

**First North American Records of the East Palearctic
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Chrysomelidae: Bruchinae), a Specialist on Mimosa
(*Albizia julibrissin*, Fabaceae)**

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FIRST NORTH AMERICAN RECORDS OF THE EAST
PALEARCTIC SEED BEETLE *BRUCHIDIUS TERRENUS*
(COLEOPTERA: CHRYSOMELIDAE: BRUCHINAE), A SPECIALIST ON
MIMOSA (*ALBIZIA JULIBRISSIN*, FABACEAE)

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ABSTRACT

The eastern Palearctic bruchine seed beetle *Bruchidius terrenus* (Sharp) (Coleoptera: Chrysomelidae: Bruchinae), a specialist seed predator of mimosa or silk tree (*Albizia julibrissin*), is reported for the first time in North America based on collections from seven southeastern states. This is the third Asian insect species recently reported from *A. julibrissin* in the United States. A diagnosis, description, photographs of the adult, a summary of the known U.S. distribution, notes on seasonal history, and a revision to an existing key to North American *Bruchidius* are presented.

Key Words: Coleoptera, Chrysomelidae, Bruchinae, *Bruchidius terrenus*, adventive, invasive species, new records

RESUMEN

Se reporta la presencia del escarabajo bruquido Paleártico oriental de la semilla, *Bruchidius terrenus* (Sharp) (Coleoptera: Chrysomelidae: Bruchinae), un depredador especialista en semilla de mimosa o el árbol de seda (*Albizia julibrissin*), por primera vez en Norteamérica basado en colecciones hechas en siete estados de sureste de los Estados Unidos. Este es la tercera especie de insecto asiático reportado de *A. julibrissin* en los Estados Unidos. Se presenta una diagnosis, descripción, fotos del adulto, un resumen de la distribución conocida en los EE.UU., notas sobre su ciclo estacional y una revisión de una clave existente de los *Bruchidius* de Norteamérica.

The Old World genus *Bruchidius*, with about 300 described species (Kingsolver 2004), is represented in North America by 2 adventive species, *B. villosus* (F.) and *B. cisti* (F.). Both species apparently were accidentally introduced with seeds of their leguminous host plants (Bottimer 1968).

The European *B. villosus*, first recorded in North America from Massachusetts (Olsen 1918), has been reported from Ontario and Quebec south to North Carolina (Chantal 1972; Redmon et al. 2000; Kingsolver 2004). This specialist of genistoid legumes has been released for the biological control of Scotch broom, *Cytisus scoparius* (L.) Link, in the Pacific Northwest (Coombs et al. 2004; Hulting et al. 2008). The Eurasian species *Bruchidius cisti* was first found in North America in British Columbia in 1922 at Nicola and again in 1965 at Lillooet (Bottimer 1968) and has been reported as a pest of the forage legume sanfoin, *Onobrychis viciifolia* Scopoli, in Montana (Hewitt & Burleson 1976).

An unidentified beetle, which would become the third adventive species of *Bruchidius* in North

America, came to our attention in Aug 2004. A homeowner in Elizabeth City, North Carolina (Tony Barefoot), by happenstance, examined developing pods of mimosa and discovered nearly all were infested with small yellowish larvae. Wanting to know more about the insect, he contacted an extension entomologist at North Carolina State University (Stephen Bambara). It was first thought that the larvae might represent a seed chalcid (Eurytomidae or Torymidae). Additional infested pods of *A. julibrissin*, collected on Sep 1, 2004 (by D.L.S.), about 5 miles NNW of Raleigh (Wake Co., NC), were brought indoors for rearing. Adults of an unfamiliar bruchine seed beetle emerged in mid- to late Sep. Specimens eventually sent to E.R.H. in May 2007 were identified as the eastern Palearctic *Bruchidius terrenus* (Sharp). The identification was confirmed after specimens were compared with identified material housed in the collection of the National Museum of Natural History (Washington, DC).

In this paper, we give the first North American records of *B. terrenus*, an Asian seed specialist of

mimosa or silk tree (*Albizia julibrissin*) that occurs widely in the eastern Palearctic Region; China, Taiwan, and Japan (Udayagiri & Wadhi 1989; Morimoto 1990; Hua 2002). We list and map locality records for 7 southeastern states (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee); give a diagnosis, description, and photographs of the adult to facilitate its recognition among the U.S. bruchine fauna; and provide observations on its seasonal history and habits in the Southeast.

