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The variegated mud-loving beetles (Coleoptera: Heteroceridae) of Mississippi and Alabama, with discussion and keys to the species occurring in the southeastern United States

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The variegated mud-loving beetles (Coleoptera: Heteroceridae) of Mississippi and Alabama, with discussion and keys to the species occurring in the southeastern United States

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Abstract. We review the variegated mud-loving beetle fauna of the southeastern United States (Coleoptera: Heteroceridae), with an emphasis on Mississippi and Alabama. A key is presented to all species known to occur in the southeastern US, and includes several extra-limital species. Descriptions, illustrations and distribution maps are presented for each species. One **new species**, *Tropicus nigrellus*, is described and a **lectotype** is designated for *Heterocerus schwarzi* Horn. Our molecular data suggest that many previously recognized generic concepts are unnatural. As a result, the following **generic synonymies are proposed**: *Culmus* Pacheco 1964, *Damfius* Pacheco 1964, *Efflagitatus* Pacheco 1964, *Erus* Pacheco 1964, *Filiolus* Pacheco 1964, *Gradus* Pacheco 1964, *Lanternarius* Pacheco 1964, *Lapsus* Pacheco 1964, *Neoheterocerus* Pacheco 1964, *Olmedous* Pacheco 1964 and *Peditatus* Pacheco 1964 are synonyms of *Heterocerus* Fabricius; the genera *Centariatus* Pacheco 1964, *Explorator* Pacheco 1964, and *Microaugyles* Pacheco 1964 are synonyms of *Augyles* Schiödtte. **New combinations** proposed and used in this paper include: *Augyles auromicans* (Kiesenwetter 1851, *Heterocerus*), *Heterocerus parrotus* (Pacheco 1964, *Lanternarius*), *Heterocerus sandersoni* (Pacheco 1964, *Neoheterocerus*) and *Heterocerus selanderi* (Pacheco 1964, *Efflagitatus*), *Heterocerus texanus* (Pacheco 1964, *Peditatus*). Other new combinations for North American species formed as a result of these generic re-configurations, but not used in this paper, include: *Heterocerus incertus* (Pacheco 1964, *Damfius*), *Heterocerus longilobulus* (Pacheco 1964, *Neoheterocerus*), *Heterocerus sinuosus* (Pacheco 1964, *Lanternarius*), *Augyles canadensis* (Fall 1920, *Heterocerus*), *Augyles compactus* (Fall 1937, *Heterocerus*), *Augyles moleculus* (Fall 1920, *Heterocerus*) and *Augyles mundulus* (Fall 1920, *Heterocerus*). **New combinations** for South American species suggested by molecular data, all originally described in the genus *Efflagitatus*, include: *Heterocerus boliviensis* (Pacheco 1964), *Heterocerus freudei* (Pacheco 1973), *Heterocerus furmidus* (Pacheco 1964), *Heterocerus ingeniosus* (Pacheco 1964), *Heterocerus meridianus* (Pacheco 1975), *Heterocerus reticulatus* (Pacheco 1964), *Heterocerus solitarius* (Pacheco 1973), *Heterocerus splendidus* (Pacheco 1964), *Heterocerus tortuosus* (Pacheco 1973), *Heterocerus woodruffi* (Pacheco 1975). No new combinations involving synonymy within the genera *Culmus*, *Erus*, *Filiolus*, *Gradus*, *Lapsus*, and *Olmedous* were proposed because all included species were originally described as *Heterocerus*.

Introduction

Variegated mud-loving beetles (Coleoptera: Heteroceridae) are widespread and common, occurring on every continent except Antarctica. Approximately 250 species of heterocerids are known, and the family is most diverse in tropical and sub-tropical regions. Currently, 87 species are known from the New World, including 34 from America north of Mexico (Marske and Ivie 2003).

Adult heterocerids are brownish, dorsoventrally depressed and have their tibiae armed with rows of robust flattened spines (Fig. 1). They live in shallow tunnels dug in damp soil around fresh and brackish lakes, rivers and ponds, and are even known to occur in intertidal sand flats (Good 1999). The uniform way in which they live seems to have favored uniformity in external anatomy (Charpentier 1965); consequently, it is often difficult to identify these beetles to species using external characteristics. Anatomy of male genitalia has been used to separate both genera and species during the past 45 years.

Few ecological studies have been conducted on members of the family. However, heterocerids appear to be an important prey group for passerine birds (Schmidt et al. 2004) and frogs (Turner 1959), and they appear to play a significant role in the dispersal and burial of seeds in sandy soils (Bernhardt 1995).

Despite their abundance, southeastern heterocerids (actually the family as a whole) are poorly known and their classification is in need of review. The objective of the current project was to conduct a faunistic survey of southeastern United States, an area of relatively high heterocerid diversity, with a focus on Mississippi and Alabama.

Brief Taxonomic History of the Family

The position of the family itself has been disputed. However, an extensive molecular analysis of Coleoptera (Hunt et al. 2007) suggests that heterocerids likely fit at the base of an aquatic clade within the Dryopoidea, and are not members of the Byrrhoidea, as is suggested by morphology (Lawrence and Newton 1995). We consider Heteroceridae as members of Dryopoidea.

Thunberg (1784) described the first heterocerid as *Dermestes fenestratus* (*Heterocerus fenestratus*). Fabricius (1792) erected *Heterocerus* for a species previously described as *Apate marginatus* Fabricius (1787). The first New World members of the family, *Heterocerus pallidus* and *H. pusillus*, were described by Say (1823). By the time Horn (1890) produced his key to *Heterocerus*, eleven North American species were known. He placed these species in two subgenera, *Heterocerus* and *Littorimus*. *Littorimus* des Gozis contained one recognized New World species (*Heterocerus auromicans* Kiesenwetter), but this group was later shown to be a synonym of *Augyles* Schiödt. Horn's key used general coloration, particularly elytral color pattern, for species diagnosis. MacLeay (1825) placed *Heterocerus* in a new family, the Heteroceridae.

The most significant North American taxonomic work concerning Heteroceridae appeared in 1964 when Francisco Pacheco published his dissertation on systematics, phylogeny and distribution of the family in the New World. Pacheco (1964) split the heterocerids into 19 genera, erecting 15 new generic names, relying heavily on characters of the male genitalia. He also described 25 additional New World species, and produced worldwide (excluding Africa) generic keys based largely on characters of the male genitalia. Thus, it is nearly impossible to identify most females to genus, except by association with males. Distribution maps were included in Pacheco's work; however, in his introduction, he admitted that he had not examined enough material to create particularly informative distributions for many New World heterocerids.

Katovich (2002) presented an outline of the higher systematic history of the family and chose to adopt Pacheco's generic classification in American Beetles. During the current project, we tested generic limits using a combined nuclear data set of partial Ef-1 and 28S sequences totaling 1293 base pairs. We were able to gather sequence data for 29 New World species (plus 28S data for an additional four species of *Tropicus* Pacheco), as well as eight Old World species from Angola, Australia, Czech Republic, India, but were not able to include specimens of the extremely rare Elythomerini from Australia. Based on the results of our molecular study (King et al. 2011), all New World species are placed in three genera: *Augyles* Schiödt, *Heterocerus* Fabricius, and *Tropicus* Pacheco.

The only other monographic works on the Heteroceridae were published by Charpentier (1965, 1968). These encompassed the species of the Ethiopian and Notogean (Malay Peninsula, Australia and associated islands) regions, respectively, and each included two species-level keys, one based on male genitalia, the other on external characteristics. Charpentier saw no justification in dividing the family into new

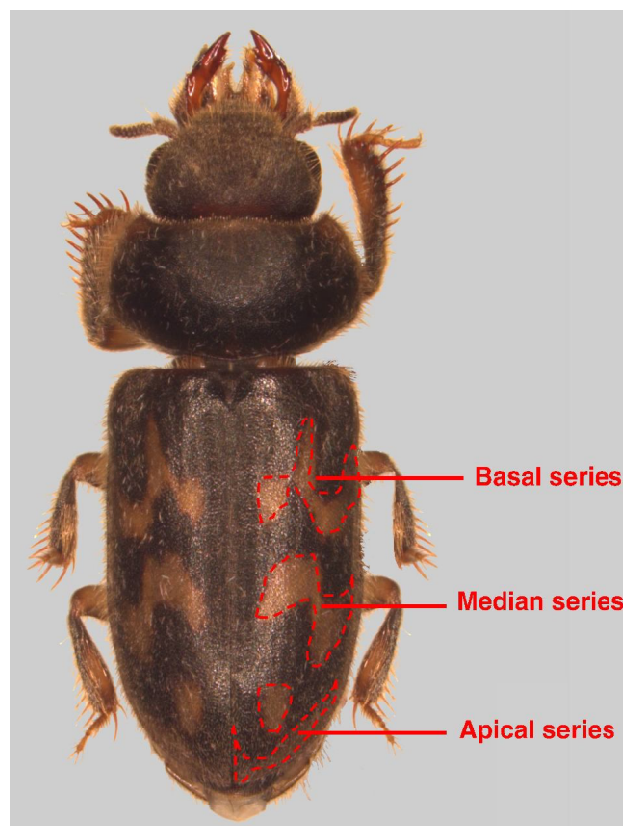


Figure 1. Habitus of *Heterocerus mollinus*. Pale elytral markings are outlined and labeled.

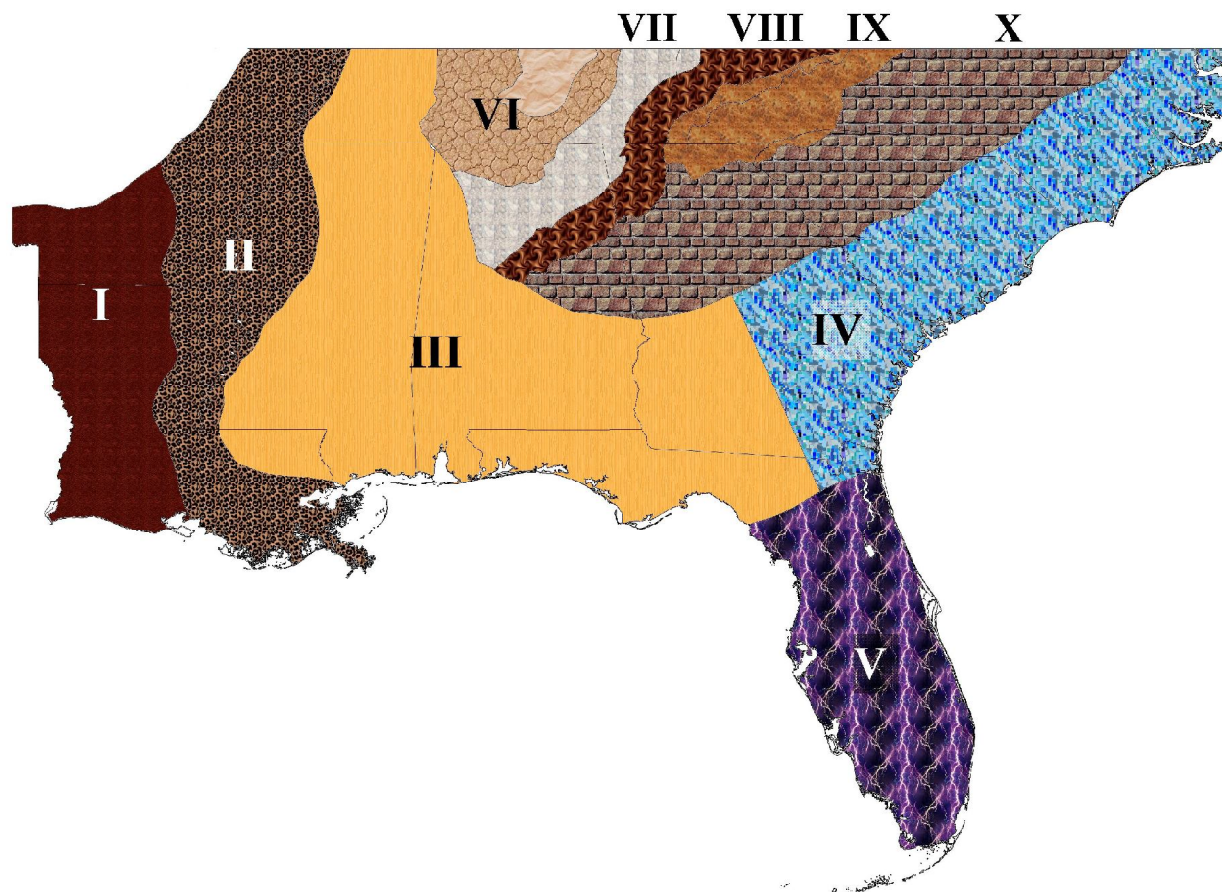


Figure 2. Physiographic regions of the southeastern U.S. I = West gulf coastal plain, II = Mississippi Alluvial Plain, III = East Gulf Coastal Plain, IV = Lower Coastal Plain (Sea Island), V = Floridian Coastal Plain, VI = Limestone Plateau (limestone ridge and Nashville Basin), VII = Cumberland Plateau, VIII = Tennessee Ridge and Valley, IX = Blue Ridge Mountains, X = Piedmont.

genera and he retained all 35 Ethiopian species in the genus *Heterocerus*. Although he did not address Pachecos decision to split the family into 19 genera, he was aware of Pachecos work and cited Pachecos dissertation. He did note, however, the great difference between the male genitalia of various groups of species.

Little subsequent taxonomic work was conducted with heterocerids until W.V. Miller began describing species (Miller 1988a, 1988b; 1994). Miller's works included the descriptions of seven new North American heterocerids, bringing the number of species to 34 for this continent. A key to 21 northeastern species, produced by Miller, appeared in Downie and Arnett's (1996) *Beetles of northeastern North America*. This key relied heavily on elytral color pattern for species identification and Miller chose to apply a taxonomic scheme in which the New World heterocerids were divided into only three genera (*Augyles*, *Heterocerus* and *Tropicus*). Miller retired from active beetle research in 2002, leaving only two Europeans currently investigating heterocerid taxonomy: S. Skalický (Czech Republic) and A. Mascagni (Italy). These authors have described numerous species in the last 20 years (Mascagni 1988a, 1988b, 1990, 1993, 1994, 1995; Skalický 1998a, 1998b, 1999, 2000a, 2000b, 2001, 2002, 2003), although their descriptive work has not yet considered North American taxa.

Study Area

This study focused on two states, Mississippi and Alabama, but distribution data are presented for seven states including 10 distinct physiographic sections (Fig. 2). Most of the land mass of these two states is located within the East Gulf Coastal Plain, a region of approximately 245,142 km² (94,650 mi²)

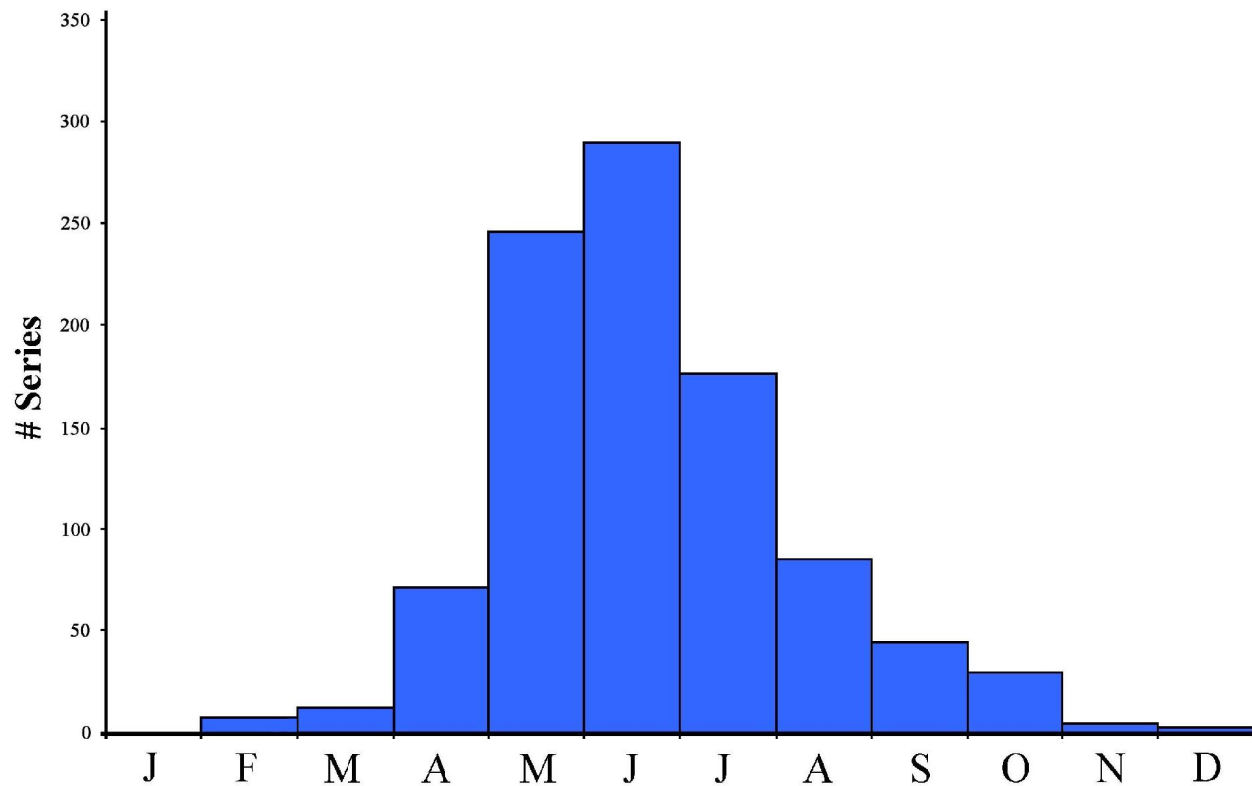


Figure 3. Seasonal distribution of Heteroceridae, by month, based on data collected as part of this study.

occupying portions of Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky, and Illinois. This region is characterized by a wide range of habitats, including coastal dunes and marshes, pine flatwoods and savannas, and upland and bottomland hardwood forests (Küchler 1964). Across this region, elevations vary from 0 to 200 meters (0 to 650 feet) above sea level. Sedimentary rock underlies the Coastal Plain and consists of sand, gravel, porous limestone, chalk marl and clay (Fenneman 1938).

Outside the Coastal Plain, the western portion of Mississippi is located within the Mississippi Alluvial Floodplain and Terraces region. This area is characterized by sand, silt and clay alluvium, with elevations not exceeding 122 meters (400 ft.). Wind-swept silt terraces also occur here. The alluvial plain has been isolated from inundation by the Mississippi River through the construction of extensive levees in the late 1800s and early 1900s. Extensive wetlands also characterize this area. The region once supported the largest expanse of forested wetland in the contiguous United States and consisted of bottomland hardwood forests, cypress swamps and bayous, and oxbow lakes (Putnam et al. 1960). The floodplain has since undergone the most extensive loss of bottomland hardwood forests in the United States (MacDonald et al. 1979; Department of the Interior 1988). Of an estimated 82,880 to 95,830 km² (32,000 to 37,000 mi²) before 1780, only 19,425 km² (7,500 mi²) of forested wetlands remain in the floodplain of the lower Mississippi River (Nature Conservancy 1992).

The extreme northeastern corner of Mississippi is within the Limestone Plateau Region, also known as the Highland Rim. Mount Woodall is located here, and at 246 meters (806 ft.), is the highest point in Mississippi. This area is characterized by limestone forest floors about 152 meters (500 ft.) in elevation with sandstone ridges reaching nearly 305 meters (1,000 ft.) (Fenneman 1938). Oak-hickory forest, cedar glades, and bluestem prairie are the predominant vegetation forms (Küchler 1964). This area has a moderate number of streams and small rivers, with the Cumberland and Tennessee rivers being the largest water courses in the area. The Limestone Plateau also covers northwestern Alabama and extends northward into southern Indiana.

The Limestone and Cumberland plateaus, Tennessee Ridge, and Piedmont make up most of northern Alabama. Elevations range from 183 to 732 meters (600 ft. to 2,400 ft.) in this region. The drastic change

in topography that occurs where the hard rocks from these Appalachian and interior plains regions are thrust underneath the sediment of the east gulf coastal plain is called the fall line. The fall line marks a break in the distributions of many insect species, but an effect was not detected among heterocerid distributions and requires no further discussion here.

Collecting techniques

Heterocerids leave their shoreline tunnels and take flight soon after sundown during the evenings of summer months. During this time, they may be captured in UV- black light traps, often in enormous numbers. The light-trap apparatus used during this study consisted of a 15-watt UV light suspended over a white enamel pan containing a liquid preservative, either 80% ethyl alcohol, or pure ethylene glycol. Beetles were transferred from the collection medium into ice-cold 95% or 100% ethanol for storage and for subsequent use in DNA analyses. Occasionally, UV lights were run in front of a suspended white bed sheet. This type of set-up created a larger attractive surface area than an enamel pan alone. However, it proved less efficient than using a pan because specimens had to be collected individually by someone constantly in attendance. To be most successful, UV light traps were placed relatively close to shoreline habitat. However, on several occasions, specimens were collected at lights that were up to 100 meters from water. The mud-loving beetles small size and habit of flying in short bursts (Kaufmann and Stansly 1979) account for their tendency not to travel long distances, especially in the presence of wind. The beetles were collected usually before 10 p.m. and when the air temperature was above 21° C. Adults of most species catalogued during this study were collected from early April through September (Fig. 3), the most active flight period was June through August.

Shoreline flooding, often listed as a useful collection method in major works such as Triplehorn and Johnson (2005), produced an insignificant number of specimens. Trampling the shoreline was also an inefficient method of collection. These techniques were probably not efficient here because of the soft, sticky nature of most of the mud found along shorelines in Mississippi. This not only makes trampling a tedious and messy affair, but probably makes it difficult for insects to escape and fly from their collapsed or flooded tunnels. These methods may be more useful in other parts of the country where physical characteristics of shorelines are different.

The process of extracting the male genitalia, often necessary for species identification, can be difficult. Completing the process without severely damaging the specimen or the genitalia requires considerable care. However, genitalia are relatively easy to remove from fresh, or alcohol preserved specimens. Dried specimens must first be softened by submersion in hot water ($\sim 80 < C$) for two minutes. The elytra are then spread and the genitalia extracted through a sagittal incision in the posterior end of the abdomen's dorsal surface. Extracted genitalia were placed in micro-vials of glycerin and pinned beneath the specimens for long term storage.

Specimens examined

As part of this study, data were gathered for southeastern heterocerids from several major museum and university collections. William Miller's collection, which was deposited in the California Academy of Science (CASC) following his retirement from heterocerid studies, provided the largest amount of data for southeastern species. Specimens in the Smithsonian Institution (NMNH), the Carnegie Museum (CMNH), Mississippi State University (MEMU) and the University of Mississippi collections (UMIC) were also examined. The University of Mississippi collection housed a particularly large number of specimens from Mississippi and Alabama that were collected during extensive field work carried out during the past 30 years by the junior author and various students in Mississippi and by Dr. S. C. Harris and collaborators in Alabama. Many of these previous studies focused on other aquatic insects and produced a wealth of light trap material. Locality data from all catalogued specimens was used to make county distribution maps for each species (Fig. 54 - 72).

In total, 1,082 series were cataloged (see the Appendix), either from existing collections, or collected as part of this study. These included 9,291 specimens of Heteroceridae, but this total did not include approximately 19,900 specimens of *H. mollinus* Kiesenwetter collected on one occasion.

Morphology

In order to use the following taxonomic keys properly, it is necessary to understand general beetle morphology as well as anatomical characters specific to heterocerids. Some characters, such as variation in body size and coloration, are easily understood, but others dealing with specific anatomy, require some explanation.

Antenna. The antennae are clubbed and oblong-serrate with an elongated scape and a small rounded pedicel (Fig. 4). The antennal club, at apex of the antenna, is usually serrate. The number of antennomeres is important during the identification of worldwide specimens and ranges from 9 to 11.

Mandibles. Between 10% and 25% of males of some species are hypermandibulate (Fig. 5a), wherein the mandibles and labrum are greatly elongated. These males are often much larger than females (Fig. 5b) and other normal males, accounting for the great range in length exhibited by individuals within series of these species. The mandibles of males of several species possess a small to large external tubercle or a tooth-like projection that varies in development and placement.

Color pattern. The general color and color pattern of the pronotum are often useful in identifying species. The pronotum may be darker than (Fig. 12) or similar in color to the darkened areas of the elytra (Fig. 15). In many cases the apical angles of the pronotum are pale yellow while the remainder of the pronotum is brown. In several southeastern species, the entire lateral margins of the pronotal disc may be pale (Fig. 11).

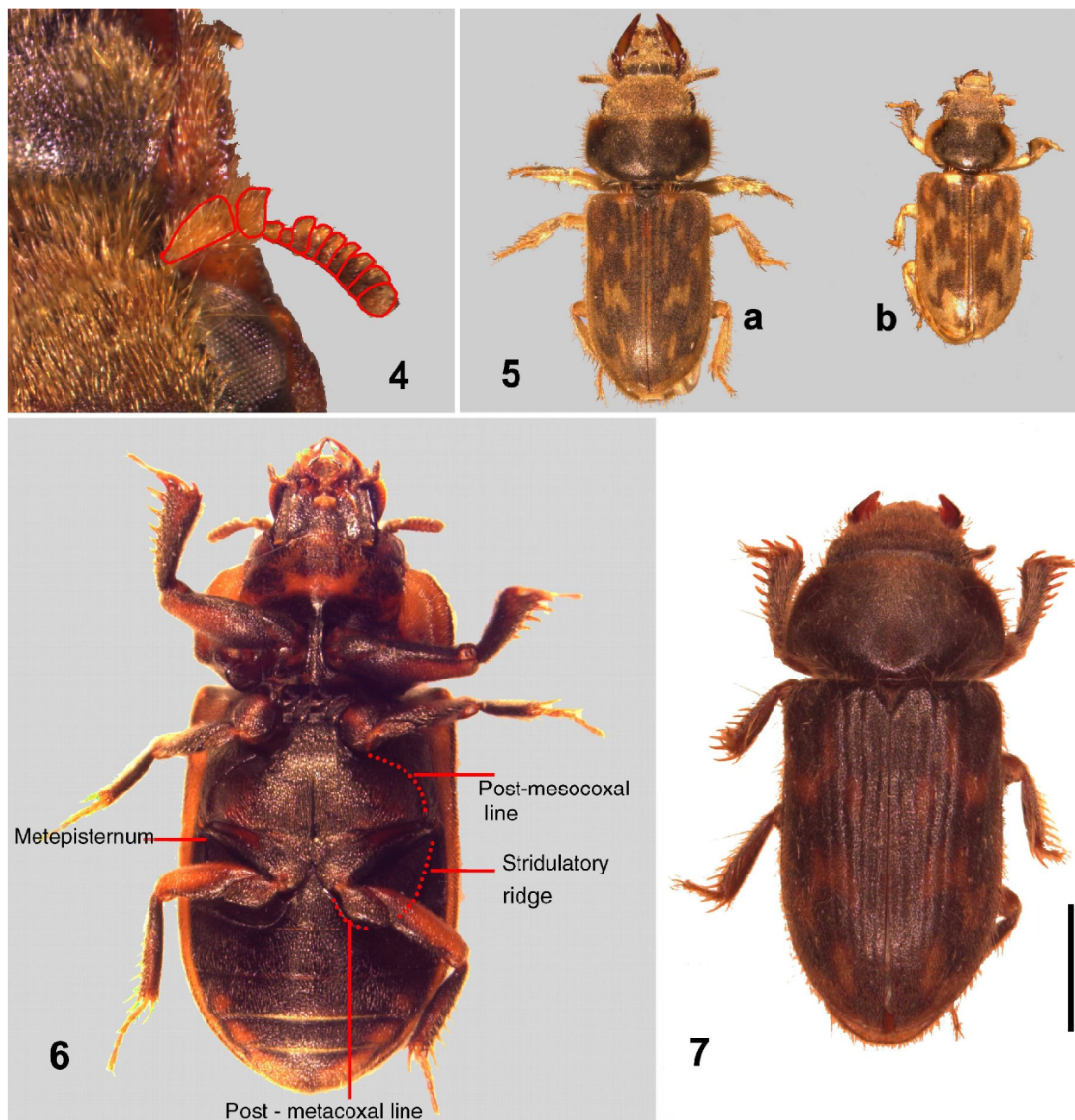
The elytra of most southeastern species are trifasciate. Elytral markings are, however, ill-defined in some species and variation among specimens within a series is often evident. Dark markings range from light to dark brown, reddish, or light grayish-brown. Three groups of pale yellow spots arise from the margin of each elytron and extend medially. These groups, or bands, are called the basal, median, and apical markings (from the anterior to posterior, respectively) (Fig. 1). Each band may be complete or divided into two or three separate spots. Coloration in members of *Tropicus* is quite different from other southeastern heterocerids. In *Tropicus pusillus* (Say), the elytra are orange laterally and share a faint medial brown stripe that covers about one-third of the surface. *Tropicus nigrellus* (n. sp.) is black, without any dorsal pattern. Longitudinal elytral striae (Fig. 7) vary from distinct to weakly defined, and may be absent on some specimens of normally striate species. Striae, varying from 8 to 10, may occur on each elytron and are generally most distinct near the middle of the elytral disc.

Venter. Ventrally (Fig. 6), post-metathoracic coxal lines are present on each side of the first abdominal sternite and curve outwardly from the posterior edge of each metathoracic coxal cavity to the anterior edge of the second abdominal suture. The stridulatory ridges are file-like series of ridges forming a narrow arc from the anterior edge of the second abdominal suture to the lateral edge of the first suture, bilaterally. The posterior tips of the post-metathoracic coxal lines and the stridulatory ridges nearly meet at the suture and together form a semicircle posterior to each metathoracic coxa. Post-mesothoracic coxal lines curve outwardly from the posterior edge of the mesothoracic coxal cavity to the anterior edge of the metathoracic episternum (Fig. 6).

