as long as, or slightly longer than, posterior width. First median tergite smooth; pair of carinae extending past...
midlength of tergite. Median syntergite 2+3 smooth, transverse depressions lacking striae.

HOSTS. Pyralidae: Acrobasis vaccinii.


_Aerophilus wyomingensis_ (Viereck, 1905) n. comb.

Figure 41

_Agathis wyomingensis_ Viereck, 1905:284. Other combinations: Bassus.

SYNONYMS. Synonymized under _Agathis nigripes_ Cresson, 1865:297 by Muesebeck (1927) but reinstated here.

_Aerophilus wyomingensis_, holotype: A. lateral habitus and wings, B. dorsal habitus, C. lateral head and mesosoma, D. anterior head, E. apex of hind tibia.
**DIAGNOSIS.** Western species. Similar to *A. nigripes* both of which have elongate faces. Unlike *A. nigripes*, *A. wyomingensis* lacks notauali and has shorter antennae with an average of 24 flagellomeres, rather than the 32–34 flagellomeres typical of *A. nigripes*. A number of undescribed western species further complicate the identity of both *A. nigripes* and *A. wyomingensis*.

**DESCRIPTION.** Length 6.3 mm. Ovipositor length 6.0 mm. Flagellomere number (24–25) broken on holotype. Gena elongate; ratio of length of malar space to eye height, viewed laterally, 0.8.Notauali barely indicated (to completely absent) and lacking pits. Propodeum mostly smooth with a narrow spindleshaped median longitudinal cell. Forewing infuscate. First metasomal tergite about as long as, or slightly longer than, posterior width. First median tergite smooth with carinae extending to midlength of tergite. Median syntergite 2+3 smooth, lacking microsculpture in transverse depressions.

**HOSTS.** Due to some historic confusion over the identity of this species the two hosts (*Homoeosoma electellum* and *Phaneta bucephaloides*) attributed to *A. nigripes* may rather be hosts of *A. wyomingensis*.


**ACKNOWLEDGMENTS**

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**LITERATURE CITED**


Doña Ana County, NM, and El Paso County, TX. *Southwestern Entomologist* 26(3):269–270.


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Supplemental Figure 1 Tree of highest log-likelihood from a 200-replicate ML analysis of the combined COI data set (summarized in Figure 3). ML bootstrap values are plotted above the branches (see Supplemental Figure 2).
Supplemental Figure 2  ML bootstrap analysis (500 replicates) of the COI data set.
Supplemental Figure 3  Tree of highest log-likelihood from a 200-replicate ML analysis of the combined COI+28S data set (summarized in Figure 4). ML bootstrap values are plotted at the nodes when supported by values ≥50 (see Supplemental Figure 4).
Majority rule

Supplemental Figure 4  ML bootstrap analysis (500 replicates) of the combined COI+28S data set.
Supplemental Figure 5

Tree of highest posterior probability from a Bayesian analysis of the combined COI+28S data set. Posterior probabilities are plotted at the nodes (see Supplemental Figure 6).
Supplemental Figure 6  Majority-rule consensus tree from a Bayesian analysis of the combined COI+28S data set.