SYSTEMATICS

BRUCHIDIUS TERRENUS (SHARP)

(FIGS. 1-6)

Bruchus terrenus Sharp, 1886: 35.

Bruchidius terrenus: Chujo, 1937a: 194; 1937b: 61; Nakane, 1963: 319; Tan et al., 1980: 38; Morimoto, 1984: 266; 1990: 135.

Bruchidius notatus Chujo, 1937a: 196; 1937b: 64; Tan et al., 1980: 39; Morimoto, 1990: 136.

Acanthoscelides terrenus: Zacher, 1952: 465; Udayagiri and Wadhi, 1989: 66.

Diagnosis. Members of the Old World genus *Bruchidius* are characterized by the presence of a single minute acute tooth on the ventromesal margin of the metafemur at the apical 1/4; the absence of marginal teeth or denticles on the pronotum; pronotum conical or transverse, without lateral carina; presence of a well-developed slender mucro at the apex of the tibia ventrally; and the median lobe of the male genitalia lacking "hinge sclerites" (Bottimer 1968; Borowiec 1987; Kingsolver 2004).

Bruchidius terrenus can be easily separated from *B. villosus* and *B. cisti* by the characters in the following description and revised key.

Description (Figs. 1-4). **Male:** Color.—Integument of head usually black, sometimes testaceous; pronotum, elytra, and pygidium black, sometimes testaceous (among specimens examined); ventral areas black except abdomen sometimes testaceous; antenna generally entirely

testaceous, but some specimens with apical segments black; fore and mid legs reddish orange; metafemur usually with basal 1/2 black, apical 1/2 testaceous.

Vestiture.—Composed of fine silvery gray setae evenly distributed over body but with dark brown circular patches on either side of midline of pronotal disk, each with conspicuous central gray spot (Fig. 1); elytral interstices with dark brown spots (Fig. 1); apices of elytra sometimes dark brown (Fig. 3); pygidium (Fig. 3) usually immaculately silvery gray, sometimes with faint darker clouding.

Structure.—Head (Fig. 4) triangular; eyes protuberant, ocular sinus 3/5 length of eye, postocular lobe narrow; frons slightly convex, in some specimens with brief frontal carina; pronotal disk semicircular in outline, lateral margins gently curvate; disk evenly convex with slight depressions at caudal angles, densely, evenly punctate; scutellum broad, bilobed; elytral striae shallow but distinct, finely punctate; 3rd and 4th striae originating on marginal tubercle; interstices alternating in width, densely setose; pygidium shallowly convex, uniformly, densely punctulate; fore and mid legs not modified; metacoxae densely punctulate, lateral 1/2 of face densely setose; metatibia with lateral carina complete and ending in a short, acute tooth, ventral carina complete ending in short mucro, mesal carina complete; basal abdominal sternite with mesal pore; terminal sternite emarginated to fit pygidial apex.

Male genitalia.—As in Fig. 5 and 6. Median lobe (Fig. 5) 4× as long as its apical width; ventral valve subtriangular with apex bluntly rounded; internal sac densely lined with very fine spicules; apical valve circular; lateral lobes (Fig. 6) separated by deep cleft, apices spatulate and inwardly curvate. The male genitalia were illustrated by Morimoto (1990: p. 135).