Genitalia. The male genitalia offer a variety of characters useful for identification and may present the only definitive means to separate similar species. Four basic types of male genitalia are seen in Heteroceridae, three of which occur in American species. It should be noted that in some cases homologies of the following structures have not been clearly determined. Therefore, these structures are not named more specifically.

In *Tropicus* and *Augyles*, the genitalia are composed of a single sclerotized structure which is either spatulate or tubular in shape (Fig. 51 - 53). In *Tropicus*, the posterior third of the structure is constricted into a stick-like projection with a knobbed tip. The anterior two-thirds of the structure forms a flattened sometimes scoop-shaped structure, which at its widest is 8 to 10 times wider than the slimmest portion of the posterior projection. The shape of the anterior end varies between species, especially at its tip, and these differences have been used to separate most species of *Tropicus*. In *Augyles*, the phallobase is a slightly dorsoventrally flattened tube-like structure with the anterior one-fourth separated into a variety of two armed caliper-like structures (Fig. 51). In both *Tropicus* and *Augyles*, the aedeagus is a membranous tube contained within the sclerotized structure and is difficult to distinguish.

The sclerotized portion of the genitalia is more complex in species of *Heterocerus* (Fig. 8), which represents the second basic type of genitalia. In most cases, the genitalia are dorso-ventrally flattened



Figures 4-7. Morphological structures. **4)** Right antenna of *Heterocerus pallidus*. Borders of the eleven antennomeres are difficult to distinguish due to pubescence and have been highlighted. **5a)** Hypermandibulate male of *Heterocerus intermuralis*. **5b)** Female (generally similar to “normal” males). **6)** Venter of *Augyles auromicans* exhibiting some taxonomically important structures. **7)** Dorsal aspect of *Heterocerus sandersoni* exhibiting conspicuous longitudinal striations on the elytra. Scale line = 1mm.

with several distinct components. The main body of the genitalia is the phallobase; it is generally flattened, around twice as long as wide, and is usually narrowed anteriorly. Expanded lateral arms are often present and extend posteriorly on either side of the phallobase. The median plate is a narrow sclerite attached to the venter of the phallobase. The dorsal plate covers the dorsal side of the aedeagus, and secures it within the hollowed phallobase. This plate articulates with the body of the phallobase at two points along its posterior edge. The parameres are two nearly transparent, lightly sclerotized projections at the anterior tip of the phallobase.

The third type of genitalia (Fig. 9) occurs in a group of species closely related to *Heterocerus undatus* Melsheimer (the undatus group of Miller 1988a). It is difficult to establish homologies between the structures in this type of genitalia with those seen in other *Heterocerus*. The median plate appears to be greatly expanded and the lateral arms of the phallobase reduced. The dorsal plate and the parameres are usually distinct, and take a variety of forms. In some of these species, such as *Heterocerus stankerus* Pacheco (Fig. 10) from Central America, much of the complexity exhibited by the genitalia of *Heterocerus* has been lost, and most structures have been consolidated into a simple tube in which the lateral arms of the phallobase and the parameres are no longer apparent.

North American Genera

Based on the results of a molecular study conducted along with this survey (King et al. 2011), three genera of New World heterocerids are recognized: *Augyles* Schiödt, *Heterocerus* Fabricius, and *Tropicus* Pacheco. *Augyles* occurs primarily in Canada and the western United States, with only one species, *A. auromicans* (Kiesenwetter), recorded from the Southeast. This genus can be separated from the others by the presence of post-metathoracic coxal lines (Fig. 6).

Heterocerus is the most diverse genus in North America. Adults have eleven antennomeres, never have post-metathoracic coxal lines, and may or may not have post-mesothoracic coxal lines. They are relatively large (length = 2.6 - 7.0 mm) and usually have trifasciate elytra.

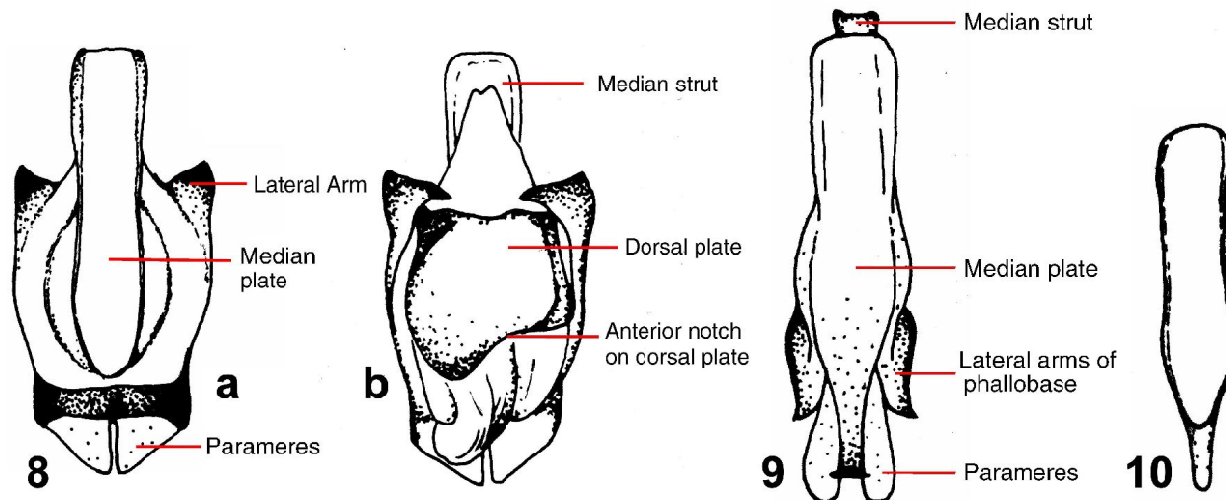
The undatus group of Miller (1988a) comprises a group of intermediate sized (3.0 - 4.5 mm) *Heterocerus*. Reduction of genitalic structures in this group seems to support their identity as a natural unit. Molecular data, however, strongly supports the undatus group as a paraphyletic taxon containing several much larger species that show no size reduction in genital structures. This, along with relatively low sequence divergence rates between the undatus group and the remainder of *Heterocerus sensu lato*, suggests that the group does not warrant generic status. There are five representative species of the undatus group in the southeastern states: *H. collaris*, *H. texanus*, *H. tenuis*, *H. undatus*, and *H. schwarzi*, all of which are similar in size and appearance. Although *H. texanus*, *H. tenuis* and *H. schwarzi* may be separated from the others by having better defined elytral markings, features of the male genitalia offer the only definitive characters to distinguish these species from one another.

Tropicus Pacheco is represented in the United States by three species; *T. pusillus*, and *T. nigrellus* n. sp. occur in the study area; *Tropicus minutus* (Fall), is represented by a single collection from southern Texas. This genus is distinguished by the presence of nine antennomeres, small size (< 3 mm), and elytra that are never trifasciate. *Tropicus pusillus* is one of the most common and widespread heterocerids in the Western Hemisphere.

Key to the Heteroceridae of the southeastern United States

*Extralimital species are labeled **EL** and are discussed at the end of this document.

1. Metathoracic coxal lines present (Fig. 6); pronotum with median longitudinal pale stripe (Fig. 30) **17. *Augyles auromicans* (Kiesenwetter)**
- Metathoracic coxal lines absent, pronotum without a median longitudinal stripe **2**
- 2(1). Length 2.0 - 3.0 mm. Nine antennomeres present, body color either uniformly orangish-brown or black, without trifasciate pattern on the elytra; males with conspicuous dorsolateral basal processes on mandibles which bend over the sides of the labrum and obscure about one fourth of its surface area (Fig. 27) **3**
- Length 2.6 - 6.9 mm. Eleven antennomeres present; elytra at least vaguely trifasciate; mandibles variable, but never with a large dorsolateral processes **4**
- 3(2). Elytra orange laterally, brown medially (Fig. 26); ventral surface of male genitalia with a depression containing no visible sutures (Fig. 53). Common North American species **18. *Tropicus pusillus* (Say)**



Figures 8-10. Male genitalia of *Heterocerus* spp. **8)** *H. pallidus* exhibiting some of the characters which are important in identifying members of this genus. **8a)** Ventral and **8b)** dorsal aspect. Apices of genitalia face downward. **9)** *Heterocerus collaris*, ventral. **10)** *Heterocerus stankerus*, ventral.

- Elytra, pronotum and head uniformly black (Fig. 29); ventral surface of male genitalia with a depression containing a dark, y-shaped suture (Fig. 52b). Rare southeastern species **19. *Tropicus nigrellus* n. sp.**
- 4(2). Mesothoracic coxal lines absent **5**
- Mesothoracic coxal lines present (Fig. 6) **12**
- 5(4). Elytra dark brown or reddish brown and similar in hue to the pronotum; pronotum without pale markings (as in Fig. 17) **6**
- Elytra dominated by undefined pale markings and lighter in color than pronotal disc; pronotum often with pale margins (as in Fig. 11, 12) **9**
- 6(5). Male genitalia with anterior edge of dorsal plate strongly notched (Fig. 8); parameres narrow conspicuously near base, causing outer anterior edge to curve (Fig. 36, 39) **7**
- Male genitalia with anterior edge of dorsal plate not strongly notched (Fig. 35); parameres narrow at an even rate throughout length, outer anterior edges relatively straight (Fig. 35, compare to Fig. 36) **8**
- 7(6). Elytral striae not pronounced; parameres not curved ventrally, and strongly narrowed basally (Fig. 36) **3. *H. longilobulus* (Pacheco)**
- Elytral striae more visible than in *H. longilobulus* (Fig. 16); parameres curved ventrally (Fig. 39, lateral view) and narrowing only slightly near their base (Fig. 39) **6. *H. sandersoni* (Pacheco)**
- 8(6). Median plate of phallobase broadened anteriorly (Fig. 32). Sparsely distributed throughout the eastern United States **5. *H. fatuus* Kiesenwetter**
- Median plate of phallobase narrowed anteriorly (Fig. 35). Common in Florida and Caribbean Islands **8. *H. angustatus* Chevrolat**
- 9(5). Elytra grayish-brown; pronotum darker brown, often with pale margins (Fig. 12); anterior end of phallobase about half the maximum width of the phallobase (Fig. 34) **7. *H. intermuralis* (Pacheco)**

- Elytra testaceous to dark brown; pronotum usually darker than elytra, coloration of margins variable; anterior end of phallobase never constricted to less than 80% of maximum width 10
- 10(9). Parameres quadrate (Fig. 33); testaceous dorsally; hypermandibulate males unknown. Uncommon, known only from southern Texas and southwestern Louisiana **EL *H. glicki* Pacheco**
- Parameres triangular; dorsal color variable; hypermandibulate males relatively common. Widespread in the United States 11
- 11(10). Elytra often testaceous, but may be dark brown, pronotum often with wide pale margins (Fig. 11); some males hypermandibulate; genitalia with posterior edge of dorsal plate only slightly notched (Fig. 37); medial edges of parameres proximate and parallel to one another (Fig. 37) **1. *H. pallidus* Say**
- Elytra and pronotal coloration varying from entirely dark brown to yellow with pale pronotal margins (Fig. 14); hypermandibulate males common; genitalia with posterior edge of the dorsal plate more deeply notched (Fig. 37); medial edge of parameres diverging slightly (Fig. 37) **2. *H. gnatho* LeConte**
- 12(4). Length 2.6 - 4.5 mm; anterior end of phallobase wider than posterior (Fig. 45 - 50); color variable; pale elytral markings variable, but sometimes poorly delimited (as in Fig. 23) 13
- Length 4.0 - 5.5 mm; anterior end of phallobase constricted (Fig. 40 - 43), either abruptly or gradually, and narrower than the base (not including the median plate); elytra reddish brown or dark brown; pale elytral markings often distinctly delimited (Fig. 20) 18
- 13(12). Length 2.6 - 2.8 mm; anterior end of phallobase expanded into a rounded lobe; parameres reduced, hornlike and proximate (Fig. 50); elytra orange with very faint, pale zigzag pattern, often not evident unless the elytra are spread and then backlit (Fig. 28). Known from Florida and southern Georgia, with one record from southern Mississippi **10. *H. selanderi* (Pacheco)**
- Length 3.0 - 4.5 mm; phallobase variable (Fig. 45 - 49), but never rounded and lobe-like; parameres spatulate, triangular or difficult to distinguish; color variable. Widely distributed. 14
- 14(13). Lateral arms of phallobase curving laterally towards their apices (Fig. 45 - 46); elytral surface relatively smooth, orange-brown; with visible striae 15
- Lateral arms of phallobase either obscured by plate-like structure, or curving inwardly; elytra at least moderately punctate, weakly striate, coloration variable 16
- 15(14). Anterior tip of median plate extending beyond anterior tip of lateral arms (Fig. 46); elytra orange-brown, often with large indistinct pale areas, usually with a noticeable pale basal area on elytra near scutellum (Fig. 25). Common throughout the eastern United States **12. *H. collaris* Kiesenwetter**
- Anterior tip of median plate not extending beyond anterior tip of lateral arms (Fig. 45); elytra orange-brown or dark brown, with no basal pale spot near scutellum (Fig. 23). Rare in southeastern states **13. *H. undatus* Melsheimer**
- 16(14). Male genitalia compact, lateral arms curved inwardly, without a sclerotized ventral plate covering apical structures (Fig. 47); elytra with relatively expanded light yellow markings (Fig. 24). Common in Texas and the southeastern United States **14. *H. texanus* (Pacheco)**
- Male genitalia with sclerotized plate covering the venter of the anterior tip (Fig. 48, 49); elytra with relatively slender yellow markings (Fig. 21, 22). Uncommon in Southeast, except Florida 17
- 17(16). Male genitalia relatively compact, lateral arms without prominent pointed projections (Fig. 48, ventral view). Known from northeastern and midwestern United States south to Mississippi; rare in the southeastern states **15. *H. schwarzi* Horn**

- Male genitalia relatively expanded with pointed projections at the anterior end of the lateral arms (Fig. 49). Known only from Florida and Ontario **16. *H. tenuis* Miller**
- 18(12). Elytral markings longitudinally elongated so that the basal series contacts the anterior elytral border near the scutellum (Fig. 31); hypermandibulate males unknown. Essentially Holarctic, common north of 40° N, recorded in the Southeast only from Florida **EL *H. fenestratus* (Thunberg)**
- Elytral markings with two to three only slightly elongated or lunate spots in each series; marginal spot often connecting to a pale lateral margin (as in Fig. 1) **19**
- 19(18). Median plate broad at connection to phallobase, nearly parallel sided throughout length (Fig. 40, 42) **20**
- Median plate distinctly and abruptly tapered to a rounded point at connection to phallobase (Fig. 41, 43) **21**
- 20(18). Pronotum reddish-brown and usually conspicuously lighter than the elytra (Fig. 19); median edge of parameres nearly parallel to one another (Fig. 40, ventral view); anterior edge of dorsal plate with a deep groove on its right side (Fig. 40). A common species in northern and western North America, but known only from Mississippi in the southeastern United States **11. *H. sinuosus* (Pacheco)**
- Elytra and pronotum chestnut brown with the medial and apical pale markings usually enlarged (Fig. 18); median edges of parameres divergent; anterior edge of dorsal plate rounded (Fig. 42). Presently known from Mississippi and Alabama only **4. *H. insolens* Miller**
- 21(19). Phallobase gradually narrowed towards parameres (Fig. 41); dorsally dark brown with anterior angles of pronotum pale; usually with 2 basal, 1 medial, and 2 apical pale markings on the elytra, although some variation occurs (Fig. 20). Extremely common in the Southeast **9. *H. mollinus* Kiesenwetter**
- Phallobase abruptly constricted before parameres (as in Fig. 43,44); elytral markings and color variable. Widespread in North America, but rare in southeastern United States **22**
- 22(21). Parameres widely separated posteriorly, curved to almost touching anteriorly, separated by an oval notch (Fig. 43); dorsal surface dark brown to nearly black. Northern U.S. and Canada, southernmost states recorded by Miller(1996) **EL *H. parrotus* (Pacheco)**
- Parameres not separated posteriorly, their medial edges slightly divergent anteriorly and not curving inwardly (Fig. 44); color variable. Common in western North America, with two specimens recorded from Florida, and one from Louisiana by Miller (1996) **EL *H. brunneus* Melsheimer**

Genus *Heterocerus* Fabricius

Heterocerus Fabricius, 1792: 262.

Culmus Pacheco, 1964: 52. (**new syn.**)

Dampfius Pacheco, 1964: 110. (**new syn.**)

Efflagitatus Pacheco, 1964: 95. (**new syn.**)

Erus Pacheco, 1964: 107. (**new syn.**)

Filiolus Pacheco, 1964: 108. (**new syn.**)

Gradus Pacheco, 1964: 93. (**new syn.**)

Lanternarius Pacheco, 1964: 57. (**new syn.**)

Lapsus Pacheco, 1964: 124. (**new syn.**)

Neoheterocerus Pacheco, 1964: 69. (**new syn.**)

Olmedous Pacheco, 1964: 92. (**new syn.**)

Peditatus Pacheco, 1964: 119. (**new syn.**)

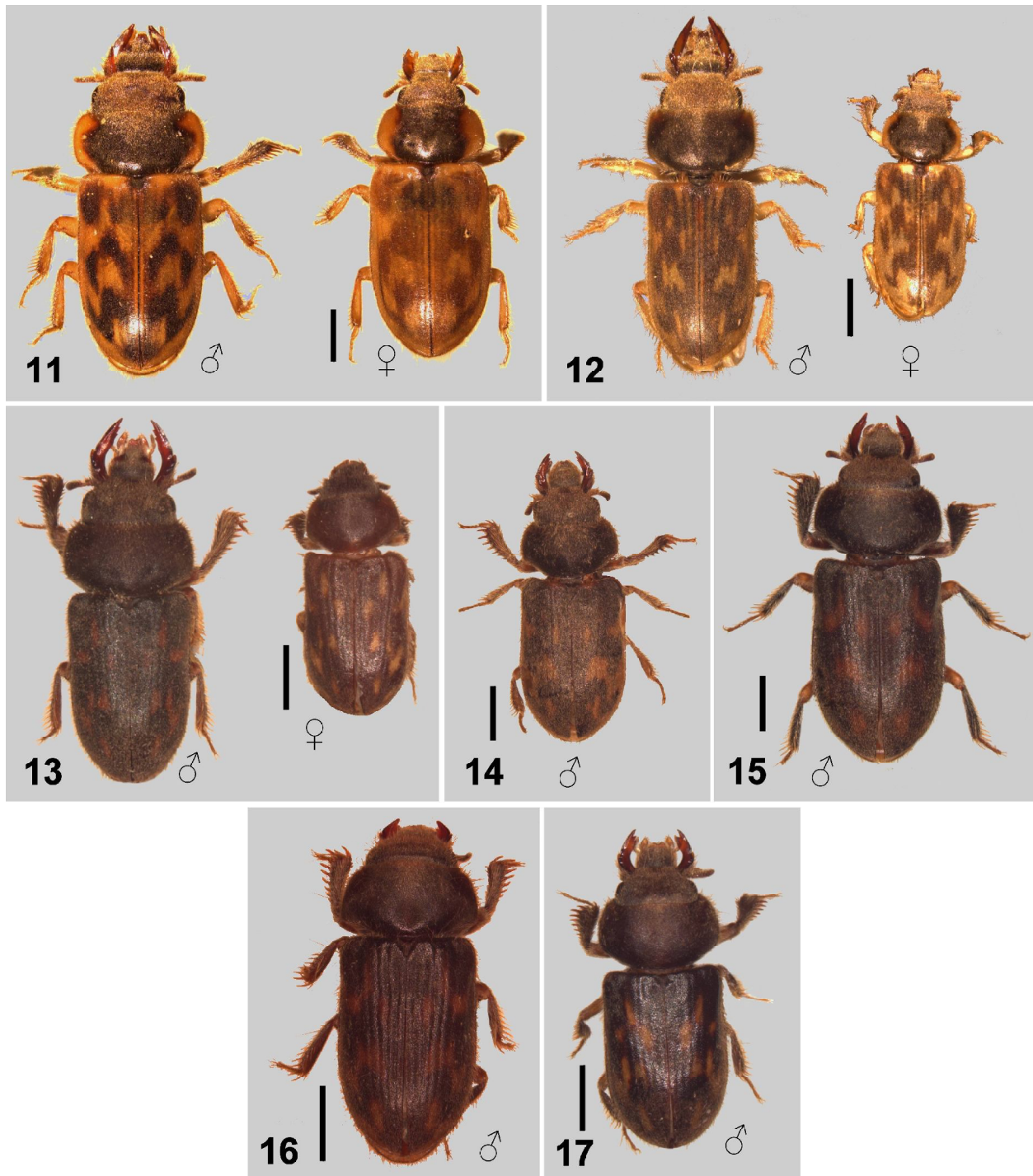
Type species. *Apatе marginatus* Fabricius, 1787: 33. (by monotypy)

Discussion. *Heterocerus*, with approximately 200 species world-wide is what most entomologists envision upon mention of the family name: brown beetles, approximately 5 mm in length, with trifasciate elytra. A few males are hypermandibulate. They occur in a wide variety of riparian habitats on all continents except Antarctica, and have been collected from most Caribbean islands, Madagascar, New Zealand and some Pacific Islands. There are 29 species in America north of Mexico, 21 of which have been recorded from the southeastern United States. Five species recorded from the Southeast, however, are represented by single collections or otherwise dubious records.

Because of the rather extensive generic changes we have suggested, numerous new combinations have been proposed. Many of these have nothing to do with the southeastern fauna. **New combinations** for North American species formed as a result of these generic re-configurations, but not used in this paper, include: *Heterocerus incertus* (Pacheco 1964, *Damfius*), *Heterocerus longilobulus* (Pacheco 1964, *Neoheterocerus*), and *Heterocerus sinuosus* (Pacheco 1964, *Lanternarius*). **New combinations** for South American species suggested by our molecular data (King, et al. 2011), all originally described in the genus *Efflagitatus*, include: *Heterocerus boliviensis* (Pacheco 1964), *Heterocerus freudei* (Pacheco 1973), *Heterocerus furmidus* (Pacheco 1964), *Heterocerus ingeniosus* (Pacheco 1964), *Heterocerus meridianus* (Pacheco 1975), *Heterocerus reticulatus* (Pacheco 1964), *Heterocerus solitarius* (Pacheco 1973), *Heterocerus splendidus* (Pacheco 1964), *Heterocerus tortuosus* (Pacheco 1973), *Heterocerus woodruffi* (Pacheco 1975). No new combinations involving the genera *Culmus*, *Erus*, *Filiolus*, *Gradus*, *Lapsus*, and *Olmedous* were proposed because all included species were originally described as *Heterocerus*. Members of *Heterocerus* are common in the shoreline substrate of aquatic habitats. During this study, specimens of *Heterocerus* were collected along riverine habitats, from small streams to large rivers; lacustrine habitats such as swamps, marshes, saline ponds; oceanic beach debris, and near ponds and streams located in xeric regions. Precise habitat does seem to correlate with species composition at a given location and quite different species were often taken from separate habitats that were physically near one another. One exception, *Heterocerus mollinus*, was present in nearly every riparian habitat sampled. Adults emerge in late spring and cycle through two or three broods during the summer, then over-winter in flask shaped hibernacula in the substrate. Individuals of *Heterocerus* are prone to fly quickly when disturbed and are strongly attracted to light.

Diagnosis. Body length varies from 2.6 - 6.9 mm among the species. Eleven antennomeres are present. Varying proportions of males in about half of the species of *Heterocerus* are hypermandibulate. Elytral patterns vary, although the elytra are trifasciate in most species. Post-mesothoracic coxal lines are present in some species of *Heterocerus*, but absent in others, a trend seen in both North American and African fauna (Pacheco 1964; Charpentier 1965). Post-metathoracic coxal lines are absent from the entire genus. As mentioned above, the male genitalia in this genus show an amazing range of structural variety. The general *Heterocerus* type of genitalia (Fig. 8) can be described as: two basally articulated, dorsoventrally flattened, rectangular sclerotized plates, with two apical parameres attached to the ventral plate and a posteriorly extending median plate attached near the middle of the ventral plate. Members of the undatus species group (Miller 1988a) have aberrant forms of genitalia that do not fit the above description. The genitalia in this group are more compact and the two main plates that form typical *Heterocerus* type genitalia seem to have been greatly reduced in exchange for an expanded median plate. Parameres are evident in most of these forms, although highly modified (see Fig. 9). In fact, it is difficult to homologize many structures on these types of genitalia with those seen in the typical *Heterocerus* type.

The lack of post-metathoracic coxal lines separates *Heterocerus* from *Augyles*. In addition, members of the latter genus are usually less pubescent and many of them have a median longitudinal pale marking on the pronotal disc that does not occur in *Heterocerus*. Normally, the larger body size and trifasciate elytra will separate *Heterocerus* from *Tropicus*. Species of *Tropicus* have either a dark central macula or solidly colored elytra and are almost always less than 2.5 mm in length. Smaller specimens of *Heterocerus selanderi* (Pacheco) can be difficult to separate from *Tropicus* macroscopically. Under magnification, however, *H. selanderi* has faint horizontal elytral markings reminiscent of the trifasciate pattern seen in other *Heterocerus*.



Figures 11-17. Habiti of large *Heterocerus* species lacking post-mesocoxal lines. 11) *H. pallidus* (male is hypermandibulate). 12) *H. intermuralis* (male is hypermandibulate). 13) *H. fatuus*. 14) *H. gnatho*. 15) *H. longilobulus*. 16) *H. sandersoni*. 17) *H. angustatus*. Scale line = 1mm.

1. *Heterocerus pallidus* Say

(Fig. 11, 37, 54)

Heterocerus pallidus Say 1823: 199.*Neoheterocerus pallidus* (Say): Pacheco 1964: 82.

Description. Length 4.5 - 6.9 mm. Dark brown to yellowish brown. Elytra dominated by pale markings that are highly variable in shape and definition (Fig. 11); striae absent. Pronotal disc usually darker than elytra, pronotal margins pale in most southeastern and midwestern specimens, while in northeastern specimens, only the anterior angles are pale normally. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 37) of the typical *Heterocerus* type; dorsal plate depressed on the right anterior edge and only slightly convex on posterior edge; parameres triangular. Hypermandibulate males common.

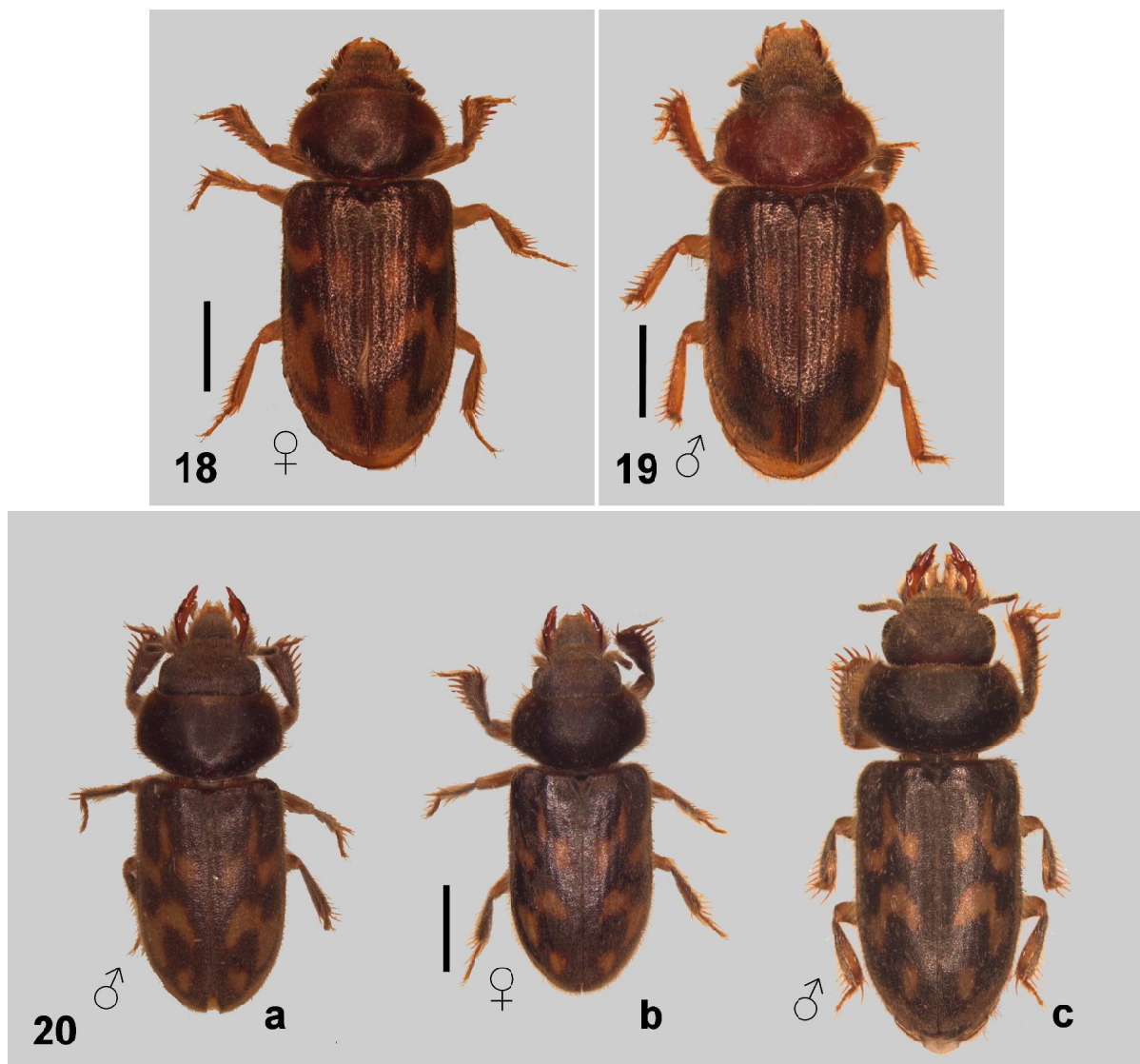
Diagnosis. This species is similar in general appearance to *Heterocerus gnatho*, and the two can be difficult to differentiate. The elytra of both species vary from dark brown to sandy yellow with distinct to rather indistinct elytral markings. The pronotum in both species varies from completely dark brown to light brown with yellow margins; however, *H. gnatho* generally has much narrower light margins. In *H. pallidus* the light margins may extend over one sixth the width of the pronotum. Males of both species may be hypermandibulate. Characters of the male genitalia represent the most trustworthy means of separating the two species. *Heterocerus pallidus* has a slight depression on the anterior edge of the median plate (Fig. 37), while the depression is much deeper in *H. gnatho* (Fig. 38). The medial edges of the parameres are nearly parallel in *H. pallidus*, while they diverge towards their apices in *H. gnatho*. Although these species are sympatric throughout a large portion of their range, *H. pallidus* rarely occurs west of the Rocky Mountains, a region where *H. gnatho* is very common. Rarely is the latter found east of the Rocky Mountains.

