The Cicada Parasite Beetles (Coleoptera: Rhipiceridae) of Virginia

Arthur V. Evans
1600 Nottoway Avenue
Richmond, Virginia 23227
arthurevans@verizon.net

Brent W. Steury
United States National Park Service
700 George Washington Memorial Parkway
Turkey Run Park Headquarters
McLean, Virginia 22101
Brent_Steury@nps.gov

ABSTRACT

The family Rhipiceridae is represented in Virginia by two species, \textit{Sandalus niger} Knoch and \textit{S. petrophya} Knoch, the latter of which is documented from the state for the first time.

\textit{Key words:} cicada parasite beetle, new state record, Rhipiceridae, \textit{Sandalus}, Virginia.

INTRODUCTION

The Rhipiceridae, also known as cicada parasite or cedar beetles, is a small family with more than 100 species in seven genera (Lawrence, 2005). The family is represented in the Nearctic region by \textit{Sandalus} (Greek σανδαλον, or sandals), a genus proposed by Knoch (1801) to include two North American species \textit{S. petrophya} and \textit{S. niger}. \textit{Sandalus} occurs in the New World, Africa, southeast Asia, China, India, and Japan (Katovich, 2002) and is in need of revision. The Nearctic fauna currently consists of five species, three of which occur in eastern North America. Of these, only two, \textit{S. niger} Knoch and \textit{S. petrophya} Knoch, occur in Virginia. The third species, \textit{S. porosus} LeConte, ranges from Florida west to Colorado and Arizona (Katovich, 2002).

The common name “cedar beetle” was most likely instigated by LeConte’s (1862) statement that the Rhipiceridae was “A family containing a small number of species, found on plants; \textit{Sandalus} especially affecting various cedars...” and popularized by Blatchley (1910) and Arnett (1963). The more recent moniker “cicada parasite beetles,” first coined by Downie & Arnett (1996), is more descriptive given the available information on the larval biology of \textit{Sandalus}.

As noted by Dodge (1941), the “apparent association with certain trees has no significance except as it may indicate host or oviposition preferences of the host cicada.”

METHODS

This study is based on our own field work, literature records, and the examination of specimens housed in the following collections: Virginia Museum of Natural History, Martinsville, Virginia (VMNH); Virginia Polytechnic Institute and State University, Blacksburg, Virginia (VPIC); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (NMNH); George Washington Memorial Parkway, Turkey Run Park, McLean, Virginia (GWMP); Arthur V. Evans, Richmond, Virginia (AVEC).

RESULTS AND DISCUSSION

Adult \textit{Sandalus} are long (15-24 mm), convex, reddish brown or black (sometimes bicolored) and coarsely punctured beetles (Fig. 1); females are typically larger than males. The head has bulging eyes,
prominent hypognathous mandibles, and 11-segmented antennae that are distinctly flabellate in males and more or less serrate in females. The prothorax becomes wider posteriorly and is narrower than the base of the elytra. The long, vaguely ribbed and coarsely punctured elytra completely conceal the abdomen, which has five visible sternites. The tarsal formula is 5-5-5. Tarsomeres 1-4 are heart-shaped with membranous lobes and the claws are simple and equal in size.

Very little is known about the biology of rhipicerid beetles, with the exception of S. niger. Adults of this species do not feed and reach peak activity from late September through early October (Rings, 1942; Elzinga, 1977; Katovich 2002). They are found resting on tree trunks or grass, in Malaise trap samples, and are occasionally attracted to lights.

Elzinga (1977) observed mating aggregations of S. niger on the trunks of American Elm (Ulmus americanus), Shingle Oak (Quercus imbricaria), beech (Fagus), and other hardwoods. Adults emerge from their burrows in the morning and crawl up trunks to mate. Females lay large numbers of eggs in the holes and cracks of bark, preferably in areas where there are numerous cicadas. Rings (1942) noted that a single female could produce more than 16,000 eggs. Craighead (1921) proposed that the larvae of S. niger develop as ectoparasitoids of immature cicadas after discovering a pupa and cast larval exoskeleton of the beetle within a dead and hollowed-out cicada nymph. This assertion was later supported by descriptions of the first instar triungulin of S. niger (Dodge, 1941; Elzinga, 1977) that is typical of other beetle parasitoids. The larval stages between the triungulin and pupa remain unknown.

The adults of Sandalus in Virginia are distinguished by the characters in the key below.