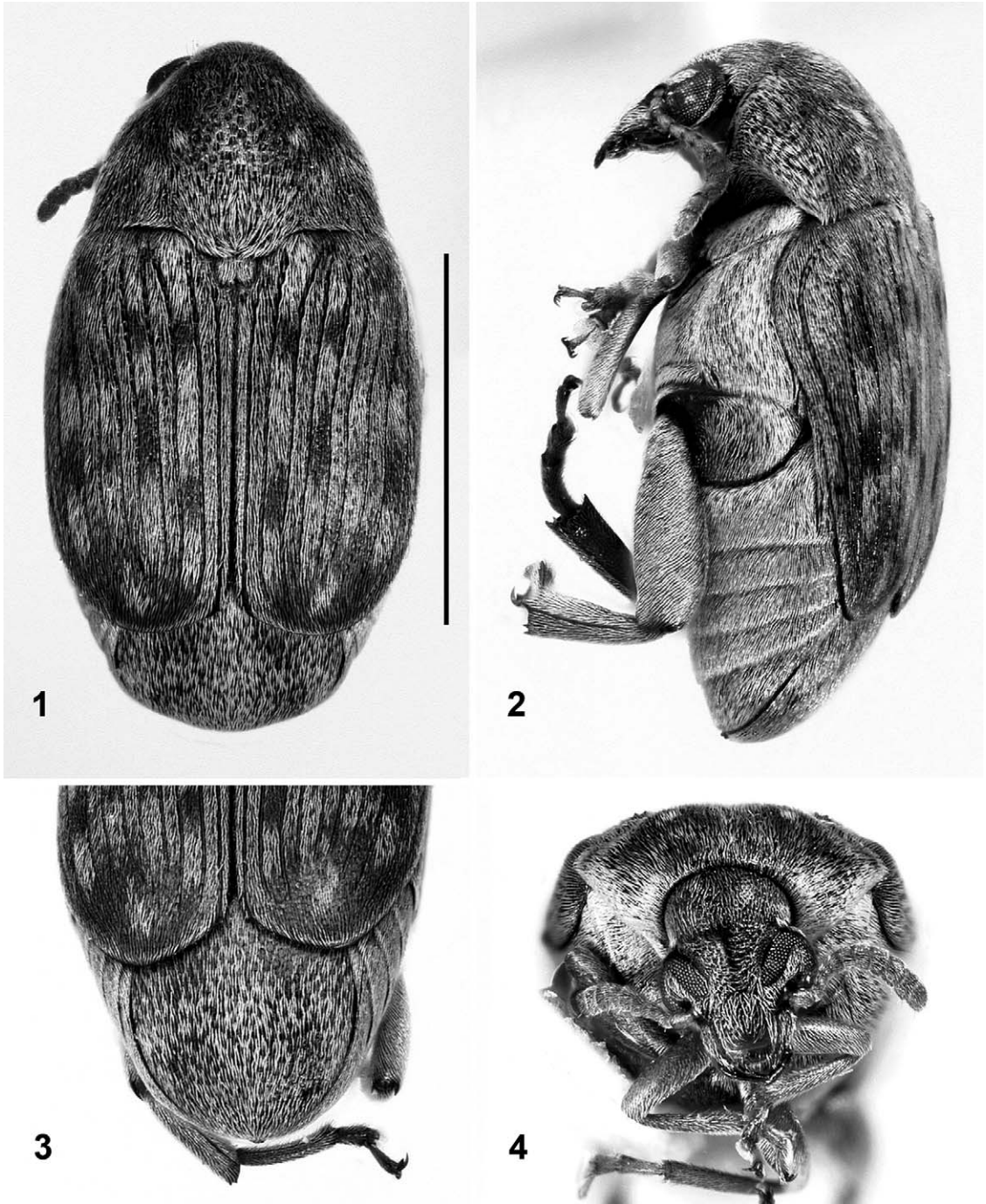
Female.—Similar in all respects to male, except basal sternite lacking medial pore; terminal sternite evenly rounded, not emarginate.

Size.—Variable among specimens examined ($n = 31$); body length ranging from 2.46 to 4.07 mm; majority of specimens measured 3.69 to 3.82 mm.

REVISED KEY TO NORTH AMERICAN *BRUCHIDIUS*

(ADAPTED FROM BOTTIMER 1968 AND KINGSOLVER 2004)

1. Body and appendages entirely black (or only antennal segments 1-4 reddish brown); dorsal vestiture uniformly white. 2
- Body usually black, but appendages not entirely black; head, thorax, elytra, and ventral abdominal segments sometimes testaceous; antennae and legs testaceous to reddish orange; dorsal vestiture predominantly silvery gray with brown mottling, especially on elytral surface (Figs. 1-2); southeastern United States *terrenus* (Sharp)
2. All antennal segments black; 4th stria with prominent, subbasal denticle; mucro absent; western United States and western Canada *cisti* (F.)
- Basal 4 antennal segments reddish brown; striae lacking subbasal denticles; mucro one-eighth as long as basitarsus; eastern United States and eastern Canada *villosus* (F.)