Notes. In Mississippi, *H. pallidus* is found generally where the shoreline is a mixture of sandy and muddy areas. Specimens are commonly collected along the Mississippi River in northern Mississippi and from the banks of the Pascagoula and Leaf rivers in the south. Additional specimens were obtained from scattered ponds and small lakes in north-central Mississippi.

Hefley (1937) and Kaufmann and Stansly (1979) discussed the bionomics of *H. pallidus*. The species may be encountered along the shorelines of midwestern rivers through all stages of yearly floodplain succession (Hefley 1937). The beetles are gregarious and prefer sandy areas covered with a thin layer of mud; therefore, they are constantly moving to new burrowing sites as water levels fluctuate. They overwinter in flask-shaped hibernacula 2-5 cm beneath the surface, emerging when temperatures rise above 16° C (Kaufmann and Stansly 1979).

Kaufmann (1987) compared the behavior and reproductive strategies of *H. pallidus* and *Augyles auromicans*. These two species belong to two distinctly different lineages of heterocerids, as recognized by most previous authors. (Molecular data gathered during this study suggests that these two species represent two of three major branches of heterocerid diversity.) *Heterocerus pallidus* generally forms larger, denser colonies and is more likely to fly in response to an environmental disturbance than is *A. auromicans*. The latter most often opted to dig deeper into the substrate rather than fly when their tunnels were flooded or mechanically compromised. A more gregarious and active lifestyle increases the frequency of mating encounters in *H. pallidus* and has apparently led to the development of non-priority in this species (sperm from multiple males are stored and mixed in the spermatheca before fertilization; a situation also called non-precedence). In *H. pallidus*, spermatogenesis and oviposition are closely linked to summer weather patterns. Spermatogenesis slows drastically in response to large summer storms that would presumably flood larval galleries or increase the flow of water drastically and potentially wash away a bank. This response is not seen in the males of *A. auromicans*, which produce sperm at a constant rate for most of their lives.

Great similarity in genital structure suggests that *H. pallidus* and *H. gnatho* are sister species. Molecular data collected as part of this study, however, strongly supports a phylogeny in which *H. pallidus* is more closely related to *H. texanus* than it is to *H. gnatho*. *Heterocerus texanus* belongs to the



Figures 18-20. Habiti of large *Heterocerus* species with post-mesocoxal lines. **18)** *H. insolens*. **19)** *H. sinuosus*. **20)** *H. mollinus*. Specimens 20a and 20c are hypermandibulate. Scale line = 1mm.

undatus species group, a group containing *Heterocerus* with atypical genital morphology. Based on genital morphology, the apparent close relationship between *H. pallidus* and the undatus group is surprising. The strikingly similar genital morphology seen in these two disparate congeners, *H. pallidus* and *H. gnatho*, along with evidence from recent molecular analysis (King et al. 2011), suggests that the basic structure of these genitalia is likely similar to the ancestral condition for *Heterocerus*.

Distribution. *Heterocerus pallidus* is common from New England west to southern Alberta and south to eastern Arizona and the coast of Mississippi. Except for several records from Pennsylvania, it is not known to occur southeast of the Ohio River. A few records from Utah are the only evidence that this species occurs west of the Rocky Mountains.

Mississippi appears to represent the extreme southeastern edge of the range of *H. pallidus*, and no specimens were seen from southern states east of Mississippi (Fig. 54). Considering the large amount of light trap material studied from Alabama, it appears unlikely that the beetle occurs here, but the reason for its absence from areas east of Mississippi is currently an enigma.

Specimens examined. 949 (See Appendix).

2. *Heterocerus gnatho* LeConte

(Fig. 14, 38, 55)

Heterocerus gnatho LeConte 1863: 74.

Neoheterocerus gnatho (LeConte): Pacheco 1964: 85.

Description. Length 3.5 - 7.0 mm. Dark brown to yellowish brown. Elytra dominated by pale markings that are highly variable in shape and definition, vaguely trifasciate (Fig. 14); striae absent. Pronotal disc usually darker than elytra, apical angles of the pronotum pale, apical spot sometimes elongated posteriorly along pronotal border, narrowing posteriorly only slightly. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 38) of the typical *Heterocerus* type, parameres triangular; dorsal plate of aedeagus depressed on the right anterior edge, and convex on its posterior edge. Hypermandibulate males common.

Diagnosis. *Heterocerus gnatho* is the largest heterocerid species in North America, although its size varies considerably. While strikingly similar in appearance to *H. pallidus*, *H. gnatho* is generally darker and has less prominent light pronotal borders. Enough variation is present in these characters, however, to warrant inspection of male genitalia. A strong notch on the posterior edge of the dorsal plate (compare dorsal views in Fig. 37 and 38), and having the interior margins of the parameres diverging slightly from one another, distinguish this species.

Notes. Southeastern records are mostly from sandy riverine and coastal areas.

Upon inspection of the male genitalia in previously identified material, it was found that specimens of *H. intermuralis* and *H. pallidus* were commonly misidentified as *H. gnatho*. This is an easy error to make if one uses Miller's (1996) key. Undoubtedly, some published records for this species are erroneous.

Distribution. *Heterocerus gnatho* occurs primarily in the northern United States and southern Canada, being most common from southern Ontario to British Columbia in Canada and west of the Rocky Mountains in the United States (Fig. 55). Scattered records exist for Kansas, Iowa, Illinois and North Dakota (**New State Record** - Pembina Co., ND, Goschke Dam, Tongue River Game Management Area, 28 June 1974, Paul K. Lago; Richland Co., ND, Walcott Dunes, 28 May 1974, Paul K. Lago). In Mississippi, specimens were collected near freshwater and saline habitats along the Mississippi Gulf Coast, at a UV light in Ocean Springs (Harrison Co.), and along the Mississippi River (Great River Road State Park) in Bolivar County.

Specimens examined. 119 (See Appendix).

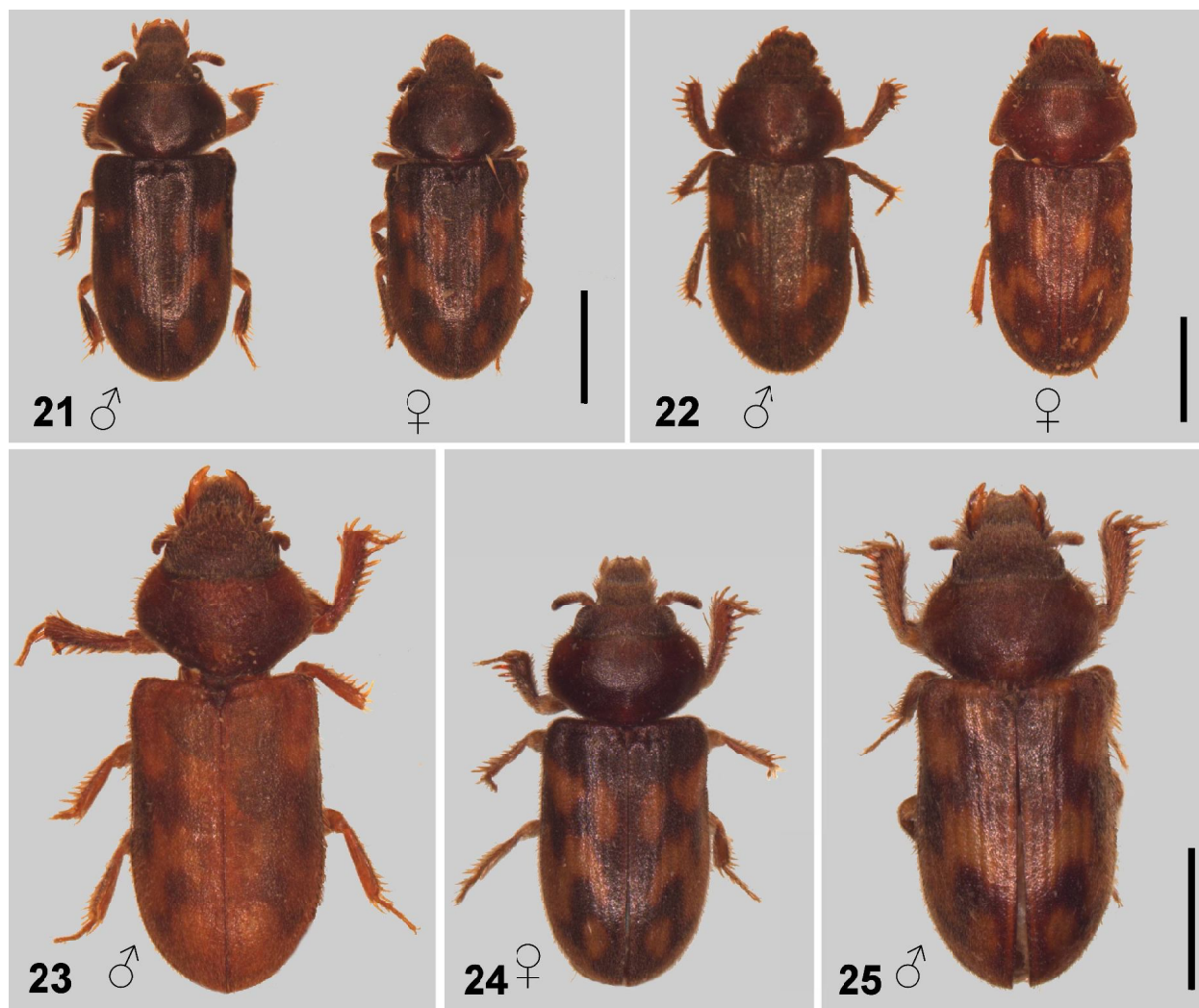
3. *Heterocerus longilobulus* (Pacheco)

New Combination

(Fig. 15, 36, 56)

Neoheterocerus longilobulus Pacheco 1964: 74.

Description. Length 3.5-6.0 mm. Pronotal disc and much of elytra dark brown. Elytra trifasciate, basal series of pale markings usually with a distinct lateral lunate marking and an ovoid medial spot; striae weak or absent. Pronotal disc same color as elytra. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 36) of the typical *Heterocerus* type, parameres triangular, constricted towards apices; dorsal plate of aedeagus depressed on the right anterior edge. Hypermandibulate males common.



Figures 21-25. Habiti of *Heterocerus* species of intermediate size with post-mesocoxal lines. **21)** *H. schwarzi*. **22)** *H. tenuis*. **23)** *H. undatus*. **24)** *H. texanus*. **25)** *H. collaris*. Scale line = 1mm.

Diagnosis. *Heterocerus longilobulus* is similar in appearance to *H. gnatho*, and *H. fatuus*. The lunate outer marking of the basal series on the elytra is quite distinctive. This species, however, can be positively identified only through inspection of the male genitalia. The constricted tips of the parameres (Fig. 36) easily distinguish this species from all other southeastern species.

Notes. This species is most often collected along large rivers, including the Mississippi, Pascagoula, Chickasawhay and Big Black rivers in Mississippi, and the Conecuh, Big Flat and Little rivers in Alabama. A few specimens were taken along smaller creeks. On one occasion, three specimens were collected along a tiny, unnamed stream, 1.5 miles north of Dixon, Neshoba County, Mississippi. The habitat was deciduous forest up to the stream edge and did not appear promising for heterocerids.

Distribution. *Heterocerus longilobulus* occurs from Iowa east through Illinois and Pennsylvania, south to Mississippi, Alabama and northern Georgia (Fig. 56). **Specimens examined.** 105 (See Appendix).

4. *Heterocerus insolens* Miller

(Fig. 18, 42, 57)

Heterocerus insolens Miller 1994:16.

Description. Length 4.5 - 5.5 mm. Chestnut brown. Apical angles of pronotum usually pale. Elytra dark brown and distinctly trifasciate with relatively large medial and distal pale markings, and small broken pale basal marks; striae absent (Fig. 18). Post-metathoracic coxal lines absent; post-mesothoracic coxal lines prominent. Male genitalia (Fig. 42) of the typical *Heterocerus* type, phallobase constricted to its narrowest point at anterior third and then slightly broadened towards outer edges of parameres; medial edges of parameres approximately 30° divergent; dorsal plate ovoid, with no constrictions. Hypermandibulate males rare.

Diagnosis. The presence of post-mesothoracic coxal lines and distinctive elytral coloration distinguishes this species from all other southeastern species except *H. mollinus*, the most common North American *Heterocerus*. In most specimens of *H. insolens*, the two distal pale marks on the elytra are much more extensive than is typical of *H. mollinus* (compare Fig. 18 and 20). Some males of *H. insolens* are reported to have a small lateral projection on the mandibles, which are absent on *H. mollinus* (Miller 1994), but we have not observed this character. The abruptly constricted anterior end of the phallobase and the divergent parameres immediately distinguish *H. insolens* from *H. mollinus*, in which the phallobase slowly tapers anteriorly and the internal edges of the parameres only slightly diverge (compare Fig. 41 and 42). Another southeastern species with post-mesothoracic coxal lines, *H. sinuosus*, has the pronotum consistently darker than the head and elytra, which immediately distinguishes it from *H. insolens*. The external features and genital morphology of this species are also similar to those of *H. brunneus*, a western species with several dubious southeastern records (see Pacheco 1964). Characters of the male genitalia must be used to separate these two species (see couplet 19).

Notes. During this project, *H. insolens* was collected on two occasions. In both instances the beetles were taken from cypress-dominated overflow areas along the Tallahatchie and Yazoo rivers. Previously collected *H. insolens* came from a variety of habitats, including small streams above the fall line in northern Alabama.

Several of Miller's paratypes were found to be misidentified specimens of *H. mollinus*. Genitalia had not been extracted from these paratypes.

Distribution. *Heterocerus insolens* has been collected in four different physiographic regions above the fall line in northern Alabama and it is also common throughout the Alluvial and Coastal plains of Mississippi and Alabama (Fig. 57). Miller (1994) provided single records from Louisiana and Illinois. Since this distribution indicates adaptation to a variety of habitats, and because the species was described fairly recently, it is probable that *H. insolens* has a much wider distribution than is currently known.

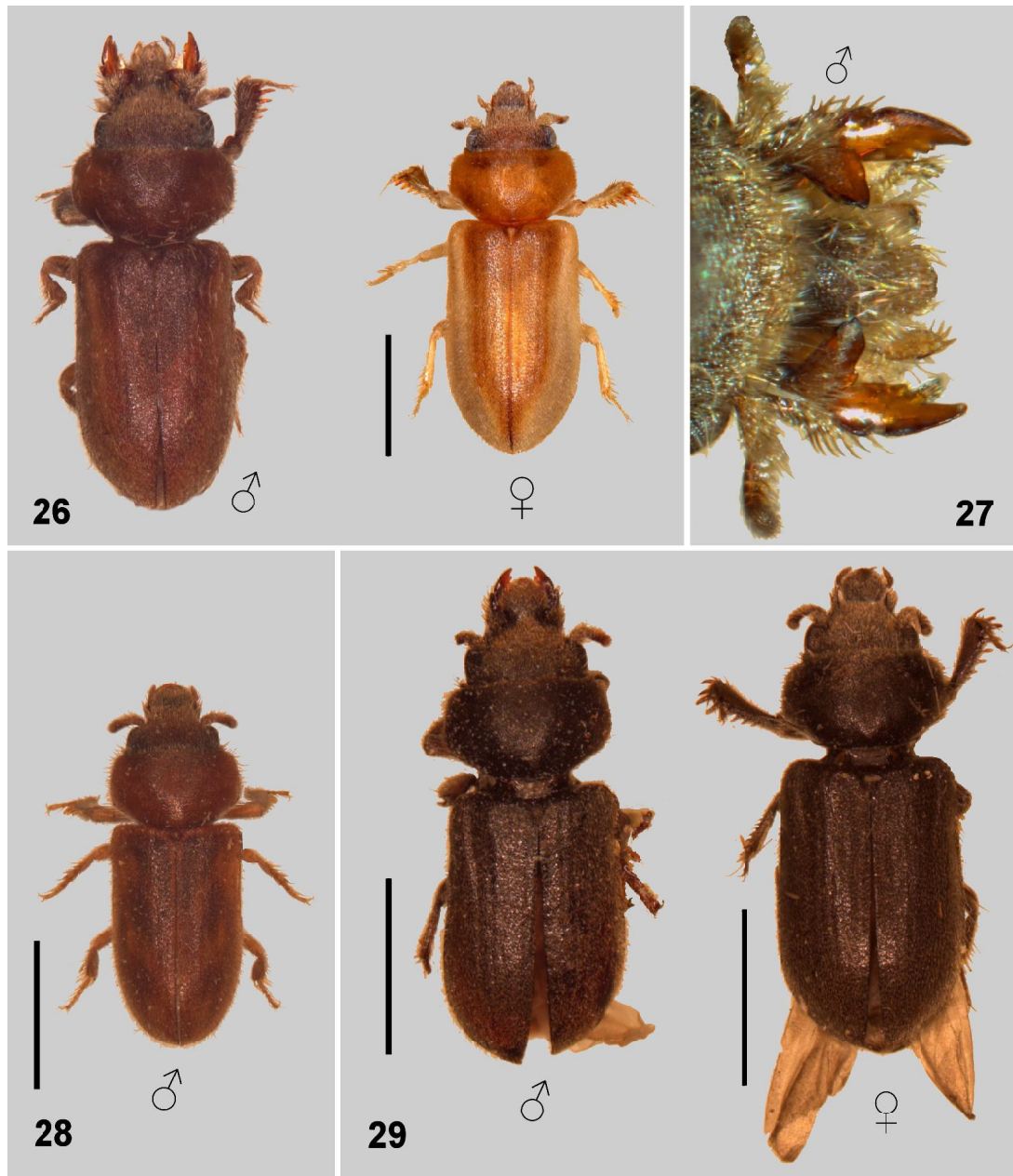
Specimens examined. 98 (See Appendix).

5. *Heterocerus fatuus* Kiesenwetter

(Fig. 13, 32, 58)

Heterocerus fatuus Kiesenwetter 1851: 292.*Neoheterocerus fatuus* (Kiesenwetter): Pacheco 1964: 78.

Description. Length 4.2 - 5.0 mm. Dark brownish-red. Elytra trifasciate; basal and medial pale markings usually broken into series of spots (Fig. 13); striae effaced or feebly indicated. Pronotal disk uniform in color, without pale margins. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 32) of the typical *Heterocerus* type; anterior third of phallobase abruptly constricted to



Figures 26-29. Habiti of small southeastern species. **26)** *Tropicus pusillus*. This level of color variation can be seen in either sex. **27)** Head of *Tropicus pusillus*. **28)** *Heterocerus selanderi*. **29)** *Tropicus nigrellus*, holotype male and allotype female. Scale line = 1mm.

75% of its greatest width; median plate broadened anteriorly; dorsal plate circular; medial edge of parameres slightly divergent. Hypermandibulate males rare.

Diagnosis. *Heterocerus fatuus* lacks both mesothoracic coxal lines and distinct elytral striae. They are reddish brown in color and can be confused with *H. sandersoni*, a species which generally has more noticeable elytral striae. They may be confused with dark specimens of *H. pallidus* and *H. gnatho* that lack pale pronotal borders. Based on the apparent difficulty previous workers encountered in correctly identifying this species using external characters only, it is obvious that examination of the male genitalia is necessary for correct placement of specimens. The anteriorly expanded median plate of the phallobase (Fig. 32) will immediately separate *H. fatuus* from all other sympatric species.

Notes. According to information presented in Miller's (1996) key, *H. fatuus* has stronger elytral striae than *H. sandersoni*. Upon inspection of the male genitalia of a large series of specimens labeled *H. fatuus* by Miller, it was apparent that the majority of the determinations were incorrect, the misidentified specimens being *H. sandersoni*.

Specimens of *H. fatuus* were collected near saline and freshwater bodies of water on Point Clear Island, Hancock County, Mississippi (Lago et al. 2002).

Distribution. This species is known from scattered records along the Gulf Coast of central Mexico, the coast of New York, and from New Brunswick (Pacheco 1964). The Point Clear Island specimens mentioned above represent the only reliably identified series of this species known from the Southeast (Fig. 58).

Specimens examined. 26 (See Appendix).

6. *Heterocerus sandersoni* (Pacheco)

New Combination

(Fig. 16, 39, 59)

Neoheterocerus sandersoni Pacheco 1964: 75.

Description. Length 4.5 - 5.5 mm. Red to dark brownish-red. Elytra trifasciate; pale markings usually broken into separate spots; striae prominent (Fig. 16). Apical angles of pronotum pale. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 39) of the typical *Heterocerus* type; anterior fifth of phallobase slightly constricted to 90% of its greatest width, then widened slightly; median plate with dark ovate sclerites on either side anteriorly; dorsal plate of phallobase elongated on its right anterior edge; parameres curved ventrally, medial edges diverge slightly in ventral view. Hypermandibulate males unknown.

Diagnosis. *Heterocerus sandersoni* is similar in appearance to *H. fatuus* and previous workers have often confused the two species. It is also similar in appearance to *H. angustatus*, with which it shares a small crescent of its range (northern Alabama and possibly eastern Tennessee). The presence of prominent elytral striae usually can be used to distinguish this species from both *H. fatuus* and *H. angustatus*. Strial definition varies, however, and unless a side-by-side comparison with identified specimens can be made, male genitalia are the most reliable means of separating these species.

Notes. This species may be encountered in a wide range of habitats. It is almost always present in light trap samples taken along the Mississippi River or oxbow lakes near the river. Ponds and flood control reservoirs also yielded specimens. This is one of the few species that frequently is captured in light traps placed considerable distances away from aquatic habitats.

Distribution. *Heterocerus sandersoni* is known from southeastern Canada and the eastern U.S. west to the Mississippi and Missouri Rivers, but is not known from the Carolinas south to Florida (Fig. 59).

Specimens examined. 516 (See Appendix).

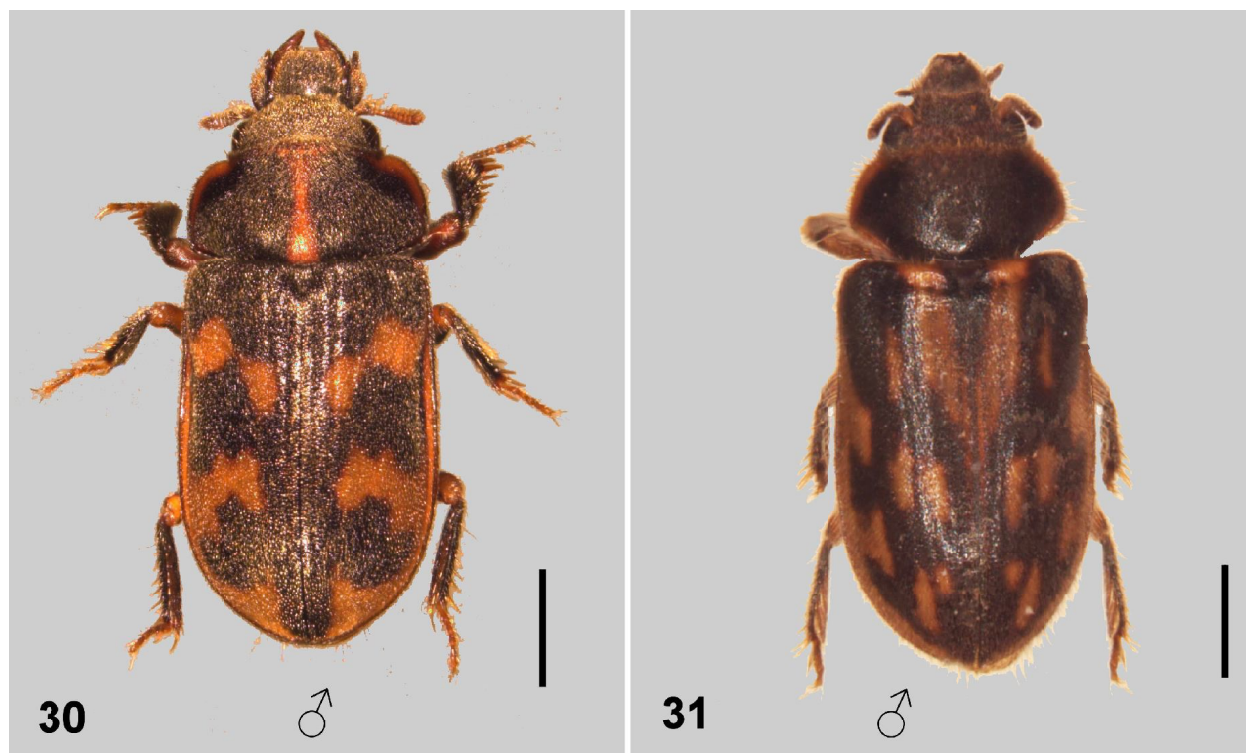
7. *Heterocerus intermuralis* (Pacheco)

New Combination

(Fig. 12, 34, 60)

Neoheterocerus intermuralis Pacheco 1964: 91.

Description. Length 3.9 - 5.9 mm. Elytra grayish-brown, without reddish hue; dominated by pale markings that are highly variable in shape and definition and only vaguely trifasciate (Fig. 12); striae absent.



Figures 30-31. Habiti of two widespread species reported to occur in the southeastern USA. **30)** *Augyles auromicans*. **31)** *Heterocerus fenestratus*. Scale line = 1mm.

Pronotal disc usually darker than elytra, apical angles of the pronotum pale or lateral pronotal margins evenly pale. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 34) of the typical *Heterocerus* type; anterior one-third of phallobase constricted to half of its greatest width, dorsal plate strongly notched on anterior and posterior edges (as in Fig. 38); parameres triangular, with medial edges diverging slightly. Hypermandibulate males common.

Diagnosis. This species is easily separated from similar *H. pallidus* and *H. gnatho* due to its grayish-brown elytral hue. The elytra of the other two species range from testaceous to dark brown. If there is a question of identity, the male genitalia should be examined. The anterior third of the phallobase is constricted to a far greater extent than any other North American *Heterocerus* that lack post-mesothoracic coxal lines.

Notes. During this study, specimens of *H. intermuralis* were collected from a variety of riparian habitats in Mississippi, as well as from widely separated spring fed mud-banked ponds and lakes in west Texas. Specimens were collected by Testa and Lago near brackish ponds on Point Clear Island, Hancock County, Mississippi, but this species was not reported as such by Lago et al. (2002).

Distribution. *Heterocerus intermuralis* was previously recorded only from southern Texas. As part of this study, it was collected from three lacustrine locations in west Texas and eight in Mississippi (Fig. 60). Six Mississippi collection sites are located along rivers on the Mississippi Alluvial Plain, and another on the Pascagoula River, 2 miles from the Mississippi sound. Two specimens were collected on Point Clear Island, Hancock County, Mississippi, by Testa and Lago (reported as *H. fatuus* in Lago et al. 2002). Several series from the Dominican Republic were discovered among specimens in the Carnegie Museum, which marks the first Caribbean record for *H. intermuralis*.

Specimens examined. 171 (See Appendix).

8. *Heterocerus angustatus* Chevrolat

(Fig. 17, 35, 61)

Heterocerus angustatus Chevrolat 1864: 407.*Neoheterocerus angustatus* (Chevrolat): Pacheco 1964: 80.

Description. Length 4.5 - 5.5 mm. Reddish brown. Elytra trifasciate; striae weakly indicated (Fig. 17). Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 35) of the typical *Heterocerus* type; phallobase constricted to 80% of its greatest width anteriorly, then expanded slightly; median plate with faint brown ovate sclerites on either side anteriorly, median plate tapering anteriorly to a distinct point; dorsal plate ovoid, posterior edge truncate, neither end deeply notched; medial edges of parameres slightly divergent. Hypermandibulate males unknown.

Diagnosis. *Heterocerus angustatus* is most similar to *H. fatuus* and *H. sandersoni*. *Heterocerus angustatus* and *H. fatuus* usually exhibit elytral striae that are much less distinct than those of *H. sandersoni*. *Heterocerus angustatus* usually has more extensive and paler elytral markings than *H. fatuus*; however, the male genitalia are the most reliable means of separating the three species. The simple (not notched), ovoid dorsal plate and the pointed medial plate distinguish this species from all other southeastern Heteroceridae.

Notes. This species is known from a variety of habitats and appears to be most common in coastal areas in the Southeast. Within the region, it is most abundant in Florida, from which the great majority of specimens were seen. In fact, of the three species of *Heterocerus* occurring in that state, *H. angustatus* is by far the most abundant.