**Key to the Adult Sandalus of Virginia**
*(after Staines, 1982)*

<table>
<thead>
<tr>
<th>Sides of prothorax uniformly narrowed from posterior to anterior (Fig. 2), keel weakly developed, especially at basal third (Fig. 3) (17-25 mm)</th>
<th>Sandalus niger Knoch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sides of prothorax subangulate behind middle (Fig. 4), and distinctly keeled throughout (Fig. 5) (12-18 mm)</td>
<td>Sandalus petrophya Knoch</td>
</tr>
</tbody>
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**Sandalus niger Knoch**

This species is known from southern Ontario to Florida, west to Colorado and Texas. **Canada:** Ontario (Hicks, 1942). **United States:** Alabama, Colorado, District of Columbia, Florida, Georgia, Indiana, Illinois, Iowa, Kansas, Kentucky, Maryland, Michigan, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, and Wisconsin (Brimley, 1938; Downey & Arnett, 1996; Dury, 1879; Elzinga, 1977; Craighead, 1921, Young & Katovich, 2002; Kirk, 1969, 1970; Leng, 1928; Manee, 1908; Rings, 1942; Skelley, pers. comm.; Staines, 1982; Ulke, 1902, Young, 2002). Specimens have been examined from the following counties and cities in Virginia: Alexandria (City), Chesapeake (City), Fairfax, Franklin, Montgomery, Richmond (City), Scott, and Shenandoah. (AVEC, GWMP, NMNH, VMNH, VPIC). In Virginia, individuals of S. niger have been found from July through November. This species is widespread in Virginia (Fig. 6) and has been collected in the Coastal Plain, Piedmont, Appalachian Plateau, and Valley and Ridge physiographic regions.

**Sandalus petrophya Knoch**

**NEW STATE RECORD**

This species occurs from New York to Florida, west to Indiana, Missouri, and Alabama, but has not been reported from Virginia previously. **United States:** Alabama, District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (Blatchley, 1910; Carlton, pers. comm.; Downie & Arnett, 1996; Dury, 1882; Leng, 1928; Say, 1835; Peck & Thomas, 1998; Smith, 1900; Staines, 1982; Ulke, 1902).
Fig. 2. Dorsal view of prothorax of *Sandalus niger* Knoch, male (top) and female (bottom).

Fig. 3. Lateral prothoracic margin of *Sandalus niger* Knoch.

Fig. 4. Dorsal view of prothorax of *Sandalus petrophya* Knoch, male (top) and female (bottom).

Fig. 5. Lateral prothoracic margin of *Sandalus petrophya* Knoch.

Little has been published on this species. Say (1835) frequently observed this species on the flowers of “a resinous plant common on the prairies of Missouri.” Wenzel (1886) observed S. petrophya near Philadelphia during the summer, mostly in mid-July. Dirt encrusted adults, mostly females, were found emerging from the ground in the morning and crawling up the trunks of American Beech (Fagus grandiflora). They have also been found under bark or on trunks of trees (Blatchley, 1910).

In Virginia, S. petrophya is widespread (Fig. 7) and found in the Coastal Plain, Piedmont, Appalachian Plateau, and Ridge and Valley physiographic regions. Habitat at the Turkey Run Park collection site is successional Tulip-tree (Liriodendron tulipifera) forest with nearby mature stands of mesic mixed hardwood forest consisting of oaks (Quercus spp.), hickory (Carya spp.) and Sugar Maple (Acer saccharum). Evans observed and collected a single female flying next to a stream through a wooded area about 1000 h in July in the Bull Run Mountains Natural Area Preserve in Prince William County.

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Sandalus was conducted by Evans while he was employed as a field zoologist with the Virginia Department of Conservation, Division of Natural Heritage, Richmond, VA. Michael Kieffer (Bull Run Mountains Conservancy, The Plains, Virginia), Chris Hobson (Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA) selected and established the Malaise trap site in the Powell Mountain Karst Preserve that produced specimens of *Sandalus petrophya*. The National Park Service funded Evans’ work on a beetle survey of the George Washington Memorial Parkway during 2010-2011. We also thank Anne Chazal (Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA) for generating the distribution maps. Kerry Katovich (University of Wisconsin-Whitewater, Whitewater, WI), Steve Roble (Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA), and Charles Staines (National Museum of Natural History, Washington, DC) suggested numerous corrections and comments that improved the accuracy and clarity of this paper.

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