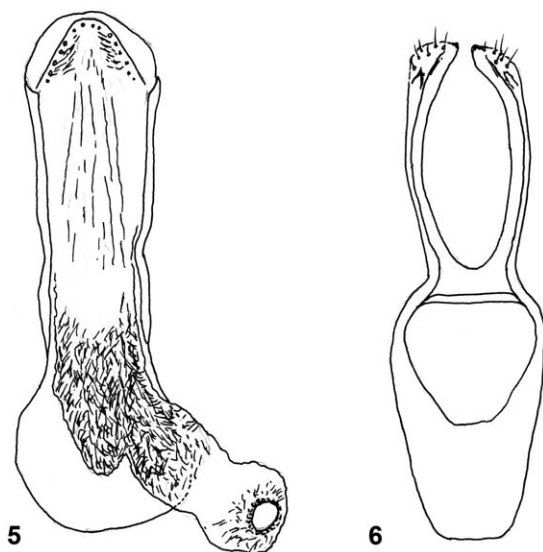


Figs. 1-4. *Bruchidius terrenus*. 1, Adult, dorsal aspect. 2, Adult, lateral aspect. 3, Pygidium, dorsal aspect. 4, Head, frontal aspect. Scale line = 2 mm.

HOST PLANT

Mimosa or silk tree (*Albizia julibrissin*) is native to southern and eastern Asia, occurring east

to China and Korea (Zheng et al. 2006). It was introduced into the United States in 1785 (Sponberg 1990). With its attractive pink flowers and umbrella-like canopy, it has been widely culti-



Figs. 5-6. *Bruchidius terrenus*, male genitalia. 5, Median lobe. 6, Lateral lobes.

vated along roadsides because it is fast growing and drought-tolerant; it is planted in gardens as a highly prized ornamental (Spongberg 1990; Cothran 2004). *Albizia julibrissin* has become invasive in the United States and has spread widely from southern New England west to Missouri and Illinois and south to Florida and Texas; it is cultivated in California and Oregon, where it has not become invasive (Anonymous 2008).

Although *B. terrenus* appears to be a specialist on seeds of *A. julibrissin*, it has been reported from seeds of black locust, *Robinia pseudoacacia* (L.), and *Acacia confusa* Merr. (Morimoto 1990). It is one of 75 species of arthropods closely associated with *Albizia* spp. in Asia and is considered an important pest of *A. julibrissin* in Taiwan and China (Zheng et al. 2006).