Distribution. *Heterocerus angustatus* is widely distributed throughout the Caribbean and occurs north through most of the southeastern United States (Fig. 61), with two county records from Ohio. Pacheco (1964) reported localities from New York and Massachusetts, but no specimens from that far north were seen during this study.

Specimens examined. 1085 (See Appendix).

9. *Heterocerus mollinus* Kiesenwetter

(Fig. 20, 41, 62)

Heterocerus mollinus Kiesenwetter 1851: 289.*Lanternarius mollinus* (Kiesenwetter): Pacheco 1964: 66.

Description. Length 4.0 - 5.5 mm. Dark red to dark brown. Apical angles of pronotum usually pale. Pale elytral markings distinct and often trifasciate with two basal, one median, and two apical light marks (Fig. 20); markings variable, in extreme cases basal and medial elytral markings lacking; striae vaguely indicated. Post-metathoracic coxal lines absent, post-mesothoracic coxal lines prominent. Male genitalia (Fig. 41) of the typical *Heterocerus* type, phallobase gradually narrowed anteriorly to approximately 75% of its greatest width; median plate, in anterior half, linear and positioned on left side of the midline of the phallobase; parameres triangular with rounded apices, their medial edges only slightly divergent anteriorly and separated by about half the width of one paramere; dorsal plate nearly circular, with a small sclerotized cleft on its left anterior edge. Perhaps half of all male specimens are indistinguishable from females externally, but the remainder show some degree of mandibular enlargement, with about 10% being truly hypermandibulate.

Diagnosis. This species is similar in general appearance to two other southeastern species that have post-mesothoracic coxal lines, *H. sinuosus* and *H. insolens*. Similar coloration of the pronotum and elytra distinguishes *H. mollinus* from *H. sinuosus*, in which the pronotum is lighter than the elytra (Fig.

19). *Heterocerus mollinus* is very similar to *H. insolens* and is most easily distinguished by examination of the male genitalia. The gradually narrowed phallobase of *H. mollinus* immediately distinguishes it from *H. insolens*, in which there is a more abrupt constriction (Fig. 42). Generally, specimens of *H. insolens* often can be distinguished from *H. mollinus* by the elytral pattern. The median and distal pale markings are less extensive in *H. mollinus* (compare Figures 18 and 20).

Notes. This is the most common species of *Heterocerus* in the eastern United States. Thousands of specimens can be collected in light traps placed near muddy river banks. During this study, much of the labor required during the processing of light trap samples involved distinguishing other species of heterocerids from the huge numbers of *H. mollinus* present. Miller (1988b) coined the term king males for male specimens of *H. mollinus* that have a dorsal horn protruding from the surface of the mandibles, as well as being hypermandibulate to an exaggerated extent. No king males were found among the thousands of specimens examined during this study.

Heterocerus mollinus has been collected from a wide range of habitats throughout Mississippi. This, and *Tropicus pusillus*, are the only heterocerids in the study area that are often collected from non-riverine environments, such as roadside ditches. It is common near rivers and ponds of all sizes.

Distribution. *Heterocerus mollinus* occurs throughout North America, except northern Canada. It occurs throughout the study area (Fig. 62), but appears to be less common near the Atlantic Coast and in Florida. Specimens examined from five localities in Georgia and two in Florida represent new state records (See Appendix).

Specimens examined. 1,931, not including approximately 19,900 collected 26 May 2005, Jefferson County Mississippi, Flathead Lake, N 31° 50.706', W -91° 12.899'. (See Appendix).

10. *Heterocerus selanderi* (Pacheco)

New Combination

(Fig. 28, 50, 63)

Efflagitatus selanderi Pacheco 1969: 37.

Description. Length 2.6 - 2.8 mm. Orange-brown. Elytra trifasciate, markings faint, darker than the rest of the elytral surface; striae vaguely indicated (Fig. 28). Post-metathoracic coxal lines absent, post-mesothoracic coxal lines feebly marked. Male genitalia (Fig. 50) of the typical *Heterocerus* type, although its overall shape is unusual among North American species; genitalia about 2.5 times longer than wide; anterior end of phallobase rounded and slightly enlarged; median plate expanded anteriorly to the width of the entire phallobase, its anterior end fused to, and indistinguishable from, the rounded anterior end of the phallobase; parameres small, hornlike and pointed, proximate at their base and diverging apically. Hypermandibulate males unknown.

Diagnosis. The small size and coloration of this beetle allows it to be easily separated from all other southeastern species except *Tropicus pusillus* and *H. texanus*. The orange-brown elytra and indistinct elytral markings make it easy to confuse *H. selanderi* with *T. pusillus* without the aid of a microscope. The difference in elytral pattern, however, is obvious under magnification, with *Tropicus pusillus* having one common macula and *H. selanderi* being trifasciate. The rounded anterior edge of the phallobase and horn-like parameres distinguish this from *H. texanus* and all other North American heterocerids.

Notes. This species emerges near the beginning of the rainy season in Florida, usually in May or June (Mark Deyrup, Archbold Biological Station, pers. comm.), but apparently ceases to fly soon thereafter. A trip to the Archbold Biological Station in early July, 2005, failed to yield any specimens.

Pacheco (1969) believed that this enigmatic species was the only North American representative of the South American genus *Efflagitatus* Pacheco. Molecular data collected as part of this study strongly support this species as a member of the predominantly North American undatus group, implying that

Efflagitatus Pacheco is polyphyletic. This species was weakly supported as a sister species to *H. tenuis*, another predominantly Floridian species with genitalia that are quite different from this species.

Distribution. This species has been collected primarily in Florida and extreme southern Georgia, although one specimen of *H. selanderi* has been collected in southern Mississippi (Fig. 63). Although the latter is a female, the identification (W.V. Miller) appears to be correct. It was attracted to a UV light on the sandy bank of the Buffalo River in Wilkinson County (Buffalo River at Highway 61, 24 June 1982, Paul K. Lago).

Specimens examined. 36 (See Appendix).

11. *Heterocerus sinuosus* (Pacheco)

New Combination

(Fig. 19, 40, 64)

Lanternarius sinuosus Pacheco 1964: 58.

Description. Length 3.8 - 4.7 mm. Brown or reddish brown. Pronotum lighter than elytra, often with a more reddish hue (Fig. 19); pale elytral markings distinct, trifasciate, pale bands variable; striae vaguely indicated. Post-metathoracic coxal lines absent, post-mesothoracic coxal lines prominent. Male genitalia (Fig. 40) of the typical *Heterocerus* type; anterior phallobase gradually narrowed to approximately 75% of posterior width; median plate approximately 30% greatest width of phallobase, not constricted anteriorly, attached to body of phallobase near the posterior edge of the parameres, point of attachment broad with squared anterior edge; parameres elongate, about one-half the length of the body of the phallobase and rounded at their apices, median edges separated by approximately half the basal width of one paramere and parallel to one another; dorsal plate ovoid, with a small sclerotized cleft on its left anterior edge, posterior edge flattened. Hypermandibulate males unknown.

Diagnosis. The difference in coloration between the light reddish-brown pronotum and the darker brown elytra distinguishes *H. sinuosus* from all other southeastern species in which post-mesothoracic coxal lines are present. The genitalia are also distinctive. The parallel edges of the median plate and its broad, squared attachment to the body of the phallobase is unique among southeastern species and, within the New World fauna, is shared only with *H. infrequens* Miller (1988a), a rare northern species.

Notes. During this study, *H. sinuosus* was collected at two localities in Mississippi. One series of twenty specimens was taken from a *Salix*-dominated oxbow off of the Tallahatchie River in Tallahatchie County (N 34° 01.484', W -90° 08.460'). Another small series was collected near the Pearl River in a suburb of Jackson, Hinds County.

Distribution. *Heterocerus sinuosus* is known from southern Canada and the United States west of the hundredth meridian as far south as northern Mexico. It had also been recorded from the eastern coast of the U.S. as far south as Virginia (Miller 1996). The Mississippi records mentioned above represent a new state record and extend the known range of this species over 500 miles to the southwest of its previously known distribution in the eastern United States (Fig. 64).

Specimens examined. 26 (See Appendix).

12. *Heterocerus collaris* Kiesenwetter

(Fig. 25, 46, 65)

Heterocerus collaris Kiesenwetter 1851: 292.

Dampfius collaris (Kiesenwetter): Pacheco 1964: 115.

Description. Length 3.0 - 4.2 mm. Brown or reddish-brown. Elytra vaguely trifasciate, limits of pale markings enlarged and sometimes poorly defined (Fig. 25); elytral striae weakly indicated. Post-metathoracic coxal lines absent, post-mesothoracic coxal lines present. Male genitalia (Fig. 46) of the *H. undatus* type; approximately three times longer than wide; phallobase dominated by the median plate, posterior third of median plate with parallel sides, slightly broadened in middle third; anterior third gradually constricted to approximately one sixth of its greatest width and curved dorsally; lateral arms of phallobase curved outwardly and produced dorsally in lateral view; dorsal plate twice as wide anteriorly, about 50% greatest width of the phallobase and 50% the length of the body of the phallobase; parameres membranous, arising from beneath median plate at its anterior point of articulation with the lateral arms, parameres lobed and extended laterally on either side of the downwardly curved median plate; the majority of the anterior end of median plate and parameres extend beyond the anterior tip of the lateral arms. Hypermandibulate males unknown.

Diagnosis. *Heterocerus collaris* is similar in size and appearance to *H. undatus*, although the pale elytral markings of *H. collaris* are generally more pronounced. However, the coloration in both species is variable, and only characters of the male genitalia can irrefutably separate the two. The constricted anterior one-third of the median plate and its sharp dorsal curvature distinguish this species from all other North American *Heterocerus*.

Notes. This species inhabits shoreline tunnels in sandbars throughout the eastern U.S. It shares this habitat with the pygmy mole crickets (Tridactylidae), *Ellipes gurneyi* Gunther and *Neotridactylus apicalis* Say. Egg guarding behavior displayed by the female beetles has apparently evolved in response to egg predation by the crickets (Folkerts 1989).

Distribution. *Heterocerus collaris* has been recorded from every state in the eastern U.S., except Florida. In the Midwest it is known from Iowa, Oklahoma and Texas. Records are especially common between the Ohio and Illinois rivers north of their junction with the Mississippi River. This species was previously unknown from Mississippi, although it has been recorded from Alabama and Louisiana (Miller 1996). During this study, specimens were collected from an oxbow off the Tallahatchie River (N 34° 01.484, W - 90° 08.460'), as well as from the banks of the Mississippi River in Bolivar County, Mississippi (Fig. 65).

Specimens examined. 46 (See Appendix).

13. *Heterocerus undatus* Melsheimer (Fig. 23, 45, 66)

Heterocerus undatus Melsheimer 1844: 98.

Dampfius undatus (Melsheimer): Pacheco 1964: 114.

Description. Length 3.2 - 4.5 mm. Brown or reddish-brown. Elytra vaguely trifasciate, limits of pale markings poorly defined; striae absent (Fig. 23). Post-metathoracic coxal lines absent, post-mesothoracic coxal lines present. Male genitalia (Fig. 45) of the *H. undatus* type; about two times longer than wide; phallobase composed primarily of median plate; posterior two-thirds of median plate gradually expanded anteriorly; anterior third abruptly constricted to about 50% of its greatest width and pointed apically, curved dorsally in lateral view; lateral arms attached to the constricted portion of the median plate and curved outwardly at their anterior ends; anterior two-thirds of dorsal plate ovoid, posterior third with parallel sides; membranous parameres small, pointed and extending from beneath the median plate at its anterior tip; anterior end of median plate and parameres not extending beyond the anterior tip of the lateral arms. Hypermandibulate males unknown.

Diagnosis. Although the general color in this species is often darker than it is in *H. collaris*, the two species are very similar in appearance and can be distinguished with certainty only by comparing male genitalia. The outwardly curved anterior tips of the lateral arms separate this species and *H. collaris*.

from other North American species. *Heterocerus undatus* is distinguished from *H. collaris* by the abrupt constriction of the median plate anteriorly, and by the median plate being much shorter (not exceeding the tip of the lateral arms) than that seen in *H. collaris*.

Notes. One specimen of *H. undatus* is known from Mississippi. It was collected on the edge of a cultivated field near deciduous forest in Pontotoc County. A flooded ditch was the likely habitat.

Distribution. *Heterocerus undatus* was previously recorded from the midwestern and northeastern United States into southeastern Canada, as far south as Missouri and Virginia (Miller 1996). Collection data indicates that *H. undatus* occurs west into southern Iowa and Kansas, and south into eastern Arkansas and northern Mississippi (Fig. 66).

Specimens examined. 17 (See Appendix).

14. *Heterocerus texanus* (Pacheco)

New Combination

(Fig. 24, 46, 67)

Peditatus texanus Pacheco 1964: 122.

Description. Length 2.9 - 3.5 mm. Brown or reddish-brown. Elytra trifasciate, with two distinct basal spots (Fig. 24); surface relatively shiny; striae absent. Post-metathoracic coxal lines absent, post-mesothoracic coxal lines present. Male genitalia (Fig. 46) of the *H. undatus* type; slightly more than two times longer than its greatest width; body of phallobase dominated by median plate; anterior half of median plate gradually expanded anteriorly, anterior edge with a rounded central lobe and dorsal spine-like projections laterally; lateral arms of phallobase greatly reduced and projecting from notches between central lobe and lateral projections on the anterior edge of the median plate; dorsal plate with a bilobed projection on its anterior edge that extends beyond the parameres; parameres membranous, small, bilobed and extending from beneath the rounded central lobe of the median plate. Hypermandibulate males unknown.

Diagnosis. This species is most similar to *H. schwarzi* and *H. tenuis*, two less common southeastern species. The elytral surface of *H. texanus* is smoother and has wider pale yellow markings in comparison to the other two species. Male genitalia should, however, be used to separate the three, unless a side-by-side comparison with identified material is possible. *Heterocerus texanus* lacks the long dorsally curved spines seen on the lateral projections of the median plate that are present in *H. schwarzi* and *H. tenuis* (compare Fig. 46 and 47). The latter two species also have a conspicuous plate on the ventral side of the anterior tip of the genitalia.

Notes. *Heterocerus texanus* is relatively common throughout Mississippi and Alabama. In the study area, this species is commonly collected from the banks of the Mississippi River and nearby oxbow lakes. It has also been collected from coastal areas, and occasionally from ponds, swamps and small streams. On two notable occasions, specimens were collected in relatively large numbers from the banks of the Mississippi River, along with large series of *H. pallidus*. Molecular data suggests that these two species are close relatives, although their general morphology would suggest otherwise.

Distribution. *Heterocerus texanus* occurs from southern Texas north to Iowa and east to the coast of the Carolinas and south to Florida (Fig. 67).

Specimens examined. 212 (See Appendix).

15. *Heterocerus schwarzi* Horn

(Fig. 21, 48, 68)

Heterocerus schwarzi Horn 1890: 11.*Peditatus schwarzi* (Horn): Pacheco 1964: 123.

Description. Length 3.0 - 3.7 mm. Brown or reddish-brown. Elytra trifasciate, pale markings well defined, elytral surface with relatively dense pubescence; striae absent (Fig. 21). Post-metathoracic coxal lines absent, post-mesothoracic coxal lines present. Male genitalia (Fig. 48) of the *H. undatus* type, slightly more than three times as long as greatest width; body of phallobase dominated by median plate; each third of plate progressively wider anteriorly; anterior edge with a rounded central lobe and a dorsal spine-like projection on either side visible only in lateral view (Fig. 48); lateral arms of phallobase greatly reduced; dorsal plate not distinct, instead dorsal surface with several distinct sclerites; parameres membranous and obscured by a sclerotized plate on the ventral side of the anterior tip of the genitalia. Hypermandibulate males unknown.

Diagnosis. *Heterocerus schwarzi* is similar to *H. texanus* and *H. tenuis*. It generally can be distinguished from *H. texanus* using external characters if specimens of the two are compared simultaneously; *H. schwarzi* has elytra with narrower pale markings, a much more punctuate surface and has more pubescence than *H. texanus*. *Heterocerus schwarzi* is nearly identical to *H. tenuis*, and male genitalia must be used to distinguish them. The dorsal spine-like projections on either side of the anterior edge of the median plate point outward and are easily seen in the ventral view of the genitalia in *H. tenuis* (Fig. 49), but curve dorsally in *H. schwarzi* and thus are not visible in the ventral view. The ranges of these two species apparently do not overlap.

Notes. This species is rarely encountered in the Southeast. Only one specimen was examined from the study area and was taken along the banks of the Mississippi River in Bolivar County, Mississippi. Additional specimens were seen from two localities along the Mississippi River in Arkansas.

Designation of Lectotype. The Museum of Comparative Zoology (MCZ) at Harvard University inherited the Horn collection from the Academy of Natural Sciences in Philadelphia during the 1960s. The material held by the MCZ was examined and Horn (1890) did not establish a holotype for this species. One specimen was previously labeled as a lectotype although this designation was apparently never published. The male specimen numbered MCZT_32152 (also labeled Lectotype 3271) is **here designated** as the **lectotype** of *Heterocerus schwarzi* Horn. One female specimen with the same collection data and labeled Para-Type 3271.2 is here designated paralectotype. Burnett County, Texas is fixed as the type locality (Horn 1890).

Labels attached to the lectotype are: Top - Burnett Co Texas, 2nd- (male symbol), 3rd - Lectotype 3271 (red), 4th - *H. Schwarzi* Horn (hand written), 5th - M.C.Z. type 32152 (red), 6th - Aug. - Dec. 2004, M.C.Z. image Database, 7th - LECTOTYPE *Heterocerus schwarzi* Horn 1890, Jonas G. King (red).

Distribution. *Heterocerus schwarzi* occurs from the northeastern United States, southeast through Indiana into northern Texas, Arkansas, northern Louisiana and western Mississippi (Fig. 68).

Specimens examined. 7 (See Appendix).

16. *Heterocerus tenuis* Miller

(Fig. 22, 49, 69)

Heterocerus tenuis Miller 1988b: 30.

Description. Length 3.0 - 3.5 mm. General appearance (Fig. 22) and male genitalia (Fig. 49) very similar to those of *H. schwarzi*; however, dorsal spine-like projections on either side of the anterior edge of the median plate point outward in the ventral view of the male genitalia.

Diagnosis. *Heterocerus tenuis* is nearly identical to *H. schwarzi* and can be separated from this species only through differences in the male genitalia. The dorsal spine-like projections on either side of the anterior edge of the median plate in *H. tenuis* project laterally in the ventral view (Fig. 49), a character not present in any other member of the undatus group. These two species are not known to be sympatric, but it should be noted that their known ranges are patchy.

Notes. Because *H. tenuis* and *H. schwarzi* are nearly identical, the possibility that the two species were synonymous was considered. A comparison of six paratypes of *H. schwarzi* and 23 paratypes of *H. tenuis* was made and none exhibited genital characters that could be considered intermediate. The two species appear to be valid.

Distribution. This species is known from Florida, southern Georgia and Rondeau Park, Ontario (Fig. 69). Rondeau Provincial Park is located on a peninsula on the north shore of Lake Erie. The wide gap in the range, and ecology, between the two regions populated by this species, along with Rondeau Parks proximity to some of the major shipping hubs of the St. Lawrence Seaway system, suggests that interstate commerce could have established *H. tenuis* in this isolated northern locale.

Specimens examined. 16 (See Appendix).

Genus *Augyles* Schiödte

Augyles Schiödte 1866: 159.

Littorimus Gozis 1885: 120.

Heterocerus (*Littorimus*) Zaitzev 1910: 4.

Heterocerus (*Taenheterocerus*) Kuwert 1890: 528.

Heterocerus Fall 1920: 212.

Explorator Pacheco 1964: 28. (**new syn.**)

Centuriatus Pacheco 1964: 30. (**new syn.**)

Microaugyles Pacheco 1964: 36. (**new syn.**)

Type species. *Heterocerus hispidulus* Kiesenwetter 1843: 211. (by monotypy)

Discussion. *Augyles* forms an assemblage of larger, primarily Holarctic species that is separated from *Heterocerus* based on the presence of post-metathoracic coxal lines. Approximately 30 species of *Augyles* have been described to date, although the exact number is hard to determine because several species described as *Heterocerus* appear to belong to this genus. Five species are known from North America and occur almost exclusively north of 38°N. Approximately 20 species of *Augyles* occur in Europe and Asia and eight species are known from northern Africa, one of which ranges into southeastern Africa (Charpentier 1965; Skalický 2001).

New combinations proposed, but not included in the text of this paper are: *Augyles canadensis* (Fall 1920, *Heterocerus*), *Augyles compactus* (Fall 1937, *Heterocerus*), *Augyles moleculus* (Fall 1920, *Heterocerus*) and *Augyles mundulus* (Fall 1920, *Heterocerus*).

Little is known about the biology of this group. Kaufmann (1987) reported that *A. auromicans* is less likely to fly in response to disturbance, or in order to disperse than *Heterocerus pallidus*. Sperm competition is absent in *Augyles auromicans*, and based on similarity in genital structure seems unlikely to be present in the rest of *Augyles*.

Diagnosis. *Augyles* range in length from 2.4 to 5.5 mm and either have some form of trifasciate, or solid brown elytra. When pale elytral markings are present, they tend to be more defined and more contrasting

to the dark background than they are in *Heterocerus*. Either 10 or 11 antennomeres are present. Males are never hypermandibulate. Some species of *Augyles* have a pale median stripe on the pronotum, post-mesothoracic coxal and post-metathoracic coxal lines are present in all species of the genus. The male genitalia in *Augyles* are dorsoventrally flattened, sclerotized tube-like structures consisting of two elongate plates that usually maintain a relatively constant width throughout, and have a variety of structures apically. In most species, there are two caliper-shaped parameres; however, saw-like structures or smoothly lobed tips may adorn the apex of the dorsal plate. A dark membranous structure curled within the apical end of the genitalia is often visible.

Members of *Augyles* can be separated from the rest of the family by the presence of post-metathoracic coxal lines. The pale median stripe on the pronotum in *Augyles* will also distinguish some species from *Heterocerus*. This character is especially useful in North America. The *gestalt* of *Augyles*, especially the slight decrease in pubescence in certain areas and an increase in shininess, along with the increased contrast between the pale elytral marking and the elytral background, can be used by experienced workers to scan large samples for specimens of *Augyles*.

Molecular data collected as part of this study yielded inconclusive results concerning the monophyly of *Augyles*, although it was strongly supported as a relatively divergent group nested between *Tropicus* and *Heterocerus*. More thorough taxon sampling or examination of additional loci will be necessary to fully resolve relationships within this group.

17. *Augyles auromicans* (Kiesenwetter)

New Combination

(Fig. 30, 51, 70)

Heterocerus auromicans Kiesenwetter 1851: 287.

Centuriatus auromicans (Kiesenwetter): Pacheco 1964: 30.

Description. Length 3.5 - 5.5 mm. Reddish-brown. Pronotal disk with a pale midline, about one-eighth the width of the pronotum (Fig. 30). Elytra trifasciate; pale elytral markings orange and distinct. Post-metathoracic coxal lines and post-mesothoracic coxal lines prominent. Male genitalia (Fig. 51) of the typical *Augyles* type; phallobase slightly expanded anteriorly; medial edges of caliper-like parameres separated by an ovoid space; a dark, membranous internal structure (presumably the aedeagus) is often curled within the anterior end. Hypermandibulate males unknown.

Diagnosis. The presence of post-metathoracic coxal lines and a median pale stripe on the pronotum make this species easy to distinguished from all other southeastern heterocerids.

Notes. Aggregations of *A. auromicans* form mud galleries that are smaller and more scattered than those made by *H. pallidus* (Kaufmann 1987). This apparently leads to less frequent mating encounters, and consequently, male priority (the last male to mate with a female fertilizes nearly all of the eggs). Spermatogenesis is constant in *A. auromicans*, in contrast to *H. pallidus* where spermatogenesis is affected by weather patterns. *Augyles auromicans* also flies less often as a response to agitation than *H. pallidus*, usually choosing to dig deeper into the substrate rather than taking flight (Kaufmann 1987).

The species has not been found in Mississippi, and only one specimen is known from Alabama. This specimen was collected from a swampy area near Tuscaloosa (Tuscaloosa County, 5 mi. SW Tuscaloosa, 18 April 1981, S.C. Harris), which has since undergone development.

Distribution. *Augyles auromicans* occurs from southern British Columbia southeast to Colorado and east throughout the northern United States to the Atlantic Coast. Records from the northern U.S. and southern Canada are common; however, *A. auromicans* has rarely been collected in the southern states (Fig. 70).

Specimens examined. 8 (See Appendix).

Genus *Tropicus* Pacheco

Tropicus Pacheco 1964: 131.

Type species. *Heterocerus pusillus* Say 1823: 200. (by original designation)

Discussion. The smaller, orange-brown heterocerids familiar to many New World coleopterists belong to the genus *Tropicus* Pacheco, which currently contains 25 species. This genus is known only from the New World and is most diverse in South America. Three species occur north of Mexico and five species occur on Caribbean Islands, the other 17 occur in Mexico, Central America, and South America. *Tropicus* was erected relatively recently by Pacheco (1964) and about half of the known species have been described during the last 20 years.

Tropicus pusillus is the most commonly collected species of heterocerid in the eastern U.S. This species occurs in all sorts of habitats and, unlike most other heterocerids, can be collected from areas that seem to be entirely sand, and lacking mud. Outside of this, virtually nothing is known of the specific biology of this group.

Diagnosis. Individuals of the various *Tropicus* species are small (length = 1.7 - 3.5 mm) and their elytra are either uniformly colored, have a dark, common, central macula, or rarely have longitudinally elongate markings on each elytron. In any case, the elytra are never trifasciate as they are in most species of *Heterocerus* and *Augyles*. Nine antennomeres are present, although the small pubescent antennae are usually difficult to examine. Males of most species have dorsolateral processes on the mandibles that curve over the lateral edges of the labrum. All species of *Tropicus* lack both post-mesothoracic coxal and post-metathoracic coxal lines. The male genitalia are composed of a single dorsoventrally flattened sclerotized tube with various folds, sutures and sculpturing on its shovel-like apical end. The basal third of the genitalia is constricted into a narrow cylindrical structure with a knobbed tip.

Although small size and lack of trifasciate elytra almost always betray the identity of *Tropicus*, several species of New World *Heterocerus* are as small as *Tropicus*, and some Asian *Augyles* are small or uniformly colored. A common macula on the elytral disc, number of antennomeres, and male genitalia will readily distinguish *Tropicus* from these species. *Micilus* Mulsant and Ray is rare and comprises two species from isolated localities in Europe and Asia. Members of *Micilus* are small, uniformly colored, have nine antennomeres and simple male genitalia. *Micilus* do have post-mesothoracic coxal lines, however, which will distinguish them from *Tropicus*.

Molecular data collected during this study strongly supports the placement of *Tropicus* as sister to the remainder of the family. The high level of sequence variation between *Tropicus* and the rest of the family suggests that it diverged early in the history of the family and was geographically isolated from the other groups by vicariance events during the Jurassic.

18. *Tropicus pusillus* (Say)

(Fig. 26, 27, 53, 71)

Heterocerus pusillus Say 1823: 200.

Tropicus pusillus (Say): Pacheco 1964: 137.

Description. Length 2.3 - 3.0 mm. Orange-brown. Elytra orange laterally, with a common brown macula medially (Fig. 26). Males with a process extending from the dorso-lateral edge of each mandible that wraps around the edge of the labrum (Fig. 27), often nearly meeting the process from other side. Post-metathoracic coxal and post-mesothoracic coxal lines absent. Male genitalia (Fig. 53) of the typical *Tropicus* type, dorsal edge projecting anteriorly.

Diagnosis. *Tropicus pusillus* can be easily distinguished from all species of southeastern heterocerid by color pattern alone. The elytra are not trifasciate, as they are in southeastern *Heterocerus*, but have

brown sutural margins. Together, these darker margins produce a rather even-edged median macula on the elytra.

This coloration also easily distinguishes *T. pusillus* from its only southeastern congener, *Tropicus nigrellus* n. sp., which is entirely black.

Notes. Often the most numerous beetle at a UV light placed near a body of water in the southeastern U.S., *T. pusillus* is the only species of heterocerid consistently collected from intermittent creek beds, drainage ditches, and sandy ponds. During this project, specimens were collected from the margin of a brackish marshy habitat on the campus of the Gulf Coast Research Laboratory in Ocean Springs, Mississippi.

Distribution. *Tropicus pusillus* occurs from near the Canadian border south to Panama and Cuba. It was collected in all 63 Mississippi counties where UV lights were run as part of this project, as well as from most Alabama collection localities sampled by Harris et al. (1991, Fig. 39).

Specimens examined. 1802 (See Appendix).

19. *Tropicus nigrellus* n.sp.

(Fig. 29, 52, 72)

Type material. **Holotype** male, labeled: USA, Mississippi, Hinds County, 19 August 1964, VH Owen. **Allotype** female, same data as holotype. **Paratypes** (two males, three females). One male, two females, labeled: Mississippi, Hinds County, 19 August 1964, VH Owens. USA. One male, labeled: South Carolina, Florence, 16 August 1955, V.M. Kirk. USA. One female, labeled: Florida, Old Town, May 1967, Dr. Lenczy. All specimens are deposited in the California Academy of Sciences, San Francisco.