SEASONAL HISTORY AND HABITS

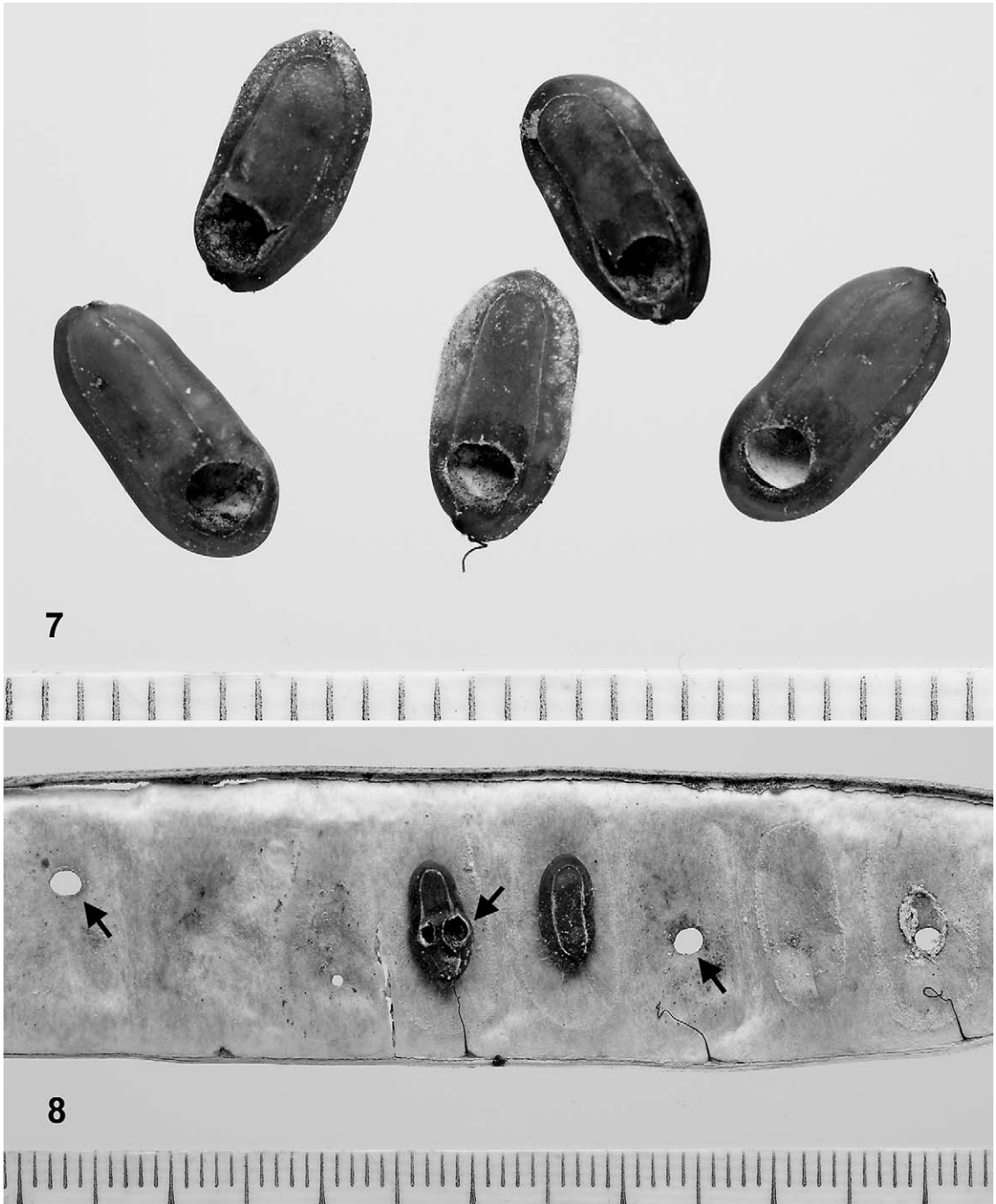
The seasonal history and habits of *B. terrenus* are based mainly on observations by the original collector (T. Barefoot, Elizabeth City, NC), D.L.S. and A.G.W, supplemented by reference to the biology of *B. villosus* (Redmon et al. 2000).

Overwintered, sexually immature adults most likely emerge in the Southeast in late spring and disperse to mimosa where they probably attain sexual maturity by feeding on pollen. In 2008 at Clemson, South Carolina, A.G.W. first found adults on 10-VI (none were found during sampling of the same trees on 2-VI) and observed adults deep in flowers at Clemson and elsewhere in the Southeast while surveying for the beetle. The latest observation of an adult in the field (1

only, by A.G.W.) was on 15-IX-2007, in Emanuel Co., GA (Swainsboro). Mimosa trees flower in Georgia from May through Aug and the fruits (pods) mature from Sep to Nov (Pardini and Hamrick 2008). In Telfair Co., GA (McRae), on 20-VI-2007, A.G.W. noted the presence of ~5 inch pods. Oviposition begins when green pods are forming, probably in early Jul. Pods ripen from late Aug to Nov and begin to disintegrate soon after but remain on the trees into winter. Females probably lay eggs individually (in clusters) on the young pods and cement them in place. Eggs probably hatch in 1-2 weeks, the larvae emerging from the underside of the egg and tunneling into the developing pod. A neonate larva burrows through the pod wall into a soft green seed. In North Carolina, early-instars infested most seeds of pods examined from early to mid-Jul in Elizabeth City (T. Barefoot, in litt.) and the Raleigh area (D.L.S., personal observation). Unhatched eggs were still observed (by D.L.S.) on the outside of pods in late Jul 2004. By mid-Aug (11-VIII-2004), late instars (~3-4 mm long) were found in seeds (T. Barefoot, in litt.). During an examination of several trees in Raleigh in Sep 2004, D.L.S. found seeds heavily infested (>90% examined), whereas seeds of these same trees in Sep 2007 were only slightly infested (<5% examined). Although several larvae probably develop in each pod, D.L.S. noted most seeds contained a single larva, occasionally 2, and rarely 3 larvae; it is unknown if more than a single larva can successfully develop in a seed. Presumably there are 4 instars. Pupation occurs within a seed inside the closed pod. The pupation period probably takes from 10 to 20 d. New-generation adults chew through the seed coat (Fig. 7) and then chew through the pod coat to escape. Adults emerged indoors in mid- to late Sep from infested pods collected near Raleigh on 1-IX-2004 (D.L.S., personal observation). Adult emergence holes were observed (by A.G.W.) on old seed pods collected in early Sep at Clemson, SC (Fig. 8). New adults, after emergence, probably feed on pollen in the fall if flowers are still available. Adults probably overwinter near host trees in plant litter. Based on collecting (by A.G.W.) in 2007 and 2008, adults are found on the host from early to late Jun to mid-Sep. *Bruchidius terrenus* appears to be univoltine.