Description. **Holotype male** - Length 2.7 mm, width across elytra 1.0 mm, width of pronotum 0.9 mm. Body uniformly black; covered in recumbent setiform pubescence (Fig. 29), pubescence especially dense on the head and labrum. Head finely punctate, punctures separated by approximately one diameter, almost entirely obscured by dense pubescence. Apical margin of clypeus slightly concave. Labroclypeus triangular. Margins of labrum rounded with an oblong projection at the apex. Labial palpi with surface slightly roughened. Males with labrum relatively elongate, mandibles long and slender, extending past apex of labrum for 25% of their length, lateral mandibular process (as in Fig. 27) developed from a dorsal ridge at base of mandible, wrapping around the lateral edge of the labrum and obscuring about 1/4 of its surface. Protheca almost clear, with 10 - 15 alternating small and large teeth. Pronotum about twice as wide as long, slightly tapered anteriorly, all angles rounded. Pronotum of male as wide, or slightly wider, than the base of the elytra. Pronotal edges entire. Pronotal pubescence concentrated near the anterior margin, several long setae project laterally near the anterior angles.

Scutellum triangular, glabrous, its margins obscured by fine pubescence along its borders. Elytra oblong, disc elevated in middle half of conjoined surface, tapering posteriorly over the apical third after reaching a width slightly greater than their basal width; apices rounded, edges entire, pubescence more sparse than on pronotum, fine punctures on the elytra visible. Punctures irregularly spaced, separated by about 1-3 diameters. Setae longer on apical fourth of elytra and generally recumbent posteriorly.

Ventral surface black with areas of dark reddish brown near the abdominal sutures, pubescence relatively sparse; fine punctures visible, separated by 1 - 2 diameters, setae concentrated around edges of sternites and coxae; no metathoracic coxal, mesothoracic coxal, or epipleural lines present; stridulatory ridge present on the first sternite, curving to the anterior edge of the second sternite directly behind the metacoxae.

Legs black, setose, prothoracic legs more robust than metathoracic legs, with a row of 7-10 spines along the posterior margin of the prothoracic tibiae, and with similar rows of smaller spines along the anterior margin of the meso- and metathoracic tibiae. Femora approximately equal in length to tibiae on all legs. Tarsi 4-4-4, inserted between first two large tibial spines, glabrous; basal tarsomere twice as long as second or third tarsomeres; apical tarsomere approximately as long as first three combined.

Male genitalia dark brown, appearing black near sutures, semi-transparent in some spots near apex; the basal 1/3 constricted to a linear structure that curves asymmetrically near the basal tip (Fig. 51), distal 2/3 expanded into a spoon shaped structure five times wider than the basal third at its widest point; dorsal surface smooth and relatively transparent, with rounded edges, composed of one continuous plate, structures on the ventral side are visible through dorsal surface; ventral surface with a depression comprising about 1/2 of the entire surface of the phallobase (Fig. 51), depression with a dark, y-shaped suture which is clearly visible from either side of the genitalia.

Allotype female - Similar to male in most respects. Length 2.8 mm, width of elytra 1.0 mm, width of pronotum 0.8 mm. Body uniformly black, clothed in dark setae. Mandibles not extending past the tip of the labrum, which is relatively short and rounded, and lacking lateral processes.

Paratypes vary in length from 2.0 - 3.0 mm but otherwise are very similar to the holotype and allotype in most respects, including sexually dimorphic mandibles. Pronotum as wide as, or slightly narrower than, the base of the elytra.

Diagnosis. *Tropicus nigrellus* is similar in overall morphology and in genitalic structure to *T. pusillus*. Relying on color alone, however, it can be easily distinguished from all other described species of *Tropicus* from Central and North America, none of which are entirely black. The ventral side of the male genitalia has a depression with a dark, y-shaped suture, which also separates *T. nigrellus* from *T. pusillus* (this suture is not present in the latter species).

Distribution. This species has been collected from three scattered locations in the Southeast (Fig. 70), each located in a different region of the southeastern Coastal Plain: the East Gulf Coastal Plain (NC), the Lower Coastal Plain (MS) and the Floridian Coastal Plain (FL).

Etymology. The specific epithet, *nigrellus*, refers to the unusually dark coloration of this beetle.

Specimens examined. 3 males (2 previously disarticulated), 6 females.

Extra-limital species

Five additional species have been recorded from the southeastern states: *Heterocerus brunneus* Melsheimer, *H. parrotus* (Pacheco), *Lapsus tristis* (Mannerheim), *Heterocerus fenestratus* (Thunberg), and *Heterocerus glicki* Pacheco. These species have been well documented as occurring in either the extreme western or northern U.S. and are represented by few southern specimens. Species were placed in this section if they met either of two criteria: 1) all southeastern specimens examined during this study were erroneously identified by previous workers, or 2) the few southeastern specimens recorded were females. Even if the identifications of the latter were correct, these species are certainly uncommon in the Southeast. Southeastern collection data for materials studied of these species are presented in the Appendix.

Two of these species, *H. brunneus* and *H. parrotus*, have post-mesothoracic coxal lines and are similar in general appearance to *H. mollinus*. *Heterocerus brunneus* is common in the western United States. Two southeastern specimens, both females, were examined, one from Florida and one from Louisiana. *Heterocerus parrotus* is known from southern Ontario and the extreme northern U.S. (Pacheco 1964). Miller (1996) greatly expanded the range of this species into the southern U.S.; however, all southeastern specimens examined during this study that were labeled as *H. parrotus* were actually misidentified individuals of *H. sandersoni*. The only true *H. parrotus* that we examined during this study were from Utah and Ontario. It seems unlikely that *H. parrotus* occurs in the Southeast.

Lapsus tristis is synonymous with *Heterocerus fenestratus* (Mascagni 1993) and has the largest known range of any heterocerid, occurring commonly in temperate areas north of 40° around the globe. *Heterocerus fenestratus* has mesothoracic coxal lines, but otherwise is not similar in appearance to any other North American species. The species can easily be recognized by the pale elytral spots that are slender and elongated longitudinally (Fig. 31), the basal pale spots extend forward to the anterior border of the elytra and form a v-shaped mark around the scutellum. Two female specimens (identified as *H.*

fenestratus by Miller) have been recorded from Florida, one from Lake County, the other from Monroe County. It is certainly feasible that this widespread species could be present elsewhere in the southeastern United States, but based on collections examined and our own collecting efforts, it is certainly not common here.

Heterocerus glicki lacks post-mesothoracic coxal lines and is known to occur from southern Texas into southwestern Louisiana. It is most similar to *H. intermuralis* although paler and has conspicuously quadrate parameres (Fig. 43). Like *H. parrotus*, it seems unlikely that this species occurs in the southern states east of the Mississippi River, but is included in the key because of the Louisiana record.

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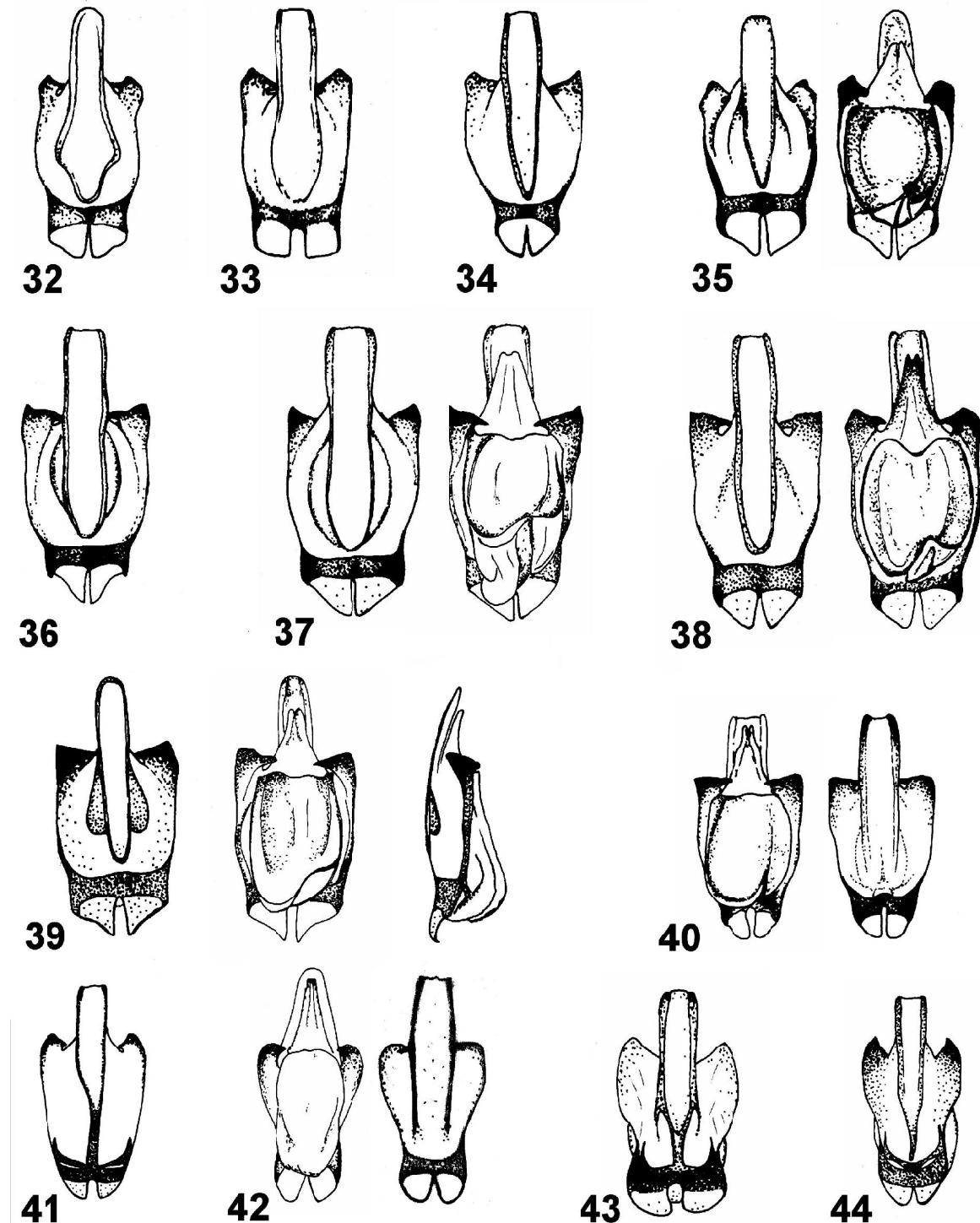
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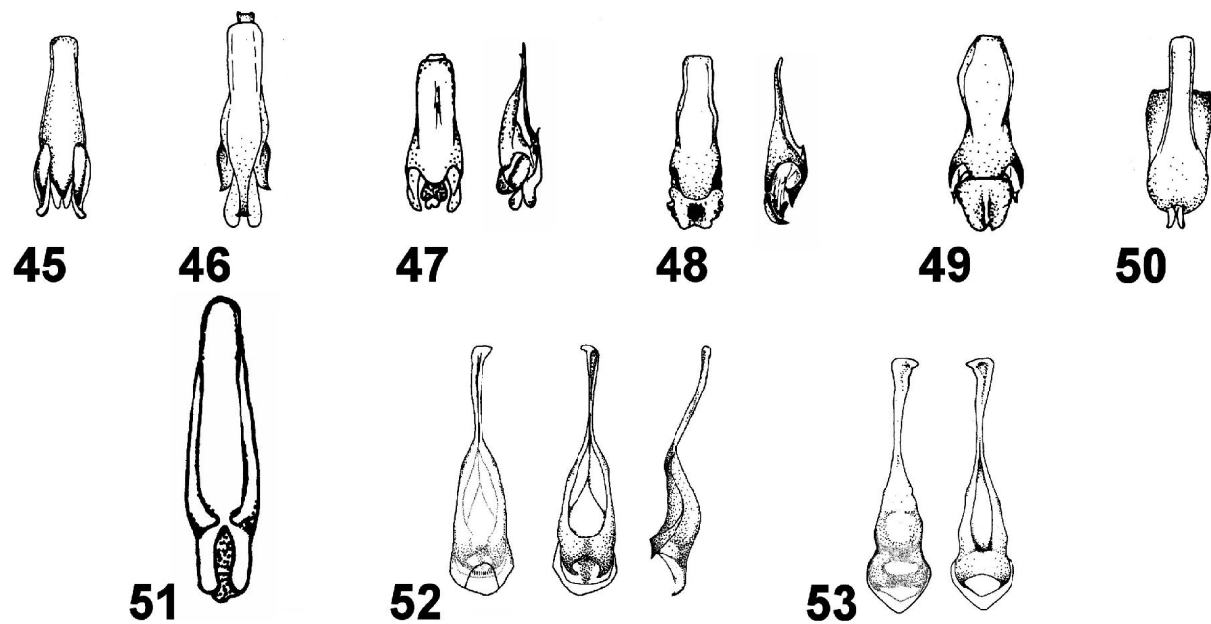
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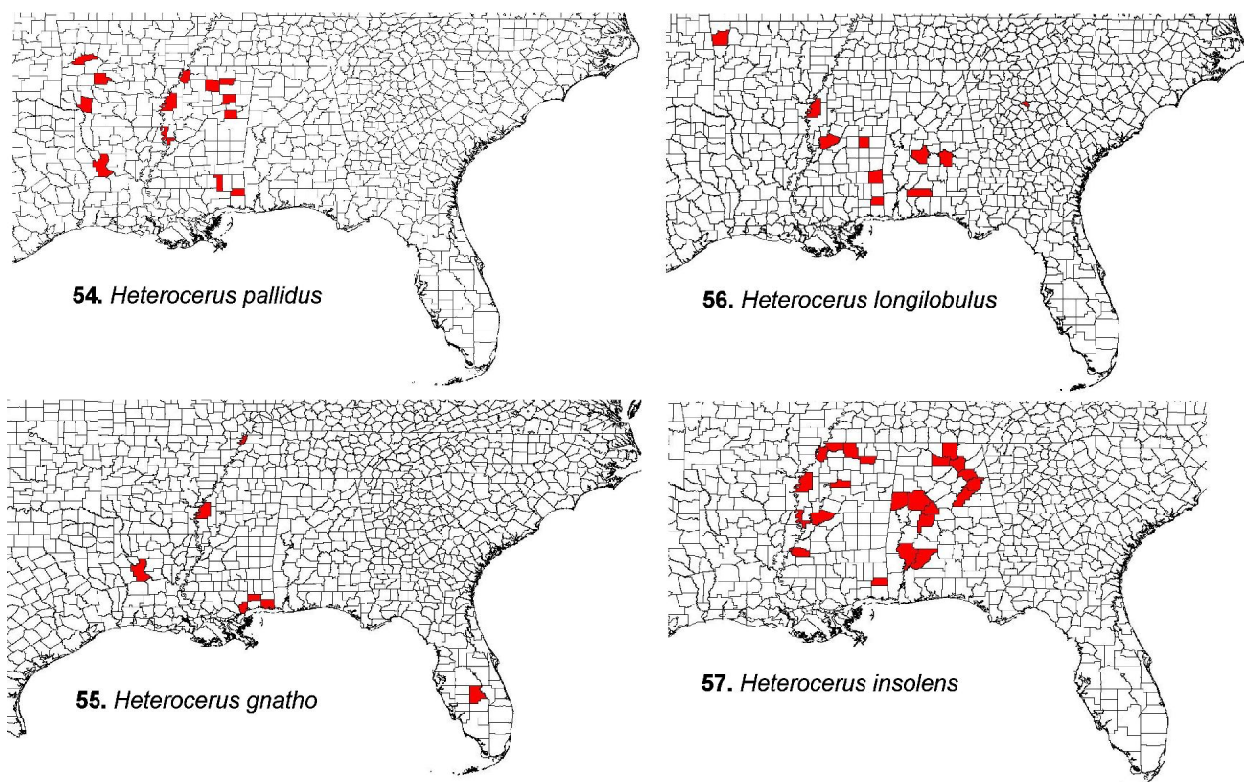
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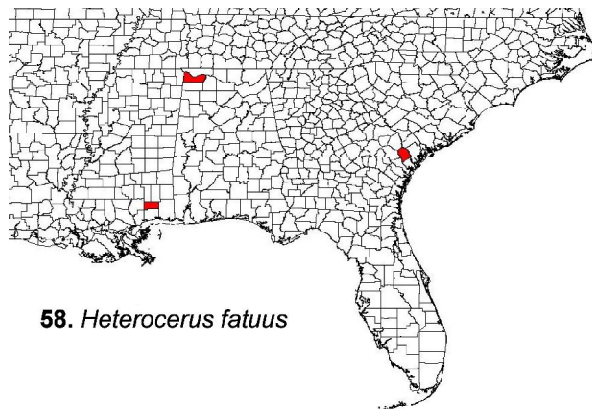
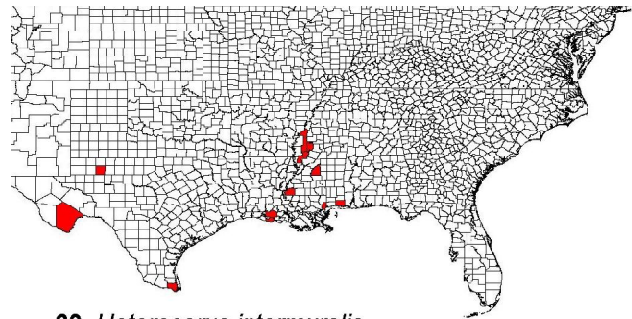
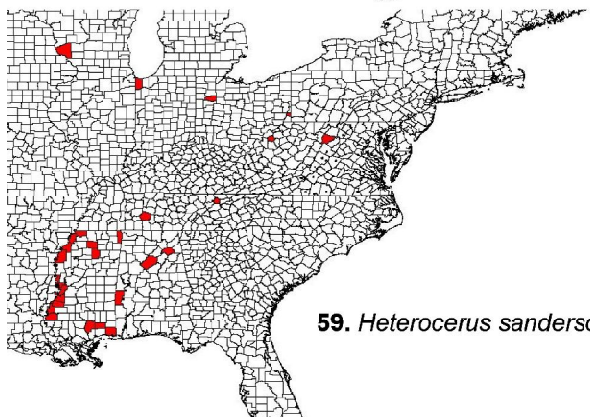
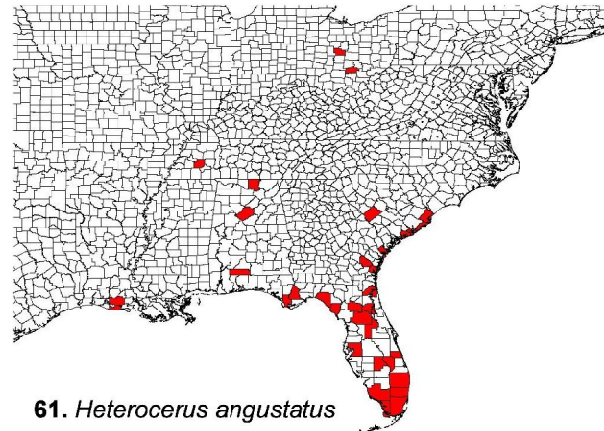
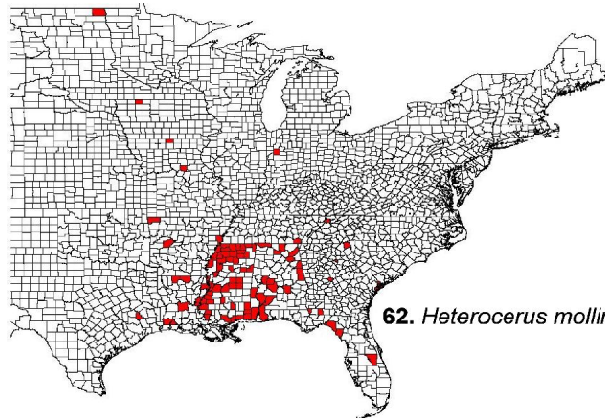
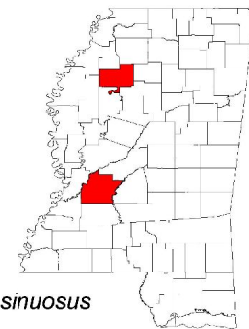
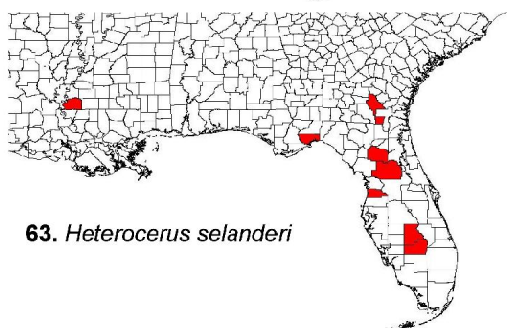
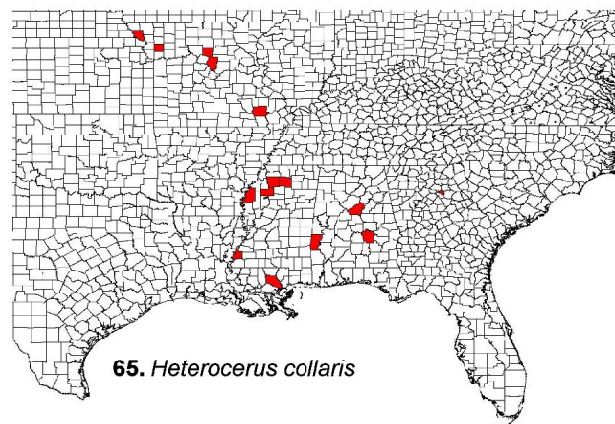
Figures 32-44. Male genitalia of southeastern *Heterocerus* species. The ventral view is shown unless otherwise stated. **32-39)** Species that lack post-mesocoxal lines. **32)** *H. fatuus*. **33)** *H. glicki*. **34)** *H. intermuralis*. **35)** *H. angustatus*; left - ventral view, right - dorsal view. **36)** *H. longilobulus*. **37)** *H. pallidus*; left - ventral view, right - dorsal view. **38)** *H. gnatho*; left - ventral view, right - dorsal view. **39)** *H. sandersoni*; left - ventral view, center - dorsal view, left - lateral view. **40-44)** Species with post-mesocoxal lines. **40)** *H. sinuosus*; left - dorsal view, right - ventral aspect. **41)** *H. mollinus*. **42)** *H. insolens*; left - dorsal view, right - ventral aspect. **43)** *H. parrotus*. **44)** *H. brunneus*.



Figures 45-53. Male genitalia of southeastern species. The ventral view is shown unless otherwise stated. **45-50)** *Heterocerus* species in the undulatus group. **45)** *H. undatus*. **46)** *H. collaris*. **47)** *H. texanus*; left - ventral view, right - lateral view. **48)** *H. schwarzi*; left - ventral view, right - lateral view. **49)** *H. tenuis*. **50)** *H. selanderi*. **51-53)** *Augyles* and *Tropicus* species. Figures 52-53 are at roughly 2x relative scale of prior genitalia. **51)** *Augyles auromicans*. **52)** *Tropicus nigrellus*; left - dorsal view, center - ventral view, right - lateral view. **53)** *Tropicus pusillus*; left - dorsal view, right - ventral view.



Figures 54-57. Distribution by county in the United States. **54)** *Heterocerus pallidus*. **55)** *Heterocerus gnatho*. **56)** *Heterocerus longilobulus*. **57)** *Heterocerus insolens*.

58. *Heterocerus fatuus*60. *Heterocerus intermuralis*59. *Heterocerus sandersoni*61. *Heterocerus angustatus*62. *Heterocerus mollinus*64. *Heterocerus sinuosus*63. *Heterocerus selanderi*65. *Heterocerus collaris*

Figures 58-65. Distribution by county in the United States. 58) *Heterocerus fatuus*. 59) *Heterocerus sandersoni*. 60) *Heterocerus intermuralis*. 61) *Heterocerus angustatus*. 62) *Heterocerus mollinus*. 63) *Heterocerus selanderi*. 64) Distribution of *Heterocerus sinuosus* by county in Mississippi. 65) Distribution of *Heterocerus collaris* by county in the United States.

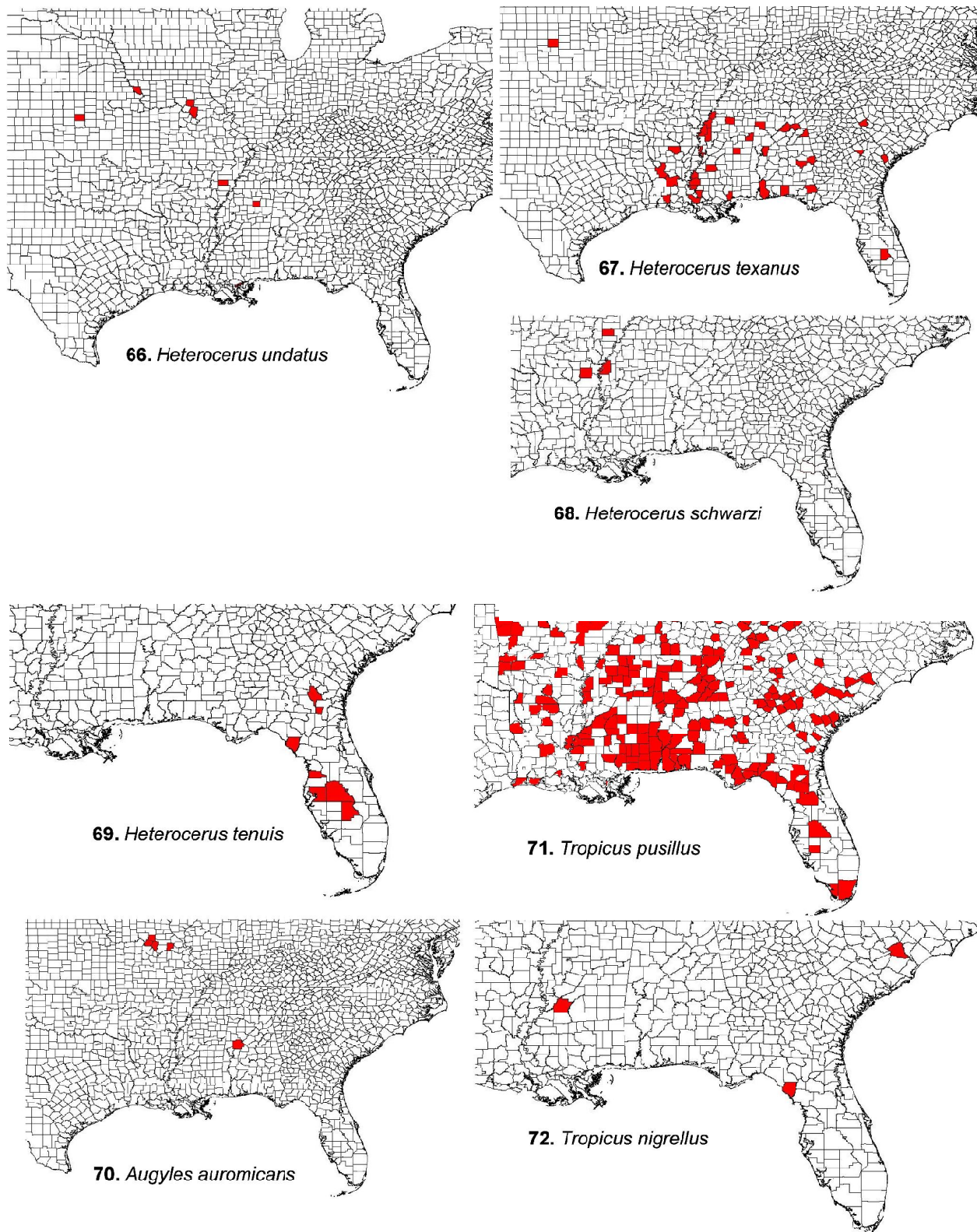


Figure 66-72. Distribution by county in the United States. **66)** *Heterocerus undatus*. **67)** *Heterocerus texanus*. **68)** *Heterocerus schwarzi*. **69)** *Heterocerus tenuis*. **70)** *Augyles auromicans*. **71)** *Tropicus pusillus*. **72)** *Tropicus nigrellus*.

Appendix. Label data for specimens examined.