NEW NORTH AMERICAN RECORDS

Distributional data for *B. terrenus* in North America (see material examined below and Fig. 9) are based primarily on collections from mimosa (*A. julibrissin*) by A.G.W. from Jun to Sep 2007, unless noted otherwise. Parenthetical numbers refer to adults collected. Voucher specimens are deposited in the Cornell University Insect Collection (Ithaca, NY), the National Museum of Natural History, Smithsonian Institution (Washing-



Figs. 7-8. Reproductive structures of *Albizia julibrissin* infested by *B. terrenus*. 7, Seeds. 8, Seeds and pod coat. Arrows denote exit holes by newly emerged adults. Scale line in millimeters.

ton, DC), North Carolina State University insect collection (Raleigh), the Florida State Collection of Arthropods (Gainesville, FL), and the personal collections of Robert H. Turnbow, Jr. (Enterprise,

AL) and Adriean J. Mayor (Great Smoky Mountains National Park, Gatlinburg, TN).

Material examined: UNITED STATES: ALABAMA: Baldwin Co., Loxley, 30-VI-2007 (3). Bul-

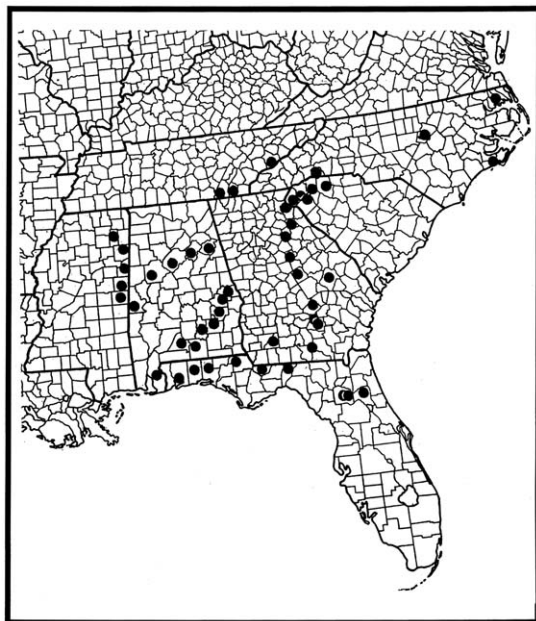


Fig. 9. Known distribution of *Bruchidius terrenus* in the southeastern United States (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee).