#	State	County	Location	Date	Collector	Notes	Collection
<i>Augyles auromicans</i> (Kiesenwetter)							
1	Alabama	Tuscaloosa	5 mi. SW Tuscaloosa	18-Apr-1981	S.C. Harris	ID W.V. Miller	CASC
1	Missouri	Boone	Columbia	6-Jun-1966	R.W. Straub		CASC
1	Missouri	Howard	?	25-Jul-1972	S.O. Swadener		CASC
1	Missouri	Montgomery	Graham Cave St. Park	18-Aug-1975	W.V. Miller		CASC
3	Missouri	Randolph	1 mi. E Moberly	3-Aug-1975	W.V. Miller		CASC
1	Missouri	Randolph	1 mi. E Moberly	26-May-1976	W.V. Miller		CASC
<i>Heterocerus angustatus</i> Chevrolat							
1	Alabama	Escambia	Conecuh River @ Hwy 41	13-Jun-1981	S.C. Harris		CASC
1	Alabama	Jefferson	Tannehill St. Park	2-Jun-1982	S.C. Harris		CASC
2	Alabama	Madison	Monte Sano St. Park, Huntsville	5-Jun-1975	Rosenberg		CASC
3	Alabama	Madison	Huntsville, Monte Sano St. Park	5-Jun-1975	Rosenberg		NMNH
3	Alabama	Madison	Huntsville, Monte Sano St. Park	3-Jun-1975	Rosenberg		NMNH
6	Florida	?	Sandford	1-Nov-1961	G.W. Desin		NMNH
1	Florida	Alachua	Gainesville	1-Aug-1959	L.A. Hetrick		CASC
1	Florida	Broward	Loxahatchee Wildlife Ref.	8-Aug-85	C. Young R. Davidson J. Rawlins		CMNH
5	Florida	Collier	Collier Seminole St. Park	4-Apr-1964	R.H. Arnett, E.R. VanTassell		CASC
1	Florida	Collier	Collier-Seminole St. Park	8-Aug-85	John Rawlins		CMNH
24	Florida	Collier	Bonita Springs	11-Jul-1972	M. Druckenbrod		NMNH
48	Florida	Collier	Everglades City	June-67	?		NMNH
20	Florida	Collier	North of Everglades	3-Jun-06	E.B. Lago		UMIC
2	Florida	Dade	Homestead	2-Jun-1983	W.H. Cross		CASC
10	Florida	Dade	Everglades Natl. Park	3-Apr-1964	R.H. Arnett, E.R. VanTassell		CASC
1	Florida	Dade	Miami Fla		H.V. Weems	ID W.V. Miller	CASC
6	Florida	Dade	Homestead	11-Jun-1967	D.E. Bright		CASC
4	Florida	Dade	Flamingo Everglades Natl. Park	7-May-1967	D.E. Bright		CASC
9	Florida	Dade	W Miami	22-Jul-1965	FN. Young		CASC
6	Florida	Dade	Miami	24-25 July 1983	FN. Young		CASC
2	Florida	Dade	Miami	24-5 VII 1983	FN. Young		CMNH
20	Florida	Dade	west Miami	VII 22 1965	M. Wible		CMNH
5	Florida	Dade	Miami	23-24 Jul 1983	FN. Young		NMNH
2	Florida	Dade	West Miami	22-Jul-1965	FN. Young		NMNH
1	Florida	Dade	Big Pine Key	11-Jun-1968	F.E. Wood		NMNH
7	Florida	Dade	13 mi. W of W. Miami	2-Dec-1970	W.H. Tyson	Light	NMNH
20	Florida	Dade	Key Largo	June-67	?		NMNH
1	Florida	Dade	Paradise Key	19 Feb (pre-1961)	?	Det. Pacheco	NMNH
6	Florida	Dade	Homestead	2-Jun-1983	W.H. Cross		MEMU
4	Florida	Dixie	6 km. S. Jena, Salt Flat	2-Apr-1991	R. Acciavatti		CASC
37	Florida	Dixie	6 km S. Jena	2 IV 1991	R. Acciavatti		CMNH
7	Florida	Dixie	10 mi. S of Steinhatchee	5-Jul-1983	Scott Gross		NMNH
17	Florida	Dixie	Old Town	May-67	?		NMNH
1	Florida	Duval	Jacksonville	26-Apr-1957	D. Ribble		CASC
2	Florida	Duval	Jacksonville	?	Ashmead		NMNH
1	Florida	Gulf	12 km W of Port St. Joe	12-Apr-1987	W.E. Steiner		NMNH
1	Florida	Highland	Highland's Hammock	24-Jun-1965	C.W. O'Brien		NMNH
12	Florida	Highlands	Archbold Biological Station	2-May-1981	L.L. Lampart		CASC
1	Florida	Highlands	Near Avon Park	22-Aug-1961	T. Morris		CASC
5	Florida	Highlands	Lake Placid Archbold Biological St.	4-May-1969			CASC
4	Florida	Highlands	Archbold Biological Station	30 Mar- 3 Apr 1973	Rosenberg		NMNH
1	Florida	Highlands	Archbold Biological Station	24-Sep-1975	Rosenberg		NMNH
12	Florida	Highlands	Lake Letta, nr Sebring & Avon Park	14-Jun-1961	Ted Morris		NMNH
329	Florida	Highlands	Lake Letta, nr Sebring & Avon Park	31-May-1961	Ted Morris		NMNH
24	Florida	Highlands	Lake Letta, nr Sebring & Avon Park	12-Jul-1972	Ted Morris		NMNH
21	Florida	Highlands	Lake Letta, nr Sebring & Avon Park	27-Jun-1961	Ted Morris		NMNH
15	Florida	Hillsborough	Hillsboro Temple Terrace	7-Jun-1968	F.E. Wood		NMNH
1	Florida	Indian River	Vero Beach	23-May-1983	W.H. Cross		MEMU
1	Florida	Lake	6mi NE Eustis	2-May-1985	J.D. Almand		CASC
1	Florida	Liberty	Torreya St. Park	20-May-1966	H.V. Weems		CASC
1	Florida	Marian	19 km west Astor Ocala Natl. Forest	12-Apr-1992	R. Acciavatti		CASC
1	Florida	Marion	Ocala	5-3 March 1953	M. Wible	Specimen in poor condition	CMNH
7	Florida	Marion	Ocala	7-May-78	M. Wible		CMNH
3	Florida	Monroe	Sugarloaf Key	4-Jun-1983	W.H. Cross		CASC
1	Florida	Monroe	Bahia Honda Key	2-May-1986	W.E. Steiner & D. Bogar		NMNH
4	Florida	Monroe	Sugarloaf Key	4-Jun-1983	W.H. Cross		MEMU
19	Florida	Okeechobee	Posey Corner	26-Aug-1981	W.V. Miller		CASC
36	Florida	Palm Beach	Belle Glade Exp. Station	12-May-1981	W.V. Miller		CASC
7	Florida	Palm Beach	Belle Glade Exp. Station	27-Apr-1981	W.V. Miller		CASC
7	Florida	Palm Beach	Belle Glade Exp. Station	29-Jul-1968	E.B. Fagin		CASC
59	Florida	Palm Beach	Boynton Beach	12-Jun-1968	F.E. Wood		NMNH
4	Florida	Palm Beach	Palm Beach	23-Mar-1935	S.W. Bromley		NMNH
1	Florida	Putnam	Welaka	11-12-May-1955	H.E. & M.A. Evans		CASC
3	Florida	Taylor	TideWater Sw10 miNWSteinhatchee	4-Jun-1972	C. Smith, R. Duffield		CASC
159	Florida	Taylor	Williams Landing	21-30 Jun 1967	R. Smith		NMNH
18	Florida	Taylor	Williams Landing	2-14Jul-1967	R. Smith		NMNH
13	Georgia	Chatham	Savanna	18-25 Sept-1971	V. Johnson		CASC
3	Georgia	Glynn	Jekyll Island	17-Jun-1968	F.E. Wood & J.A. Davidson		NMNH
2	Georgia	Wayne	Mt. Pleasant	25-Jun-1984	J.F. Kavey		NMNH
1	Louisiana	Vermillion	Gueydan, East Kalmbach	15-Jun-1925	?	At light	NMNH
2	Ohio	Hocking	Lake Logan	29 VI 1986	R. Acciavatti	det. Mascagni	CMNH
4	Ohio	Hocking	Scioto River, 3 mi. S Mill Point	29 VI 1986	R. Acciavatti		CMNH
1	S Carolina	Aiken		31-May-1969	Robert Gordon		NMNH
1	S Carolina	Charleston	7mi N McClellanville	1-Jun-1977	E.G. Munroe		CASC

1	S Carolina	Georgetown	Huntington St. Park	3-May-1980	J.L. Cross		CASC
6	S Carolina	Georgetown	Huntington St. Park	3-May-1980	J.L. Cross		NMNH
6	Tennessee	Madison	Jackson	29-Jun-1955	?		NMNH

***Heterocerus brunneus* Melsheimer**

1	Arkansas	Hope	Hope?	8-Aug-1931	Blaisdall Coll.		CASC
1	Florida	Collier	Naples	24-Mar-1947	J.W. Green		CASC
1	Louisiana	Orleans	New Orleans		A. Fenyes Coll.		CASC

***Heterocerus collaris* (Kiesenwetter)**

1	Alabama	Choctaw	Mid. Tallawamp Creek	16-May-1982	S.C. Harris		UMIC
1	Alabama	Montgomery	10 mi SW Montgomery	11-May-1988	S.C. Harris		CASC
1	Alabama	Shelby	Cahaba River @ Highway 52	22-Sep-1982	S.C. Harris		CASC
1	Georgia	Clarke	Ben Burton City Park	19-Apr-1975		Standing Pools	CASC
1	Louisiana	St. Tammany	Covington	?-Jun-1956	Shoemaker		NMNH
1	Mississippi	Adams	Natchez	25-May-1983	Paul K. Lago		UMIC ethanol
4	Mississippi	Bolivar	2 mi. W Rosedale	7-Oct-1983	Paul K. Lago		UMIC
12	Mississippi	Bolivar	2 mi. W Rosedale	23-Aug-1980	Paul K. Lago		UMIC
1	Mississippi	Bolivar	2 mi. W Rosedale	19-Jul-1982	Paul K. Lago		UMIC
2	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC
1	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC ethanol
1	Mississippi	Lafayette	Oxford	23-Jul-1982	Paul K. Lago		UMIC
1	Mississippi	Lafayette	Oxford	19-May-1982	Paul K. Lago		UMIC ethanol
1	Mississippi	Panola	Sardis	13-Apr-1972	W.A. Jones		UMIC
5	Mississippi	Tallahatchie	N 34° 01.484' , W -90° 08.460'	6-Jun-2005	J.G. King, S.E. Murray		UMIC
1	Missouri	Boone		13-Sep-1981	D. Palawski		CASC
3	Missouri	Clinton	Lathrop	27-Jun-1955	E.C. Becker	Marshy Ground	CASC
1	Missouri	Holt	Thurnau Wildlife Area	11-Aug-1975	E.G. Riley		CASC
3	Missouri	Randolph	1 mi E Moberly	24-Jun-1973	E.G. Riley		CASC
1	Missouri	Randolph	1 mi E Moberly	30-Jun-1972	E.G. Riley		CASC
1	Missouri	Randolph	1 mi E Moberly	2-Aug-1972	E.G. Riley		CASC
1	Missouri	Randolph	1 mi E Moberly	4-Jun-1984	E.G. Riley		CASC
1	Missouri	Wayne	Williamsville	11-Jun-1955	E.C. Becker		CASC

***Heterocerus fatuus* (Kiesenwetter)**

1	Alabama	Colbert	5 mi. SE Tuscumbia	14-Jun-1994	B.P. Stark	Labeled H. parrotus by WVM	UMIC
1	Alabama	Limestone	Limestone Creek @ Nicle Davis Rd.	2-Jun-1984	S.C. Harris	misabeled ???	CASC
1	Alabama	Monroe	Big Flat River @ Hwy 41	15-May-1982	S.C. Harris	misabeled ???	CASC
1	Alabama	Morgan	5.5 mi W Flint City @ Flint Creek	15-Jun-1988	S.C. Harris	misabeled ???	CASC
1	Alabama	Tallapoosa	Tallapoosa Road @ Hwy 66	25-May-1984	PK Lago	misabeled ???	CASC
1	Iowa	Dickinson	Marble Lake	18-Jun-1988	Paul K. Lago		UMIC
2	Iowa	Osceola	2 mi. NE Ocheyedan	22-Jul-1988	Paul K. Lago		UMIC
1	Louisiana	Vidalia	Concordian Park	2-Jul-1978	A.E. Zuccaro		CASC
1	Michigan	Ingham	Ag. College. Mich		H.E. Weed		MEMU
1	Mississippi	Hancock	Buccaneer St. Park	29-Jun-1984	PK Lago		CASC
1	Mississippi	Hancock	Stennis Space Center	15-Apr-1994	R. Kergosian		UMIC
194	Mississippi	Hancock	Point Clear Island	15-Aug-1986	Sam Testa III		UMIC
10	Mississippi	Hancock	Point Clear Island	10-Aug-1986	Sam Testa III		UMIC
20	Mississippi	Hancock	Point Clear Island	11-Aug-1986	Sam Testa III		UMIC
10	Mississippi	Hancock	Point Clear Island	12-Aug-1986	Sam Testa III		UMIC
1	Mississippi	Stone	UMIC Forest lands	10-Apr-1981	Paul K. Lago		UMIC
2	Mississippi	Tishomingo	Tishomingo St. Park	22-Jun-1978	PK Lago	misabeled ???	CASC
1	Mississippi	Tishomingo	Tishomingo St. Park	9-Jun-1984	PK Lago	misabeled ???	CASC
3	Mississippi	Tishomingo	Tishomingo St. Park	17-Jun-1986	Sam Testa III	misabeled ???	CASC
2	Missouri	Holt	Thurnau Wildlife Area	11-Aug-1975	E.G. Riley		CASC
2	N Dakota	Pembina	Goshke Dam (TRGMA)	28-Jun-1974	P.K. & B.A. Lago		UMIC
3	S Carolina	Beaufort	Hilton Head Island	11-22-July-1965	H.F. Howden		CASC
1	S Carolina	Effingham	2 mi W Meldrim	31-May-1983	A.C. Benke		UMIC

***Heterocerus fenestratus* (Thunberg)**

1	Florida	Lake	Leesburg	5-Dec-1963	?		NMNH
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***Heterocerus glicki* (Pacheco)**

16	Louisiana	Calcasieu	West Lake	4-Jul-1969	?	Light trap	NMNH
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***Heterocerus gnatho* LeConte**

1	California	Inyo	Lone Pine	7-Jul-1982	W.H. Cross		MEMU
2	Florida	Highlands	Archbold Biological Station	14-18 IV 1989	Chen Wen Young		CMNH
2	Florida	Highlands	Lake Letta, nr. Sebring & Avon Pk.	14-Jun-1961	Ted Morris		NMNH
1	Iowa	Dickinson	Cavler's Prairie	7-Aug-1992	Paul K. Lago		UMIC
2	Iowa	Dickinson	Cavler's Prairie	18-Jul-1992	Paul K. Lago		UMIC
2	Iowa	Osceola	2 mi. S Ocheyedan	25-May-1981	Paul K. Lago		UMIC
2	Iowa	Osceola	2 mi. NE Ocheyedan	22-Jul-1985	Paul K. Lago		UMIC
1	Iowa	Osceola	Ocheyedan	22-Jul-1988	Paul K. Lago		UMIC
1	Louisiana	Natchipoches	Red Dirt Wildlife area	8-9-June-1988	E.G. Riley		CASC
3	Mexico	Tamaulipas	San Fernando	25-Sep-1981	W.H. Cross		MEMU
1	Mississippi	Bolivar	Great River Road St. Park	26-May-1995	Paul K. Lago		UMIC
1	Mississippi	Hancock	Buccaneer St. Park	29-Jun-1984	Paul K. Lago		UMIC
4	Mississippi	Hancock	Stennis Space Center	15-Apr-1994	R. Kergosian		UMIC
12	Mississippi	Jackson	Ocean Springs	13-May-1984	Paul K. Lago		UMIC
1	Mississippi	Stone	UMIC Forest lands	18-Oct-1984	Paul K. Lago		UMIC
3	Montana	Dawson	Glendive	14-Jul-1991	Paul K. Lago		UMIC
1	N Dakota	Billings	Sully's Creek St. Park	13-Jul-1991	Paul K. Lago		UMIC
2	N Dakota	Pembina	Goshke Dam (TRGMA)	28-Jun-1974	Paul K. Lago		UMIC

14	N Dakota	Richland Co.	Walcott Dunes	28-May-1974	Paul K. Lago	UMIC
1	N Dakota	Richland Co.	Walcott Dunes	21-May-1974	Paul K. Lago	UMIC
7	Tennessee	Lake	Reelfoot Lake	10-Jun-1946	O.L. Cartwright	NMNH
1	Texas	Cameron	Brownsville	17-Jun-1981	W.H. Cross	MEMU
3	Texas	Kleberg	Kingsville	5-Jul-1983	W.H. Cross	MEMU
9	Texas	S. Patricio	Welder WR, 8 mi NE of Sinton	13-May-1985	Paul K. Lago	UMIC
42	Utah	Utah	Orem Utah Lake ST. Park	19-Jul-1991	Paul K. Lago	UMIC

Heterocerus insolens Miller

1	Alabama	Bibb	Cahaba River N Centreville	25-Aug-1981	S.C. Harris	UMIC
1	Alabama	Calhoun	Cane Creek @ R 24 A	21-Jun-1984	S.C. Harris	CASC
2	Alabama	Clarke	Silver Ck Cmpgd, 10 km. N Gosport	29-May-91	R. Davidson et. al	Paratypes CMNH
1	Alabama	Etowah	Wills Creek @ Highway 277	17-Jul-1972	S.C. Harris	CASC
1	Alabama	Etowah	L. Wills Creek X Hwy 227	17-Jul-1982	S.C. Harris	UMIC
1	Alabama	Madison	1.5 mi NE New Market Mtn. Fork	31-May-1989	S.C. Harris	CASC
1	Alabama	Madison	1.5 mi. NE New Market	31-May-1989	Harris & McGregor	UMIC
1	Alabama	Marshall	3.7 mi. N Albertville Short Creek	28-May-1985	S.C. Harris	UMIC
2	Alabama	Monroe	Big Flat River @ Hwy 41	15-May-1982	S.C. Harris	CASC
9	Alabama	Monroe	Big Flat River @ Hwy. 41	15-May-1982	S.C. Harris	UMIC
1	Alabama	Monroe	Big Flat River @ Hwy. 41	15-May-1982	Steve Harris	UMIC
6	Alabama	Morgan	5.5 mi W Flint City @ Flint Creek	15-Jun-1988	S.C. Harris	CASC
2	Alabama	Morgan	5.5 mi W Flint City @ W Flint City	15-Jun-1988	S.C. Harris	UMIC
1	Alabama	Perry	2mi E Perryville @ Talladega Natl. F	5-Jun-1981	S.C. Harris	CASC
1	Alabama	Perry	2 mi. E Perryville Talladega Natl F	5-Jun-1981	S.C. Harris	UMIC
1	Alabama	Pickens	4.5 mi NW Reform Coal Fire Creek	26-Jun-1985	S.C. Harris	CASC
1	Alabama	Talladega	3 mi. SW Waldo	18-Jun-1988	S.C. Harris	UMIC
1	Alabama	Tuscaloosa	3.5 mi. NWN Brownville	15-Jun-1983	S.C. Harris	UMIC
3	Mississippi	Bolivar	Great River Road St. Park	19-Jun-1986	Sam Testa III	UMIC
2	Mississippi	Bolivar	Great River Road St. Park	19-Jun-1986	Sam Testa III	UMIC
1	Mississippi	De Soto	8mi WSW Hernando	1-Aug-1987	Sam Testa III	CASC
2	Mississippi	George	12mi SW Lucedale	19-May-1987	PK Lago	CASC
3	Mississippi	George	12 mi. SW Lucedale Pascagoula WMA	13-Apr-1992	Paul K. Lago	UMIC
1	Mississippi	George	12 mi. SW Lucedale Pascagoula WMA	10-Apr-1992	Paul K. Lago	UMIC
1	Mississippi	George	12 mi. SW Lucedale	10-Apr-1992	Paul K. Lago	UMIC
1	Mississippi	George	12 mi. SW Lucedale Pascagoula WMA	13-Apr-1992	Paul K. Lago	UMIC
1	Mississippi	Grenada	Malmaison GMA 7 mi. SW Holcomb	22-May-1996	Paul K. Lago	UMIC
1	Mississippi	Issaquena	2 mi. SW Shipland	20-Jun-1992	Paul K. Lago	UMIC
2	Mississippi	Jefferson	American Legion Lake	25-Jun-1987	Sam Testa III	CASC
10	Mississippi	Marshall	Trib. into Tallahatchie Riv.	24-Jul-05	Jonas G. King	UMIC
1	Mississippi	Tunica	14 mi. SE Tunica Akew W. A.	6-Jun-1993	E. Lago & S. Testa	UMIC
30	Mississippi	Yazoo	Big Black River @ HWY 49	18-Jul-04	Jonas King and Lydia Hailman	UMIC
1	Mississippi	George	12 mi. SW Lucedale Pascagoula WMA	19-May-1987	Paul K. Lago	UMIC
1	Mississippi	George	12 mi. SW Lucedale	19-May-1987	Paul K. Lago	UMIC
2	Mississippi	Jefferson	American Legion Lake	25-Jun-1987	Sam Testa III	UMIC
1	Mississippi	Union	11 mi. W New Albany	28-Jul-1986	Paul K. Lago	UMIC

Heterocerus intermuralis (Pacheco)

15	Louisiana	Vermillion	Gueydan, East Kalmbach	25-26-Jun-1925	?	Paratype NMNH
2	Louisiana	Vermillion	Gueydan, East Kalmbach	21-Jul-1925	?	NMNH
1	Louisiana	Vermillion	Gueydan, East Kalmbach	1-Jul-1925	?	NMNH
1	Louisiana	Vermillion	Gueydan, East Kalmbach	28-Jul-1925	?	NMNH
4	Mississippi	Coahoma	Ponds off Miss. Riv.	10-May-05	J.G. King & W Bet-Sayad	UMIC
1	Mississippi	Hancock	Point Clear Island	24 Jun 1986	Sam Testa III	UMIC
1	Mississippi	Hancock	Point Clear Island	11 May 1986	Sam Testa III	UMIC
10	Mississippi	Humphry's	Bear Creek at Hwy 3	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
2	Mississippi	Jackson	West bank Pascagoula River @ I-10	18-May-05	J King, W Bet-Sayad, N. Prescott	UMIC
20	Mississippi	Leflore	3 mi NNW Swiftville	4-Aug-04	Jonas G. King	UMIC
1	Mississippi	Rankin	N 32° 22.838', W -89° 57.795'	30-May-05	Jonas G. King	UMIC
40	Mississippi	Sharkey	W bank Sunflower River @ Hwy. 14	12-Jun-05	J.G. King, S.E. Murray	UMIC
10	Mississippi	Su nflower	Macon Lake, N 33.35°, W -90.49°	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
10	Mississippi	Wilkinson	Artonish Lake	3-Oct-04	Jonas G. King	UMIC
25	Texas	Brewster	Post Park, S. Marathon	22-Jul-06	PK and EB Lago	UMIC
18	Texas	Brewster	Balmorhea Lake	18-Jul-06	PK and EB Lago	1 grossly hypermandibulate UMIC
12	Texas	Howard	Comanche Lake, Big Springs St. Pk	6-Aug-06	J.G. King, L.E. Hailman	UMIC

Heterocerus longilobulus (Pacheco)

1	Alabama	Dallas	1 mi. SE of Pleasantville Station	11-Jun-1985	S.C. Harris	UMIC
3	Alabama	Escambia	Conecuh River @ Hwy 41	13-Jun-1982	S.C. Harris	CASC
9	Alabama	Escambia	Conecuh River X Hwy 41	13-Jun-1982	S.C. Harris	UMIC
10	Alabama	Monroe	Big Flat River @ Hwy 41	15-May-1982	S.C. Harris	CASC
55	Alabama	Monroe	Big Flat River crossing HWY 41	15-May-1982	S.C. Harris	UMIC
1	Alabama	Monroe	Little River Stake Park	11-May-1982	S.C. Harris	UMIC
1	Alabama	Montgomery	10 mi. SW Montgomery	11-May-1988	S.C. Harris	UMIC
1	Arkansas	Washington	War Eagle Creek	24-Jun-1963	O.A.Hite & L.R. Aggus	NMNH
1	Georgia	Clarke	Whitehall Forest	21-26-May-1976	R. Turnbow	CASC
2	Indiana	Tipp.Co.		10-Jun-1970	P.H.Darst	UMIC
1	Mississippi	Bolivar	2mi W Rosedale	23-Aug-1980	PK Lago	CASC
1	Mississippi	Bolivar	Great River Road St. Park	26-May-1995	Paul K. Lago	UMIC
2	Mississippi	George	12 mi. SW Lucedale	19-May-1987	Paul K. Lago	UMIC
3	Mississippi	Neshoba	1.5 mi N Dixon	9-May-1979	PK Lago	CASC
1	Mississippi	Wayne	2 mi. W Waynesboro	15-Jun-1987	Sam Testa III	UMIC
10	Mississippi	Yazoo	Big Black River @ HWY 49	18-Jul-04	Jonas King and Lydia Hailman	UMIC
1	Missouri	Grundy	Spickard	8-Jul-1983		CASC
2	Missouri	Holt	Thurnau Wildlife Area	11-Aug-1975	E.G. Riley	CASC

Heterocerus mollinus Kiesenwetter

1	Alabama	Baldwin	Turkey Creek @ Hwy 59	11-May-1982	S.C. Harris		UMIC
1	Alabama	Chambers	Snapper Creek	2-Jun-1988	S.C. Harris		UMIC
1	Alabama	Choctaw	Mid Tallawamp Creek	16-May-1982	S.C. Harris		CASC
1	Alabama	Choctaw	Bogueloosa Creek .5 mi E Toxey	16-May-1982	S.Harris		UMIC
1	Alabama	Clarke	10 km N Gosport	29-May-1991	R. Acciavatti		CASC
3	Alabama	Clarke	Silver Creek Cmpgd, 10 km. NGosport	29-May-91	R. Davidson et. al		CMNH
1	Alabama	Cleburne	3.5 mi. SW Borden Springs	25-May-1989	S.C. Harris		UMIC
1	Alabama	Dallas	3.5 mi. NE Marion junction	30-Jun-1987	S.C. Harris		UMIC
1	Alabama	DeKalb	4.5 mi WNW Lakeview	27-Jun-1989	S.C. Harris		UMIC
1	Alabama	DeKalb	4.5 mi. WNW Lakeview	27-Jun-1989	S.C. Harris	Labeled H. parrotus by WVM	UMIC
1	Alabama	Etowah	L. Wills Creek @ Hwy 277	17-Jul-1982	S.C. Harris		CASC
5	Alabama	Etowah	L. Wills Creek @ Hwy 227	17-Jul-1982	S.C. Harris		UMIC
1	Alabama	Lauderdale	Florence (10) Tennessee River	21-Jul-1981	S.C. Harris		UMIC
1	Alabama	Madison	Monte Sano St. Park, Huntsville	25-May-1984	N.M. Downie		CASC
1	Alabama	Madison	5 mi NNW Owen's Crossroads	3-Jun-1984	S.C. Harris		UMIC
4	Alabama	Madison	1.5 mi. NE New Market	31-May-1989	S.C. Harris		UMIC
3	Alabama	Mobile	4mi Mt Vernon	24-Jun-1982	S.C. Harris		CASC
1	Alabama	Mobile	Little River St Park	11-May-1982	S.C. Harris		CASC
1	Alabama	Mobile	4mi Mt Vernon	24-Jun-1982	S.C. Harris		CASC
1	Alabama	Mobile	6mi E Citronelle	24-Jun-1982	S.C. Harris		CASC
1	Alabama	Monroe	Little River St Park	11-May-1981	S.C. Harris		CASC
1	Alabama	Montgomery	10 mi. SW Montgomery	11-May-1988	S.C. Harris		UMIC
1	Alabama	Montgomery	10 mi. SW Montgomery	11-May-1988	S.C. Harris	Labeled H. parrotus by WVM	UMIC
7	Alabama	Morgan	5.5 mi W Flint City @ Flint Creek	15-Jun-1988	S.C. Harris		CASC
6	Alabama	Morgan	5.5 mi W Flint City @ Flint Creek	15-Jun-1988	S.C. Harris		UMIC
1	Alabama	Morgan	5.5 mi W Flint City @ Flint Creek	15-Jun-1988	S.C. Harris	Labeled H. parrotus by WVM	UMIC
4	Alabama	Perry	2 mi. E Perryville Talladega Natl F	5-Jun-1981	S.C. Harris		UMIC
1	Alabama	Perry	2 mi. E Perryville	5-Jun-1991	S.C. Harris	Labeled H. parrotus by WVM	UMIC
1	Alabama	Randolph	Shoal Creek @ Pine Glen	23-May-1981	S.C. Harris		UMIC
1	Alabama	Hale	3 mi. E Prairieville	11-Jul-1981	S.C. Harris	Labeled H. parrotus by WVM	UMIC
4	Arkansas	Benton	Monte, SW1/4 Sec 27; T19N, R29W	29-Jul-1963	O.A.Hite & L.R. Aggus		NMNH
1	Arkansas	Crittenden	Marion	25-Jul-1975	W.H. Cross		MEMU
7	Arkansas	Yell	3 mi. W of Havanna	25-May-1977	W.H. Cross		MEMU
2	Arkansas	Yell	Dardanelle	27-May-1977	W.H. Cross		MEMU
1	Arkansas	Yell	3 mi W Havana	25-May-1977	W.H. Cross		CASC
2	Florida	Dixie	6 km S Jena	2-Apr-91	R. Acciavatti		CMNH
2	Florida	Taylor	Williams Landing	21-30 Jun 1967	R.Smith		NMNH
1	Georgia	Bibb	5 mi SE Macon	1-Jun-1964	L.A. Cambre		CASC
1	Georgia	Clarke	Athens	12-13-June-1973	R. Turnbow		CASC
2	Georgia	Clarke	3 mi N Athens	16-19 July 1974	R. Turnbow		CASC
11	Georgia	Grady	Beachton	18-24 Jun 1967	E.V.Komarek		NMNH
1	Georgia	Seminole	Lake Seminole	23-May-1975	L. Smith		CASC
1	Indiana	Tipp.Co.		26-Apr-1970	R.H.Darst		UMIC
2	Iowa	Dickinson	Cavler's Prairie	7-Aug-1992	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
2	Iowa	Dickinson	Marble Lake	18-Jul-1988	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
2	Iowa	Lucas	4 mi. N Chariton	28-May-1981	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
1	Iowa	Osceola	2 mi S Ocheyedan	6-Jul-1991	Paul K. Lago		UMIC
1	Iowa	Osceola	2 mi. NE Ocheyedan	22-Jul-1988	Paul K. Lago		UMIC
1	Iowa	Osceola	2 mi. NE Ocheyedan	22-Jul-1988	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
2	Louisiana	?	Shreveport	?	Shoemaker		NMNH
1	Louisiana	Calcasieu	West Lake	4-Jul-1969	?	Light trap	NMNH
1	Louisiana	Claiborne	Corney Lake	28-Jun-1983	B.F. & J.L. Carr		CASC
2	Louisiana	Concord	Vidalia	2-Jul-1978	PK Lago		CASC
3	Louisiana	Concordia	Vidalia	2-Jul-1977	A.E. Zuccherro		UMIC
1	Louisiana	Concordia	Vidalia	2-Jul-1979	A.E. Zuccherro		UMIC
13	Louisiana	Concordia	Vidalia	2-Jul-1978	A.E. Zuccherro		UMIC
1	Louisiana	E.Bat.Rouge	Baton Rouge	31-Aug-1984	E.G. Riley		CASC
1	Louisiana	E.Bat.Rouge	Baton Rouge	1-Sep-1984	E.G. Riley		CASC
1	Louisiana	E. Bat.Rouge	Baton Rouge	31-Aug-1984	E.G. Riley		CASC
1	Louisiana	East Feliciana	Camp Ave., 3 mi E Clinton	3-May-1984	E.G. Riley		CASC
1	Louisiana	East Feliciana	Camp Ave., 3 mi E Clinton	28-Apr-1984	E.G. Riley		CASC
1	Louisiana	Madison	Mound	28-May-1982	G. Snodgrass		CASC
1	Louisiana	Rapides	Alexandria	2-Aug-1970	C.W. Griffin		CASC
2	Louisiana	St. Tammany	Covington	?-Jun-1956	Shoemaker		NMNH
1	Louisiana	Union	Corney Lake	26-Jun-1983	B.F. & J.L. Carr		CASC
2	Mississippi	Adams	Natchez St. Park	23-Jun-1982	PK Lago		CASC
7	Mississippi	Adams	Natchez St. Park	3-Jul-1982	PK Lago		CASC
2	Mississippi	Adams	Natchez St. Park	17-May-1983	PK Lago		CASC
1	Mississippi	Adams	Natchez St. Park	3-Jun-1982	PK Lago		CASC
200	Mississippi	Adams	5.5 mi WSW Natchez	11-Jun-04	Jonas G. King		UMIC
7	Mississippi	Adams	Natchez St. Park	3-Jul-1978	Paul K. Lago		UMIC
6	Mississippi	Adams	Natchez St. Park	5-Jul-1978	Paul K. Lago		UMIC
1	Mississippi	Adams	Natchez St. Park	17-May-1983	Paul K. Lago		UMIC
1	Mississippi	Adams	Natchez	13-May-1977	A.E. Zuccherro		UMIC
5	Mississippi	Adams	5 mi. N Natchez	22-May-1978	Paul K. Lago		UMIC
3	Mississippi	Adams	Natchez	8-Nov-1980	PB. Alford		UMIC ethanol
86	Mississippi	Adams	5 mi. S Natchez	3-Jul-1978	Paul K. Lago		UMIC ethanol
14	Mississippi	Adams	Natchez	23-Jun-1982	A.E. Zuccaro		UMIC ethanol
1	Mississippi	Adams	Natchez St. Park	7-May-1983	Paul K. Lago		UMIC ethanol
1	Mississippi	Alcorn	15.5 mi W Corinth	18-May-1992	PK Lago		CASC
1	Mississippi	Alcorn	15.5 mi W Corinth	18-May-1992	Paul K. Lago		UMIC
1	Mississippi	Benton	Curtis Creek @ Hwy 4	22-Jul-04	Jonas G. King		UMIC
6	Mississippi	Benton	2 mi. W Ashland	11-Jul-1981	Paul K. Lago	UMIC ethanol	
5	Mississippi	Bolivar	2 mi. W Rosedale	23-Aug-1980	PK Lago		CASC
1	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	PK Lago		CASC
40	Mississippi	Bolivar	Scott	20-Aug-1964	V.H. Owens		NMNH
6	Mississippi	Bolivar	Great River Road St. Park	26-May-1995	Paul K. Lago		UMIC
1	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC

2	Mississippi Bolivar	2 mi W Rosedale	23-Jul-1980	Paul K. Lago	UMIC
9	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago	UMIC
11	Mississippi Bolivar	2 mi. W Rosedale	10-Oct-1980	Paul K. Lago	UMIC ethanol
48	Mississippi Bolivar	2 mi. W Rosedale	20-Jun-1980	Paul K. Lago	UMIC ethanol
10	Mississippi Bolivar	Great River Road St. Park	26-May-1985	Paul K. Lago	Labeled H. parrotus by WVM UMIC
1	Mississippi Calhoun	13mi NE Bruce	11-Jul-1978	PK Lago	CASC
1	Mississippi Calhoun	13mi NE Bruce	12-Jul-1978	PK Lago	CASC
4	Mississippi Calhoun	T115-R3W-sec.25	12-Jul-1978	D.F. Stanford	UMIC ethanol
1	Mississippi Claiborne	Owen's Creek	24-Apr-1992	B.P. Stark	UMIC
60	Mississippi Coahoma	10 mi WSW Clarksdale @ Miss. Riv	10-May-05	J.G. King & W Bet-Sayad	UMIC
4	Mississippi Coahoma	Desoto Lake, N 34.155°, W -90.840°	3-Jun-04	J.G. King & W Bet-Sayad	UMIC
11	Mississippi De Soto	Southaven	5-Jun-1987	Sam Testa III	UMIC
4	Mississippi De Soto	2 mi. W Eudora	6-Jun-1993	P. Lago & P. Ford	UMIC
1	Mississippi De Soto	8 mi. WSW Hernando	1-Aug-1987	Sam Testa III	Labeled H. parrotus by WVM UMIC
1	Mississippi De Soto	2 mi. W Eudora	6-Jun-1993	P. Lago & P. Ford	Labeled H. parrotus by WVM UMIC
1	Mississippi Franklin	Tally's Creek	6-Apr-1991	B.P. Stark	UMIC
2	Mississippi Franklin	7 mi SW Meadville	5-Sep-1981	Paul K. Lago	UMIC
6	Mississippi George	12 mi. SW Lucedale	21-May-1983	Paul K. Lago	UMIC ethanol
1	Mississippi Greene	Stateline	10-Sep-1980	S. Winters	CASC
2	Mississippi Hancock	2 mi. N Waveland Bayou la Croix	23-May-1982	WH Cross	CASC
1	Mississippi Hancock	Buccaneer St Park	29-Jun-1984	PK Lago	CASC
1	Mississippi Hancock	2 mi. N Waveland Bayou La Croix	23-May-1982	W.H. Cross	MEMU
2	Mississippi Harrison	Keesler Field	26-Aug-1943	FN. Young	NMNH
2	Mississippi Harrison	Gulfport	6-Jun-1966	V.H. Owens	NMNH
1	Mississippi Harrison	12 mi E Saucier	11-May-1986	Paul K. Lago	UMIC
4	Mississippi Hinds	4.5 mi NW Clinton	21-May-1977		CASC
3	Mississippi Hinds	4.5 mi NW Clinton	21-May-1977	B. Stark	CASC
1	Mississippi Hinds	4.5 mi. NW Clinton	10-May-1979	PD. Hartfield	UMIC
1	Mississippi Hinds	4.5 mi. NW Clinton	21-May-1977	B.P. Stark	UMIC
12	Mississippi Humphry's	Bear Creek at Hwy 3	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
1	Mississippi Issaquena	Miss. River @ Mayersville	2-Oct-04	Jonas G. King	UMIC
2	Mississippi Issaquena	2 mi SW Shipland	20-Jun-1992	Paul K. Lago	UMIC
1	Mississippi Issaquena	Anderson Tully WMA	7-Jun-1996	Paul K. Lago	Labeled H. parrotus by WVM UMIC
1	Mississippi Jackson	Ocean Springs	17-Jun-1978	Sarah Hurdle	UMIC
1	Mississippi Jackson	Ocean Springs	23-May-1983	Paul K. Lago	UMIC ethanol
19,900 MS	Jefferson	Flathead Lake	26-May-05	Jonas G. King	UMIC
5	Mississippi Jefferson	American Legion Lake	25-Jun-1987	Sam Testa III	UMIC
4	Mississippi Lafayette	Oxford	19-Jul-1988	PK Lago	CASC
3	Mississippi Lafayette	Oxford	23-Jul-1982	PK Lago	CASC
3	Mississippi Lafayette	Oxford	16-Jun-1988	PK Lago	CASC
1	Mississippi Lafayette	Oxford	7-Jun-1979	PK Lago	CASC
2	Mississippi Lafayette	Oxford	4-Jun-1982	PK Lago	CASC
4	Mississippi Lafayette	Oxford	19-Jun-1978	PK Lago	CASC
10	Mississippi Lafayette	10 mi NNE Oxford	9-Aug-05	J.G. King & W Bet-Sayad	UMIC
1	Mississippi Lafayette	Bagley Bottoms	18-Jun-05	J.G. King, S.E. Murray	UMIC
4	Mississippi Lafayette	Oxford	10-May-1991	Paul K. Lago	UMIC
3	Mississippi Lafayette	8 mi NE Oxford	12-Sep-1991	M. Caterino	UMIC
1	Mississippi Lafayette	6 mi. ENE Oxford	15-Jul-1986	Sam Testa III	UMIC
1	Mississippi Lafayette	6 mi ENE Oxford	15-Jul-1986	Sam Testa III	UMIC
1	Mississippi Lafayette	8 mi NE Oxford	17-Sep-1987	S. Rosado	UMIC
2	Mississippi Lafayette	Oxford	11-Sep-1977	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	24-Apr-1989	E.B. Lago	UMIC
9	Mississippi Lafayette	Oxford	23-Jul-1985	Paul K. Lago	UMIC
10	Mississippi Lafayette	Oxford	16-Jun-1978	Paul K. Lago	UMIC
7	Mississippi Lafayette	Oxford	7-Jun-1982	Paul K. Lago	UMIC
6	Mississippi Lafayette	Oxford	19-Jul-1978	Paul K. Lago	UMIC
5	Mississippi Lafayette	Oxford	4-Jun-1982	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	18-Apr-1981	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	15-Jun-1981	Paul K. Lago	UMIC
1	Mississippi Lafayette	5 mi E Oxford	27-Jul-1977	D.F. Stanford	UMIC
1	Mississippi Lafayette	5 mi E Oxford	6-Aug-1977	D.F. Stanford	UMIC
1	Mississippi Lafayette	Oxford	31-May-1977	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	6-Jun-1981	Paul K. Lago	UMIC
12	Mississippi Lafayette	Oxford	11-Jun-1981	Paul K. Lago	UMIC
2	Mississippi Lafayette	Oxford	16-Jun-1981	Paul K. Lago	UMIC
2	Mississippi Lafayette	Oxford	26-May-1982	Paul K. Lago	UMIC
3	Mississippi Lafayette	Oxford	19-May-1982	Paul K. Lago	UMIC
3	Mississippi Lafayette	Oxford	20-Jul-1981	Paul K. Lago	UMIC
3	Mississippi Lafayette	Oxford	17-Aug-1982	Paul K. Lago	UMIC
6	Mississippi Lafayette	Oxford	7-Jul-1982	Paul K. Lago	UMIC
38	Mississippi Lafayette	Oxford	15-Jun-1981	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	30-Jun-1983	Paul K. Lago	UMIC
6	Mississippi Lafayette	Oxford	14-Jul-1982	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	27-Jul-1980	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	2-Aug-1982	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	23-Jul-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	13-Jul-1982	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	27-May-1982	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	7-Aug-1981	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	25-Sep-1981	Paul K. Lago	UMIC ethanol
7	Mississippi Lafayette	Oxford	8-Jun-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	2-May-1982	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	2-Jul-1982	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	20-Jun-1982	Paul K. Lago	UMIC ethanol
8	Mississippi Lafayette	Oxford	28-May-1982	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	26-Apr-1979	Darlene Massey	UMIC ethanol
7	Mississippi Lafayette	6 mi. E Oxford	14-Jun-1978	D.F. Stanford	UMIC ethanol
2	Mississippi Lafayette	5 mi. NW Oxford	31-May-1978	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	7-Jun-1978	Paul K. Lago	UMIC ethanol
7	Mississippi Lafayette	Oxford	25-Aug-1981	Paul K. Lago	UMIC ethanol

3	Mississippi Lafayette	Oxford	7-Jul-1981	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	30-Jul-1978	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	26-Jun-1978	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	16-Jun-1978	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	25-Jun-1978	Paul K. Lago	UMIC ethanol
3	Mississippi Lafayette	Oxford	30-May-1980	Paul K. Lago	UMIC ethanol
162	Mississippi Lafayette	Oxford	19-Jul-1978	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	19-May-1982	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	23-Apr-1980	Paul K. Lago	UMIC ethanol
4	Mississippi Lafayette	Oxford	17-Mar-1982	Paul K. Lago	UMIC ethanol
10	Mississippi Lafayette	7 mi. W Oxford	29-May-1982	Paul K. Lago	UMIC ethanol
1	Mississippi Lamar	5 mi. N Baxterville	9-Apr-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Lawrence	1.5 mi. S Monticello	7-Jul-1986	J. Trott	CASC
1	Mississippi Lawrence	Monticello	28-Jul-1986	Paul K. Lago	UMIC
1	Mississippi Leake	Carthage	8-May-1979	PK Lago	CASC
1	Mississippi Lee	4.8 mi SE Saltillo	22-May-1994	Judy Dakin	UMIC
1	Mississippi Lee	4.8 mi SE Saltillo Lake Piomingo	23-May-1984	Judy Dakin	Labeled H. parrotus by WVM UMIC
10	Mississippi Leflore	3 mi NNW Swiftville	4-Aug-04	Jonas G. King	UMIC
3	Mississippi Lowndes	14 mi. W Columbus	20-May-1992	Paul K. Lago	UMIC
3	Mississippi Lowndes	Lowndes St. Park	23-Jun-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Marshall	T35R3WSSEC.13	15-Jun-1978	Sara Hurdle	CASC
2	Mississippi Marshall	Wall Doney St Park	30-Jul-1986	Sam Testa III	UMIC
3	Mississippi Marshall	Holly Springs	27-Jul-1977	Sara Hurdle	UMIC
9	Mississippi Marshall	T3S-R3W-sec.13	1-Jun-1978	Sara Hurdle	UMIC ethanol
2	Mississippi Montgomery	3 mi NE Winona	21-Jun-1996	James P. Key	UMIC
4	Mississippi Neshoba	1.4 mi N Dixon	9-May-1979	Paul K. Lago	UMIC
2	Mississippi Newton	6 mi SE Newton	10-May-1979	Paul K. Lago	UMIC
1	Mississippi Oktibbeha	Starkville	31-May-1975	W.H. Cross	CASC
1	Mississippi Oktibbeha	Adaton	7-Jun-1981	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	15-May-1982	W.H. Cross	CASC
1	Mississippi Oktibbeha	Starkville	30-May-1982	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	13-May-1975	WH Cross	CASC
1	Mississippi Oktibbeha	Dorman Lake	10-Apr-1981	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	5-Jul-1975	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	15-Jul-1975	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	21-Jul-1975	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	28-May-1982	WH Cross	CASC
1	Mississippi Oktibbeha	Starkville	15-Aug-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	2-Jun-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	29-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	31-May-1975	W.H. Cross	MEMU
4	Mississippi Oktibbeha	Starkville	29-Apr-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	7-Jun-1982	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	22-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	31-May-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	6-Sep-1981	W.H. Cross	MEMU
2	Mississippi Oktibbeha	Starkville	30-May-1982	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	19-May-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	9-May-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	24-Jun-1974	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	15-Jul-1981	R.L. Brown	MEMU
1	Mississippi Oktibbeha	Starkville	15-Jul-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	13-Aug-1975	W.H. Cross	MEMU
3	Mississippi Oktibbeha	Starkville	16-Jul-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	21-Aug-1979	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	26-Aug-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	1-May-1981	W.H. Cross	MEMU
4	Mississippi Oktibbeha	Starkville	1-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	13-Apr-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	11-Aug-1975	W.H. Cross	MEMU
3	Mississippi Oktibbeha	Starkville	29-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	14-Jul-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	17-Jul-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	30-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	25-Jun-1975	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	26-Jun-1975	W.H. Cross	MEMU
3	Mississippi Panola	4 mi. ENE Como	18-Jun-1979	W.P. Scott	CASC
6	Mississippi Panola	4 mi. ENE of Como	18-Jun-1979	W.P. Scott	MEMU
13	Mississippi Panola	Clear Springs Nat. Area	18-May-04	J.G. King & W Bet-Sayad	UMIC
4	Mississippi Pontotoc	1 mi. SE of Ecu	8-May-1980	RR. Miller	MEMU
5	Mississippi Quitman	2 mi. S Sledge	25-Apr-1981	PK Lago	CASC
18	Mississippi Quitman	2 mi. S Sledge	25-Apr-1981	Paul K. Lago	UMIC
1	Mississippi Rankin	N 32° 22.838', W -89° 57.795'	30-May-05	Jonas G. King	UMIC
3	Mississippi Rankin	NE Canton	6-May-1980	Paul K. Lago	UMIC
1	Mississippi Scott	Golden Memorial St. Park	21-Jun-1978	Sara Hurdle	UMIC ethanol
1	Mississippi Stone	UM Forest Lands	12-Apr-1981	PK Lago	CASC
1	Mississippi Stone	Red Crk @ Hwy 15	9-Apr-1992	PK Lago	CASC
1	Mississippi Stone	T35-R9W-Sec 17	10-May-1986	Sam Testa III	UMIC
1	Mississippi Stone	U.MS Forest	10-Apr-1981	Paul K. Lago	UMIC
2	Mississippi Tallahatchie	8 mi ESE Charleston	14-Apr-1992	PK Lago	CASC
500	Mississippi Tallahatchie	N 34° 01.484', W -90° 08.460'	6-Jun-2005	J.G. King, S.E. Murray	UMIC
5	Mississippi Tallahatchie	3 mi. S Charleston	7-Jun-1992	Paul K. Lago	UMIC
2	Mississippi Tallahatchie	8 mi. ESE Charleston	14-Apr-1992	M. Caterino	Labeled H. parrotus by WVM UMIC
18	Mississippi Tate	Wetlands .3 mi E of I-55 @ Senatobia	7-Jun-2004	J.G. King, Bob King	UMIC
100	Mississippi Tate	Wetlands .3 mi E of I-55 @ Senatobia	21-Jun-2005	J.G. King, Bob King	UMIC
8	Mississippi Tippah	N 34.7440, W -89.0692	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
1	Mississippi Tishomingo	Tishomingo St. Park	22-Jun-1981	PK Lago	CASC
3	Mississippi Tishomingo	Tishomingo St. Park	6-Jun-1992	PK Lago	CASC
1	Mississippi Tishomingo	Tishomingo St. Park	17-Jun-1986	Sam Testa III	UMIC
1	Mississippi Tishomingo	Tishomingo St. Park	1-May-1992	Paul K. Lago	UMIC

1	Mississippi Tishomingo	Tishomingo St. Park	18-May-1982	Paul K. Lago		UMIC
5	Mississippi Tishomingo	Tishomingo St. Park	22-Jun-1981	Paul K. Lago		UMIC ethanol
19	Mississippi Tishomingo	Tishomingo St. Park	8-Sep-1980	Paul K. Lago		UMIC ethanol
1	Mississippi Tunica	14 Mi SE Tunica Askew Wldf Area	6-Jun-1993	Sam Testa III		CASC
4	Mississippi Tunica	MhoonLanding, nr old Splash Casino	6-Jun-2004	Jonas King		UMIC
50	Mississippi Tunica	N 34° 44.901' , W -90° 22.117'	2-Jun-2005	Jonas G. King		UMIC
2	Mississippi Tunica	14 mi. SE Tunica	6-Jun-1993	E. Lago & S. Testa		UMIC
1	Mississippi Union	Darden Lake	28-Jul-1986	Sam Testa III		UMIC
3	Mississippi Union	12.5 mi W New Albany	28-Jul-1986	PK Lago		CASC
1	Mississippi Union	11 mi. W New Albany	28-Jul-1986	Paul K. Lago		UMIC
1	Mississippi Union	2 mi. NE Etta	12-May-1992	Paul K. Lago		UMIC
3	Mississippi Union	2 mi. NE Etta	12-May-1992	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
3	Mississippi Warren	8 mi NE Bovina	24-Jun-1981	PK Lago		CASC
1	Mississippi Warren	8 mi NE Bovina	24-Jun-1981	Paul K. Lago		UMIC
34	Mississippi Warren	8 mi. NE Bovina	24-Jun-1981	Paul K. Lago		UMIC
50	Mississippi Warren	Yazoo River @ Hwy 61	13-Jun-2005	J.G. King, S.E. Murray		UMIC
200	Mississippi Wilkinson	Buffalo River at Mississippi River	3-Oct-04	Jonas G. King		UMIC
80	Mississippi Wilkinson	Palmetto Point	24-May-05	Jonas G. King	Many teneral	UMIC
200	Mississippi Wilkinson	Artonish Lake	3-Oct-04	Jonas G. King		UMIC
1	Mississippi Wilkinson	Buffalo River @ Hwy 61	12-Jun-1982	Paul K. Lago		UMIC
18	Mississippi Yalobusha	Tillatoba Lake	22-May-04	J.G. King, P.K. Lago		UMIC
1	Mississippi Yalobusha	12.5 mi. SW Coffeeville	17-Jul-1986	Paul K. Lago		UMIC
1	Mississippi De Soto	Southaven	5-Jun-1987	Sam Testa III		CASC
1	Mississippi Lafayette	Oxford	15-Jul-1986	Sam Testa III	Labeled H. parrotus by WVM	UMIC
1	Mississippi Lee	4.8 mi SE Saltillo	7-May-1995	Judy Dakin		UMIC
2	Mississippi Tallahatchie	3 mi. S Charleston	7-Jun-1992	Paul K. Lago		UMIC
1	Mississippi Union	12.5 mi W New Albany	28-Jul-1986	Paul K. Lago		UMIC
2	Missouri Randolph	1 mi E Moberly	4-Jul-1984	E.G. Riley		CASC
3	N Dakota Pembina	Goschke Dam (TRGMA)	28-Jun-1974	PK & B.A. Lago		UMIC
1	S Carolina Beaufort	Hilton Head Island	17-Jul-1965	A.T. Howden		CASC
1	S Carolina Effingham	2 mi W Meldrim	25-May-1983	A.C. Benke		CASC
1	S Carolina Pickens	Clemson	30-Apr-1975	J.R. Ables		CASC
1	Tennessee Marion	Foster falls, 10 km. SE Tracy City	31 V 1991	R. Davidson et. al		CMNH
2	Tennessee Union	4mi S La Folette	6-Aug-1973	W.T. Atyeo		CASC
1	Texas S. Jacinto	Sam Houston Natl Forest	12-May-1985		Labeled H. parrotus by WVM	UMIC

***Heterocerus pallidus* Say**

1	Arkansas Barton	Great Bend	25-Jun-1963	Ball, Freitag, Lister, and McDonald		CASC
2	Arkansas Garland	Lake Ouchita	20-Jun-1990	V.L. Moseley		CASC
1	Arkansas Hempstead		6-Jul-1961	Larry Lewis		CASC
1	Arkansas Logan	Cove lake near Paris	16-May-1958	Evans & Flint		CASC
1	Iowa Osceola	2 mi. NE Ocheyedan	22-Jul-1988	Paul K. Lago		UMIC
1	Louisiana Natchitoches	Kisatchie NF 2 mi E Redbluff Cmpgd.	17-18 June 1988	J.B. Chapin		CASC
22	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	PK Lago		CASC
1	Mississippi Bolivar	2 mi. W Rosedale	7-Oct-1983	PK Lago		CASC
1	Mississippi Bolivar	Scott	17-May-1973			CASC
147	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC
15	Mississippi Bolivar	2 mi. W Rosedale	7-Oct-1983	Paul K. Lago		UMIC
216	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC
13	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC
11	Mississippi Bolivar	2 mi. W Rosedale	10-Oct-1980	Paul K. Lago		UMIC ethanol
11	Mississippi Bolivar	2 mi. W Rosedale	20-Jun-1980	Paul K. Lago		UMIC ethanol
235	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago		UMIC ethanol
115	Mississippi Bolivar	Scott	17-May-1973	Chas Bryson		MEMU
2	Mississippi Chickasaw	Ponds @ Egypt	19-Jul-2004	Jonas G. King	with wide pronotal margins	UMIC
2	Mississippi Forest	Leaf River at Petal	4-Sep-2005	Jonas King and Lydia Hailman		UMIC
2	Mississippi George	12 mi. SW Lucedale	21-May-1983	Paul K. Lago		UMIC ethanol
2	Mississippi Issaquena	2 mi SW Shiplant WMA	20-Jun-1992	PK Lago		CASC
2	Mississippi Issaquena	Miss. Riv. @ Mayersville	2-Oct-04	Jonas G. King		UMIC
1	Mississippi Lafayette	Oxford	23-Jul-1982	PK Lago		CASC
1	Mississippi Oktibbeha	Ag. College, Mississippi		HE Weed		CASC
4	Mississippi Oktibbeha	Ag. College, Mississippi		H.E. Weed		MEMU
1	Mississippi Riley		26-Jun-1952	L.O. Warren		CASC
120	Mississippi Tunica	Mhoon Landing, Old Splash Casino	6-Jun-2004	Jonas King		UMIC
1	Mississippi Union	12.5 mi W New Albany	28-Jul-1986	Paul K. Lago		UMIC
11	Mississippi Bolivar	2 mi. W Rosedale	11-Apr-1986	Sam Testa III		UMIC
1	N Dakota Billings	Sully's Creek St. Park	13-Jul-1991	PK. & E.B. Lago		UMIC
5	Mississippi Oktibbeha	Ag. College, Mississippi		H.E. Weed		MEMU

***Heterocerus parrotus* (Pacheco)**

1	Alabama Choctaw	Bogueloosa Creek .5 mi E Toxey	16-May-1982	S.C. Harris	Mislabeled ???	CASC
1	Mississippi De Soto	8mi WSW Hernando	1-Aug-1987	Sam Testa III	Mislabeled ???	CASC
4	Mississippi Tallahatchie	3mi S Chareleston	7-Jun-1992	PK Lago	Mislabeled ???	CASC
1	Mississippi Tippah	4 mi N Ripley	18-May-1992	PK Lago	Mislabeled ???	CASC
1	Utah Utah	Utah Lake St. Park	19-Jul-1991	Paul K. Lago		UMIC

***Heterocerus sandersoni* (Pacheco)**

1	Alabama Choctaw	Mid. Tallawamp Creek	16-May-1982	S.C. Harris	Labeled H. fatuus by WVM	UMIC
1	Alabama Etawah	Black Creek @ Loccalulu Falls	17-Jun-1982	S.C. Harris	Labeled H. fatuus by WVM	CASC
1	Alabama Etowah	Canoe Creek NR Steele	19-Jul-1982	S.C. Harris	Labeled H. fatuus by WVM	UMIC
2	Alabama Jefferson	Tannehill St. Park	2-Jul-1982	S.C. Harris		UMIC
1	Indiana Lake					CASC
3	Mississippi Adams	Natchez St. Park	23-Jun-1982	PK Lago	Labeled H. fatuus by WVM	CASC
5	Mississippi Adams	5 mi. N Natchez	22-May-1978	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Adams	5 mi. S Natchez	3-Jul-1978	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
3	Mississippi Adams	Natchez	23-Jun-1982	A.E. Zuccaro	Labeled H. fatuus by WVM	UMIC
50	Mississippi Adams	5.5 mi WSW Natchez	11-Jun-04	Jonas G. King		UMIC

1	Mississippi Bolivar	2mi W Rosedale	19-Jun-1981	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Bolivar	2mi W Rosedale	23-Jul-1980	PK Lago	Labeled H. fatuus by WVM	CASC
6	Mississippi Bolivar	2 mi. W Rosedale	8-Jun-1987	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
3	Mississippi Bolivar	Great River Road St. Park	19-Jun-1986	Sam Testa III	Labeled H. fatuus by WVM	UMIC
9	Mississippi Bolivar	2 mi. W Rosedale	20-Jun-1980	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
11	Mississippi Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Bolivar	2mi W Rosedale	19-Jun-1981	PK Lago		CASC
11	Mississippi Bolivar	Great River Road St. Park	26-May-1985	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
1	Mississippi Calhoun	T115-R3W-sec.25	12-Jul-1978	D.F. Stanford	Labeled H. fatuus by WVM	UMIC
1	Mississippi Clairborne	Sandcreek @ Waterfall	3-Jun-1986	B.PStark	Labeled H. fatuus by WVM	CASC
3	Mississippi Coahoma	Desoto Lake, N 34.155°, W -90.840°	3-Jun-04	J.G. King & W Bet-Sayad		UMIC
1	Mississippi De Soto	2mi W Eudora	6-Jun-1993	PK Lago, P.Ford	Labeled H. fatuus by WVM	CASC
3	Mississippi De Soto	8 mi WSW Hernando	1-Aug-1987	Sam Testa III	Labeled H. fatuus by WVM	UMIC
1	Mississippi De Soto	Southhaven	5-Jun-1987	Sam Testa III	Labeled H. fatuus by WVM	UMIC
2	Mississippi Issaquena	2 mi SW Shipland WMA	20-Jun-1992	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Issaquena	2 mi. SW Shipland	20-Jun-1992	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
3	Mississippi Jackson	Ocean Springs	13-May-1984	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Jackson	Horn Island	9-Jun-1944	E.A. Richmond		NMNH
3	Mississippi Jefferson	American Legion Lake	25-Jun-1987	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
50	Mississippi Jefferson	Flathead Lake,	26-May-05	Jonas G. King		UMIC
1	Mississippi Lafayette	Oxford	19-June-1987	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Lafayette	Oxford	15-Jun-1981	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Lafayette	6 mi ENE Oxford	15-Jul-1986	Sam Testa III	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	5 mi E Oxford	27-Jul-1977	D.F. Stanford	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	Oxford	7-Jun-1979	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	Oxford	23-Jul-1982	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	Oxford	15-Jun-1981	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	Oxford	16-Jun-1978	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
79	Mississippi Lafayette	Oxford	19-Jul-1978	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Lafayette	Oxford	10-May-1991	Paul K. Lago	Labeled H. parrotus by WVM	UMIC
2	Mississippi Pearl River	4.5 mi SSW Silver Run	12-May-1986	Sam Testa III	Labeled H. fatuus by WVM	UMIC
1	Mississippi Stone	UMIC Forest lands	13-May-1986	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
8	Mississippi Stone	T35-R9W-Sec 17	10-May-1986	Sam Testa III	Labeled H. fatuus by WVM	UMIC
2	Mississippi Stone	UMIC Forest lands	26-Jun-1986	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Tishomingo	5 mi. E Tishomingo	9-Jun-1984	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
6	Mississippi Tishomingo	J.P. Coleman St. Park	25-Jun-1984	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
1	Mississippi Tishomingo	Tishomingo St. Park	8-Oct-1980	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
30	Mississippi Tunica	N 34° 44.901', W -90° 22.117'	2-Jun-2005	Jonas G. King		UMIC
6	Mississippi Warren	8mi NE Bovina	24-Jun-1981	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Warren	8mi NE Bovina	19-Jun-1981	PK Lago	Labeled H. fatuus by WVM	CASC
1	Mississippi Warren	8 mi.NE Bovina	24-Jun-1981	Paul K. Lago	Labeled H. fatuus by WVM	UMIC
30	Mississippi Warren	Yazoo River @ Hwy 61	13-Jun-2005	J.G. King, S.E. Murray		UMIC
100	Mississippi Wilkinson	Buffalo River at Mississippi River	3-Oct-04	Jonas G. King		UMIC
100	Mississippi Wilkinson	Artonish Lake	3-Oct-04	Jonas G. King		UMIC
1	Ohio Allen					CASC
1	Tennessee Maury	Spring Hill	20-Jul-1955	?		NMNH
1	Tennessee Union	4mi S La Folette	6-Aug-1973	B. L. Stables		CASC
1	W Virginia Hardy					CASC
1	W Virginia Ohio					CASC
1	W Virginia Wirt					CASC
1	Wisconsin Grant					CASC
1	Hancock				Unknown locality	CASC