lock Co., Union Springs, 1-VII-2007 (2). Calhoun Co., Oxford, 6-VII-2007 (3). Conecuh Co., SW of Evergreen, 30-VI-2007 (1). Conecuh Co., Evergreen, 30-VI-2007 (4). Covington Co., W of River Falls, 30-VI-2007 (3). Crenshaw Co., S of Luverne, 1-VII-2007 (4). Jefferson Co., Hueytown, 6-VII-2007 (6). Lee Co., Auburn, 1-VII-2007 (2). Macon Co., Tuskegee, 1-VII-2007 (7). Pike Co., Troy, 1-VII-2007 (5). St. Clair Co., Cook Springs, 6-VII-2007 (3). Sumter Co., York, 6-VII-2007 (3). FLORIDA: Alachua Co., W of Hawthorne, 29-VI-2007 (2); Gainesville, 24-IV-2007, M. C. Thomas, beating flowers of *Hydrangea quercifolia* and *Cornus foemina* (1, FSCA coll.). Gadsden Co., S of Quincy, 30-VI-2007 (1). Jackson Co., S of Cottondale, 30-VI-2007 (8). Jefferson Co., S of Monticello, 29-VI-2007 (9). Okaloosa Co., S of Crestview, 30-VI-2007 (4). Putnam Co., E of Palatka, 29-VI-2007 (8). Santa Rosa Co., N of Avalon Beach, 30-VI-2007 (3). Walton Co., De Funiak Springs, 30-VI-2007 (3). GEORGIA: Coffee Co., Douglas, 28-VI-2007 (1); Pridgen, 28-VI-2007 (4). Emanuel Co., Swainsboro, 15-IX-2007 (1). Lanier Co., Stockton, 28-VI-2007 (62). Madison Co., jct. Hwys. 72 & 172, 1-VIII-2004, R. Turnbow (1, Turnbow coll.). Mitchell Co., S of Camilla, 9-VIII-2008 (5). Oconee Co., N of Bishop, 28-VI-2007 (1). Putnam Co., N of Eatonton, 28-VI-2007 (5); Stephens Co., Toccoa Falls College, 1-VIII-2004, R. Turnbow, on *Solidago* (10, Turnbow coll.). Telfair Co., McRae, 28-

VI-2007 (8). Wilkinson Co., McIntyre, 28-VI-2007 (17). MISSISSIPPI: Kemper Co., De Kalb, 7-VII-2007 (11). Lee Co., Tupelo, 7-VII-2007 (1). Noxubee Co., E of Shuqualak, 7-VII-2007 (24). Lowndes Co., W of Columbus, 7-VII-2007 (19). Monroe Co., W of Amory, 7-VII-2007 (12). NORTH CAROLINA: Carteret Co., Ft. Macon St. Pk., 10-IV-2006, R. Newman (1, FSCA coll.). Polk Co., Columbus, 24-VI-2007 (3). Wake Co., 5 mi. NNW of Raleigh, 1-IX-2004, D.L. Stephan (4). SOUTH CAROLINA: Anderson Co., Powdersville, 24-VI-2007 (1). Greenville Co., Greenville, 24-VI-2007 (1). Oconee Co., SE of Newry, 21-VI-2007 (2); Westminster, 20-VI-2007 (4); Rt. 123, E of Chauga River, 23-VI-2007 (4). Pickens Co., Lake Hartwell, Clemson, 20 & 21-VI-2007 (5) & 10-VI-2008 (2); Spartanburg Co., Inman, 24-VI-2007 (24). TENNESSEE: Bradley Co., Cleveland, 8-VII-2007 (1). Hamilton Co., E of Chattanooga, 8-VII-2007 (1). Sevier Co., Old Gatlinburg Land Fill off Gnatty Branch, 5-X-2004, M. Tomkasky (1, Adriean Mayor coll.).

DISCUSSION

Two other Asian mimosa-associated insects have been detected recently in North America. The buprestid beetle *Agrilus subrobustus* Saunders, whose native range includes China, Japan, North and South Korea, and Taiwan, was discovered in northern Georgia in 2006. In Japan, the only known host of this little-studied species is mimosa (Westcott 2007). *Acizzia jamatonica* (Kuwayama), a psyllid native to east Asia, was reported from 2 localities in Georgia in 2006 (Halbert 2007; Ulyshen & Miller 2007). Surveys of this mimosa specialist in the southeastern United States in 2007 and 2008 yielded records from 5 new states and additional counties in Georgia. *Acizzia jamatonica* was detected in Europe in 2001, with establishment probably resulting from shipments of mimosa from Asia as prized ornamentals (Wheeler & Hoebeker 2009).

Bruchidius terrenus might have been similarly introduced to the southeastern states with mimosa nursery stock. This seed predator might become a pest of mimosa in landscape plantings and could even be considered a beneficial addition to our fauna by those who regard mimosa as an invasive species and, therefore, an undesirable plant.

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to Kent Loeffler (Department of Plant Pathology, Cornell University, Ithaca, NY) for photographing infested seeds and pods of *Albizia julibrissin*, and to 2 anonymous reviewers for their helpful comments on a draft of the manuscript.

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