***Heterocerus schwarzi* Horn**

1	Arkansas Cross	Valley Creek St Park	18-May-1975	Larry Lowman		CASC
1	Arkansas Drew		30-Jul-1966			CASC
1	Florida Alachua	2mi. N Santa Fe, shallow puddle	21-May-1975	PD. Perkins	possibly H. tenuis ???	NMNH
1	Mississippi Bolivar	Scott	20-Jul-1964	V.H. Owens		NMNH
1	NHampsh Straf					CASC
1	Ontario Backus				Mud Pond	CASC
1	Ontario Rondeau					CASC

***Heterocerus selanderi* (Pacheco)**

1	Florida Alachua		13-Apr-1954	H.V. Weems		CASC
1	Florida Glades	Palmdale	27-Apr-1967	D.E. Bright		CASC
1	Florida Hernando	Weeki Wachee	1-Oct-1955			CASC
10	Florida Highlands	Archbold Biological Station	22-26 April 1967	D.E. Bright		CASC
1	Florida Highlands	Hammock St Park	25-Apr-1967	D.E. Bright		CASC
1	Florida Highlands	Lake Placid	19-Apr-1950	J.G. Needham		CASC
3	Florida Highlands	6 mi S Lake Placid	9-13 Mar 1968	A. Smetana		CASC
1	Florida Highlands	Archbold Biological Station	30-Mar-1961	A & H Dietrich		CASC
1	Florida Highlands	Archbold Biological Station	18-Mar-1964	R.A. Morse		CASC
1	Florida Highlands	Near Avon Park	22-Aug-1961	T. Morris		CASC
5	Florida Highlands	2mi N Archbold Biological Station	26-Apr-1967	D.E. Bright		CASC
4	Florida Highlands	Archbold Biological Station	2-May-1981	L.L. Lampart		CASC
5	Florida Highlands	Archbold Biological Station	14-18 IV 1989	M. Wible	Borrowed	CMNH
9	Florida Highlands	Archibold Biological Station	29-Apr-1964	R.W.Hodges		NMNH
4	Florida Marion	Lake Eaton	8-Apr-1975	Peter Drummond		CASC
3	Florida Marion	Ocala	19 IV 1973	M. Wible		CMNH
1	Florida Wakulla	8 mi W Panacea	10-Jun-1972	W. Atyeo		CASC
1	Georgia Ware	Laura, S.Walker St. Park	4-Jun-1968	?		NMNH
1	Mississippi Wilkinson	Buff River @ Highway 61	24-Jun-1982	PK Lago		CASC

***Heterocerus sinuosus* (Pacheco)**

6	Mississippi Hinds	Pearl River @ Byram	10-Sep-2004	J. Kazery		UMIC
10	Mississippi Tallahatchie	N 34° 01.484', W -90° 08.460'	6-Jun-2005	J.G. King, S.E. Murray		UMIC
10	Mississippi Tallahatchie	N 34° 01.049' W -90° 09.741'	6-Jun-2005	Paul Lago & Eric Lago		UMIC

Heterocerus tenuis Miller

2	Florida	Dixie	Old Town	May-67	?		NMNH
3	Florida	Hernando	Weeki Wachee	19-May-1955	J.F. May	1 Allotype, 2 Paratypes	NMNH
1	Florida	Highlands	Archibold Biological Station	29-Apr-1964	R.W. Hodges		NMNH
7	Florida	Highlands	Archibold Biological Station	5-12 April 1975	Rosenberg		NMNH
1	Florida	Hillsborough	Hillsboro Temple Terrace	7-Jun-1968	F.E. Wood		NMNH
1	Florida	Polk	Lake Wales	13-Jul-1970	Robert Gordon		NMNH
1	Georgia	Ware	Laura, S.Walker St. Park	4-Jun-1968	F.E. Wood & J.A. Davidson		NMNH

Heterocerus texanus (Pacheco)

7	Alabama	Baldwin	Turkey Creek X Hwy 59	11-May-1982	S.C. Harris		UMIC
28	Alabama	Baldwin	2 mi. S. Lantham	11-May-1982	S.C. Harris		UMIC
6	Alabama	Baldwin	2 mi. S Lantham	11-May-1982	S.C. Harris		CASC
1	Alabama	Baldwin	Turkey Crk. @ Hwy 59	11-May-1982	S.C. Harris		CASC
1	Alabama	Blount	L. Warrior R X Hwy 231	11-Jul-1982	S.C. Harris		UMIC
1	Alabama	Bullock	12 mi. SSW Union Sprs Canecuh Riv	16-May-1989	S.C. Harris		UMIC
1	Alabama	Cleburne	3.5 mi. SW Borden Sprs @ Terrapin	25-May-1989	S.C. Harris		CASC
1	Alabama	Etowah	L. Wills Creek X Hwy 227	17-Jul-1982	S.C. Harris		UMIC
1	Alabama	Hale	Big Brush Creek @ Hwy 60	27-Jun-1985	S.C. Harris		UMIC
1	Alabama	Marion	Rock Quarry BR X Hwy 43	29-May-1985	S.C. Harris		UMIC
1	Alabama	Russell	1.5mi NRutherford@CowikeeCreek	17-May-1989	S.C. Harris		CASC
1	Alabama	Pickens	4.5 mi. NW Reform Coal Fire Creek	26-Jun-1985	S.C. Harris		CASC
1	Alabama	Russell	7.5 miSWPhenix@ littleUchee Creek	17-May-1989	S.C. Harris		CASC
1	Arkansas	Washington	White River @ Hwy 68 bridge	9-Sep-1963	?		NMNH
1	Florida	Highlands	Hammock St Park	30-Mar-1979	E.G. Riley		CASC
1	Florida	Jackson	Fla. Cave St. Park	8-10 June 1981	S. Peck		CASC
1	Florida	Okaloosa	Ft. Walton Beach	13-Feb-1975	E.J. Kiteley		CASC
1	Georgia	Effingham	2 mi. W Meldrim	31-May-1983	A.C. Benke		UMIC
1	Georgia	Johnson	1 mi. E Kite	16-Apr-1977	R. Turnbow		CASC
1	Kansas	Barton	Ark. Riv @ Great Bend	25-Jun-1963	Ball, Freitag, Lister, and McDonald		CASC
1	Louisiana	Baton Rouge	Baton Rouge	30-Apr-1986	E.G. Riley		CASC
3	Louisiana	Iberville	St. Gabriel Exp. Station	2-Sep-1984	E.G. Riley		CASC
1	Louisiana	Jeff. Davis	2.5 mi. N Welsh on LA Hwy 99	24-Apr-1979	C.B. Barr		CASC
1	Louisiana	Natchitoches	Bellwood	4-Jul-1983	BF & J.L. Carr		CASC
1	Louisiana	Natchitoches	KisatchieNF 2 mi E Redbluff Cmpgd.	8-9 April 1988	E.G. Riley		CASC
1	Louisiana	Natchitoches	Red Dirt Wildlife area	8-9 April 1988	E.G. Riley		CASC
1	Louisiana	Rapides	Boyce	14-May-1982	E.G. Riley		CASC
1	Louisiana	Union	Corney Lake	28-Jun-1983	BF & J.L. Carr		CASC
1	Louisiana	W. Feliciana	2 mi W Jackson	19-Mar-1982	E.G. Riley		CASC
3	Mississippi	Adams	5.5 mi WSW Natchez	11-Jun-04	Jonas G. King		UMIC
9	Mississippi	Adams	Natchez	23-Jun-1982	A.E. Zuccaro		UMIC ethanol
1	Mississippi	Adams	Natchez	25-May-1983	Paul K. Lago		UMIC ethanol
2	Mississippi	Bolivar	2 mi. W Rosedale	7-Oct-1983	PK Lago		CASC
4	Mississippi	Bolivar	2 mi. W Rosedale	19-Jul-1981	PK Lago		CASC
1	Mississippi	Bolivar	2 mi. W Rosedale	23-Aug-1983	PK Lago		CASC
1	Mississippi	Bolivar	Scott	20-Jul-1964	V.H. Owens		NMNH
3	Mississippi	Bolivar	2 mi. W Rosedale	11-May-1982	Paul K. Lago		UMIC
6	Mississippi	Bolivar	2 mi. W Rosedale	10-Oct-1980	Paul K. Lago		UMIC ethanol
2	Mississippi	Bolivar	2 mi. W Rosedale	20-Jun-1980	Paul K. Lago		UMIC ethanol
10	Mississippi	Coahoma	10 mi WSW Clarksdale@Miss. River	10-May-05	J.G. King & W Bet-Sayad		UMIC
1	Mississippi	Copiah		25-Jun-1964	V.H. Owens		NMNH
1	Mississippi	Hancock	Stennis Space center	5-May-1994	PK Lago		CASC
1	Mississippi	Issaquena	A. TullyWMA. 6.5 miSSW Mayersville	7-Jun-1996	PK Lago		CASC
1	Mississippi	Lafayette	Oxford	15-Jun-1981	PK Lago		CASC
1	Mississippi	Lafayette	Oxford	19-Jul-1978	Paul K. Lago		UMIC ethanol
1	Mississippi	Lafayette	Oxford	23-Apr-1980	Paul K. Lago		UMIC ethanol
1	Mississippi	Lowndes	2.5 mi. W Columbus	11-Aug-1987	Sam Testa III		UMIC
1	Mississippi	Neshoba	1.5 mi. N Dixon	9-May-1979	PK Lago		CASC
3	Mississippi	Su nflower	Macon Lake, N 33.35°, W -90.49°	4-Aug-04	J.G. King & W Bet-Sayad		UMIC
50	Mississippi	Tunica	N 34° 44.901', W -90° 22.117'	2-Jun-2005	Jonas G. King		UMIC
30	Mississippi	Wilkinson	Buffalo River at Mississippi River	3-Oct-04	Jonas G. King		UMIC
10	Mississippi	Wilkinson	Artonish Lake	3-Oct-04	Jonas G. King		UMIC

Heterocerus undatus Melsheimer

1	Arkansas	Cross	Valley Creek St. Park	18-May-1975	L. Lowman		CASC
1	Kansas	Ellsworth					CASC
3	Louisiana	Orleans	New Orleans	10-Mar-1945	W.M. Spectre		CASC
2	Michigan	Ingham	Ag. College. Mich		H.E. Weed		MEMU
1	Mississippi	Pontotoc	1 mi. SE of Ecru	27-Aug-1980	W.H. Cross	Det W.V. Miller	MEMU
1	Missouri	Boone					CASC
1	Missouri	Holt					CASC
1	Missouri	Randolph					CASC
1	New York	Rochester					CASC
1	New York	Tompkins					CASC
1	Oklahoma	?	Rock Canyon St. Park				CASC
1	Virginia	Anne					CASC
1	Wisconsin	?					CASC
1	Wisconsin	Grant					CASC

Tropicus nigrellus n.sp.

1	Florida	Dixie	Old Town	? May 1967	Dr. Lenczy		CASC
4	Mississippi	Hinds	?	19-Aug-64	VH Owen		CASC
1	S Carolina	Florence	Florence	16-Aug-55	VM. Kirk		CASC

Tropicus pusillus (Say)

1	Alabama	Baldwin	2 mi. S. Lantham	11-May-1982	S.C. Harris	UMIC
4	Alabama	Baldwin	Turkey Creek @ Hwy 59	11-May-1982	S.C. Harris	UMIC
1	Alabama	Bibb	Cahaba River @ Hwy. 27	6-Oct-1982	S.C. Harris	UMIC
1	Alabama	Bibb	Shultz Creek near Centerville	12-Sep-1982	S.C. Harris	UMIC
7	Alabama	Bibb	Shultz Creek near Centerville	6-Oct-1982	S.C. Harris	UMIC
1	Alabama	Blount				CASC
28	Alabama	Blount	Mulberry Creek X Co. Hwy 55	11-Jul-1982	S.C. Harris	UMIC
2	Alabama	Blount	1 mi. W Cleveland	1-May-1985	S.C. Harris	UMIC
15	Alabama	Blount	Horton Mill Bridge	12-Jul-1982	S.C. Harris	UMIC
16	Alabama	Butler	Pigeon Creek X Hwy 110	4-Sep-1982	S.C. Harris	UMIC
5	Alabama	Butler	Persimmon Creek @ Hwy 16	4-Sep-1982	S.C. Harris	UMIC
1	Alabama	Charles	Fisher's Creek	18-May-1985	S.C. Harris	UMIC
26	Alabama	Choctaw	Mid. Tallawamp Creek	16-May-1982	S.C. Harris	UMIC
1	Alabama	Choctaw	Bogueloosa Creek .5 mi E Toxey	16-May-1982	S.C. Harris	UMIC
4	Alabama	Clay	Hatchet 2.5 mi S Coleta	29-May-1989	S.C. Harris	UMIC
1	Alabama	Clay	Crooked Creek 2 mi. S Lineville	29-May-1989	Harris & Sheppard	UMIC
16	Alabama	Conecuh	Sepulga River X Hwy 15	4-Sep-1982	S.C. Harris	UMIC
16	Alabama	Covington	Pea River @ Hwy 153	12-Jun-1982	S.C. Harris	UMIC
1	Alabama	Covington	Floral St. Park	12-Jun-1982	S.C. Harris	UMIC
12	Alabama	Escambia	L. Escambia Creek @ Hwy 31	6-Aug-1982	S.C. Harris	UMIC
2	Alabama	Escambia	Black Water River @ Hwy 4	12-Jun-1982	S.C. Harris	UMIC
1	Alabama	Etowah				CASC
22	Alabama	Etowah	Black Creek @ Nocalulu Falls	17-Jul-1982	S.C. Harris	UMIC
26	Alabama	Etowah	L. Wills Creek X Hwy 227	17-Jul-1982	S.C. Harris	UMIC
1	Alabama	Etowah	Little Canoe Creek near Steele	19-Jul-1982	S.C. Harris	UMIC
1	Alabama	Etowah	Canoe Creek near Steele	19-Jul-1982	S.C. Harris	UMIC
2	Alabama	Jefferson	Trussville	9-Oct-1982	S.C. Harris	UMIC
4	Alabama	Jefferson	4 mi. N Leeds	9-Oct-1982	S.C. Harris	UMIC
1	Alabama	Jefferson	Tannehill St. Park	22-Oct-1982	S.C. Harris	UMIC
6	Alabama	Jefferson	Cahaba River in Trussville	9-Oct-1982	S.C. Harris	UMIC
3	Alabama	Jefferson	Tannehill St. Park	2-Jul-1982	S.C. Harris	UMIC
1	Alabama	Lawrence	4.5 mi. NNW Monticello	27-Jul-1986	John Trott	UMIC
1	Alabama	Lawrence	Bankhead Natl. Forest	28-May-1983	S.C. Harris	UMIC
1	Alabama	Limestone	LimestoneCreek@ Nicle Davis Road	2-Jun-1984	S.C. Harris	UMIC
1	Alabama	Madison				CASC
43	Alabama	Mobile	6 mi. E Citronelle	4-Aug-1982	S.C. Harris	UMIC
7	Alabama	Mobile	6 mi. E Citronelle	5-Aug-1982	S.C. Harris	UMIC
15	Alabama	Mobile	Mt. Vernon	24-Jun-1982	S.C. Harris	UMIC
11	Alabama	Mobile	6 mi. E Citronelle	24-Jun-1982	S.C. Harris	UMIC
1	Alabama	Mobile	Nobodies Creek @ Escatawpa River	13-May-1982	S.C. Harris	UMIC
24	Alabama	Mobile	6 mi. E Citronelle	5-Aug-1982	S.C. Harris	UMIC
14	Alabama	Mobile	7 mi W Citronelle	25-Jun-1982	S.C. Harris	UMIC
52	Alabama	Mobile	Puppy Creek @ Hwy 217	12-Jun-1982	S.Harris & P. O'Neal	UMIC
8	Alabama	Mobile	Escatawpa River	20-Sep-1982	S.C. Harris	UMIC
10	Alabama	Mobile	7 mi W Citronelle	5-Aug-1982	S.C. Harris	UMIC
23	Alabama	Mobile	7 mi SW Citronelle	5-Aug-1982	S.C. Harris	UMIC
4	Alabama	Mobile	6 mi E Citronelle	24-Jun-1982	S.C. Harris	UMIC
1	Alabama	Monroe	Big Flat River X Hwy. 41	19-Jun-1986	S.C. Harris	UMIC
5	Alabama	Monroe	Beaver Creek @ Hwy 41	5-Aug-1982	S.C. Harris	UMIC
2	Alabama	Monroe	Little River Stake Park	11-May-1982	S.C. Harris	UMIC
1	Alabama	Perry	2 mi E Perryville	5-Jun-1981	S.C. Harris	UMIC
2	Alabama	Pickens	1 mi SE Pickensville	26-Jun-1985	S.C. Harris	UMIC
2	Alabama	Russell	Cowikee Creek 1.5 mi. N Rutherford	17-May-1989	S.C. Harris	UMIC
20	Alabama	Shelby	Ebenizer church S of Alabaster	5-Jul-1982	S.C. Harris	UMIC
20	Alabama	St. Clair	Beaver Creek @ Hwy 26	19-Jul-1982	S.C. Harris	UMIC
2	Alabama	St. Clair	Beaver Creek X Hwy 26	19-Jul-1982	S.C. Harris	UMIC
16	Alabama	Tuscaloosa	5 mi. E New Lexington	17-Jul-1987	S.C. Harris	UMIC
1	Alabama	Tuscaloosa	US Geological Station Yellow Creek	23-Aug-1984	S.C. Harris	UMIC
1	Alabama	Tuscaloosa	7 mi. ENE New Lexington	25-Jul-1983	S.C. Harris	UMIC
6	Alabama	Tuscaloosa	Turkey Creek @ Hwy 69	10-May-1983	S.C. Harris	UMIC
2	Alabama	Tuscaloosa	Boone Creek	27-May-1983	S.C. Harris	UMIC
7	Alabama	Tuscaloosa	12 mi. NE Tuscaloosa	16-Jun-1983	S.C. Harris	UMIC
8	Alabama	Tuscaloosa	12 mi. NE Tuscaloosa	24-Aug-1983	S.C. Harris	UMIC
2	Alabama	Tuscaloosa	2 mi. E Samantha	16-Jun-1983	S.C. Harris	UMIC
5	Alabama	Washington	Okwakee Creek	15-May-1982	S.C. Harris	UMIC
7	Alabama	Washington	Pond Creek X Hwy 9	15-May-1982	S.C. Harris	UMIC
1	Alabama		Barachias			NMNH
1	Alabama	Jefferson	Bessemer	2-Jul-1982	S.C. Harris	UMIC
2	Alabama	Tuscaloosa	7 mi. ENE New Lexington	28-Sep-1983	S.C. Harris	UMIC
2	Alabama	Tuscaloosa	7 mi. ENE New Lexington	25-May-1983	S.C. Harris	UMIC
18	Arizona	Cochise	Guadalupe Canyon, 30 mi E Douglas	25-Jul-1985	Paul K. Lago	UMIC
22	Arizona	Maricopa	Salt River, Phoenix	19-Jul-1985	Paul K. Lago	UMIC
1	Arkansas	Benton				NMNH
4	Arkansas	Yell	Dardanelle	27-May-1977	W.H. Cross	MEMU
1	Arkansas		White River @ Hwy 68			NMNH
2	Arkansas	Yell				CASC
3	Florida	Alachua	Gainsville			CASC
4	Florida	Alachua	Gainsville Forest Insect Lab	19-Jul-1978	F.N. Young	MEMU
5	Florida	Dade	Homestead	2-Jun-1983	W.H. Cross	MEMU
1	Florida	Dade	Homestead			NMNH
1	Florida	Dixie	Old Town			NMNH
1	Florida	Highlands				CASC
1	Florida	Highlands				CASC
1	Florida	Highlands	Lake Letta, nr Sebring & Avon Park			NMNH
3	Florida	Liberty				CASC
1	Florida	Marion				CASC
1	Florida	Marion				CASC
1	Florida	Marion	Juniper Springs	9-Jun-1963	Leon W. Hepner	MEMU

1	Florida	Miami	Miami			CASC
1	Florida	Monroe				CASC
1	Florida	Polk	Winter Haven			CASC
1	Florida	Santa Rosa				CASC
1	Florida	Taylor				NMNH
1	Florida	Wakulla				CASC
1	Florida		Tyndall AF Base			NMNH
1	Georgia	Clarke				CASC
1	Georgia	Grady				NMNH
1	Illinois	Vienna		3-Jun-1962	Leon W. Hepner	MEMU
1	Indiana	Monroe	Bloomington	8-May-1990	F.N. Young	UMIC
5	Indiana	Monroe	Bloomington	19-Aug-1986	F.N. Young	UMIC
5	Indiana	Monroe	Bloomington	10-Sep-1987	F.N. Young	MEMU
2	Indiana	Monroe	Bloomington	22-Jul-1985	F.N. Young	MEMU
1	Indiana	Monroe	Bloomington	23-Jul-1985	F.N. Young	MEMU
1	Indiana	Monroe	Bloomington	27-Jul-1985	F.N. Young	MEMU
4	Indiana	Monroe	Bloomington	4-Aug-1988	F.N. Young	MEMU
1	Indiana	Monroe	Bloomington	10-Aug-1984	F.N. Young	MEMU
1	Louisiana	Calcasieu				NMNH
1	Louisiana	E.B. Rouge	Baton Rouge			CASC
1	Louisiana	E.B. Rouge	Baton Rouge			CASC
1	Louisiana	E.B. Rouge	LSU			CASC
1	Louisiana	Rapides				CASC
2	Louisiana	St John				CASC
1	Louisiana	Tangipahoa				CASC
1	Louisiana	W Feliciana				CASC
1	Louisiana	Webster	Carey Lake, Nr. Minden			NMNH
3	Mexico	Sinaloa	Sin. Culiacan	13-Nov-1982	W.H. Cross	MEMU
1	Mexico	Tamaulipas	NE. of Aldama	21-Sep-1981	W.H. Cross	MEMU
4	Mexico	Tamaulipas	San Fernando	25-Sep-1981	W.H. Cross	MEMU
6	Mexico	Tamaulipas	La Pesca	19-Sep-1981	W.H. Cross	MEMU
2	Mexico	Tamaulipas	San Fernando	17-Sep-1981	W.H. Cross	MEMU
7	Mississippi	Adams	5.5 mi WSW Natchez	11-Jun-04	Jonas G. King	UMIC
10	Mississippi	Adams	Natchez	17-May-1983	Paul K. Lago	UMIC ethanol
1	Mississippi	Adams	Natchez	11-Apr-1978	A.E. Zuccaro	UMIC ethanol
2	Mississippi	Adams	Natchez	21-May-1978	Paul K. Lago	UMIC ethanol
1	Mississippi	Adams	5 mi. N Natchez	22-May-1978	Paul K. Lago	UMIC ethanol
29	Mississippi	Adams	5 mi. S Natchez	3-Jul-1978	Paul K. Lago	UMIC ethanol
3	Mississippi	Adams	5 mi W Natchez	3-Jul-1978	Paul K. Lago	UMIC ethanol
6	Mississippi	Adams	Natchez	23-Jun-1982	A.E. Zuccaro	UMIC ethanol
13	Mississippi	Adams	Natchez St. Park	7-May-1983	Paul K. Lago	UMIC ethanol
10	Mississippi	Adams	14 mi. E Sibley	18-May-1983	Paul K. Lago	UMIC ethanol
25	Mississippi	Benton	Curtis Creek @ Hwy 4	22-Jul-04	Jonas G. King	UMIC
11	Mississippi	Benton	2 mi. W Ashland	11-Jul-1981	Paul K. Lago	UMIC ethanol
8	Mississippi	Bolivar	Great River Road St. Park	19-Jun-1986	Sam Testa III	UMIC
8	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago	UMIC
34	Mississippi	Bolivar	2 mi. W Rosedale	7-Oct-1983	Paul K. Lago	UMIC
18	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago	UMIC
6	Mississippi	Bolivar	2 mi. W Rosedale	10-Oct-1980	Paul K. Lago	UMIC ethanol
6	Mississippi	Bolivar	2 mi. W Rosedale	20-Jun-1980	Paul K. Lago	UMIC ethanol
10	Mississippi	Bolivar	2 mi. W Rosedale	19-Jun-1981	Paul K. Lago	UMIC ethanol
3	Mississippi	Calhoun	T115-R3W-sec.25	12-Jul-1978	D.F. Stanford	UMIC ethanol
147	Mississippi	Chickasaw	Ponds @ Egypt	19-Jul-2004	Jonas G. King	UMIC
2	Mississippi	Claiborne	Sand Creek @ water fall	3-Jun-1986	B.P. Stark	UMIC
1	Mississippi	Claiborne	Natchez Trace Natl. Pkwy.	1-Nov-1991	D. Hildebrandt	UMIC
1	Mississippi	Clarke	Clarkco St. Park	22-May-1985		UMIC
5	Mississippi	Coahoma	10 mi WSW Clarksdale @ Miss. Riv	10-May-05	J.G. King & W Bet-Sayad	UMIC
4	Mississippi	Coahoma	Ponds off Miss. Riv.	10-May-05	J.G. King & W Bet-Sayad	UMIC
1	Mississippi	Copiah				NMNH
9	Mississippi	De Soto	Southhaven	5-Jun-1987	Sam Testa III	UMIC
1	Mississippi	De Soto	2 mi. W Eudora	6-Jun-1983	P. Lago & P. Ford	UMIC
4	Mississippi	De Soto	8 mi. WSW Hernando	1-Aug-1987	Sam Testa III	UMIC
1	Mississippi	Forrest	P.B. Johnson St. Park	23-Jun-1986	Paul K. Lago	UMIC
2	Mississippi	Forrest	P.B. Johnson St. Park	30-Apr-1981	Paul K. Lago	UMIC ethanol
12	Mississippi	Franklin	7 mi SW Meadville	5-Sep-1981	Paul K. Lago	UMIC
24	Mississippi	Franklin	7 mi. SW Meadville	5-Sep-1981	Paul K. Lago	UMIC ethanol
1	Mississippi	Franklin	2 mi. W Quentin	19-Aug-1982	R.L. Brown	MEMU
3	Mississippi	George	12 mi. SW Lucedale	19-May-1987	Paul K. Lago	UMIC
5	Mississippi	George	12 mi SW Lucedale	10-Apr-1992	Paul K. Lago	UMIC
5	Mississippi	George	Black Creek @ Hwy 57	11-Apr-1981	Paul K. Lago	UMIC
2	Mississippi	George	12 mi. SW Lucedale	23-Sep-1983	Paul K. Lago	UMIC
8	Mississippi	George	12 mi. SW Lucedale	21-May-1983	Paul K. Lago	UMIC ethanol
7	Mississippi	George	7 mi. S Benndale	11-Apr-1981	Paul K. Lago	UMIC ethanol
5	Mississippi	Greene	W. Stateline	24-Sep-1983	Paul K. Lago	UMIC
10	Mississippi	Greene	4 mi W StateLine	20-May-1983	Paul K. Lago	UMIC ethanol
1	Mississippi	Hancock				CASC
8	Mississippi	Hancock	2 mi. N Waveland Bayou La Croix	23-May-1982	W.H. Cross	MEMU
1	Mississippi	Hancock	Stennis Space Center	25-Jun-1991	Paul K. Lago	UMIC
16	Mississippi	Hancock	4 mi NW Kiln Orphan Creek	26-May-1980	Paul K. Lago	UMIC ethanol
1	Mississippi	Harrison	12.5 mi. E Saucier	25-May-1987	Sam Testa III	UMIC
1	Mississippi	Harrison	12 mi. E Saucier	11-May-1986	Paul K. Lago	UMIC
1	Mississippi	Harrison	2 mi. N Lyman	10-Apr-1981	Paul K. Lago	UMIC ethanol
12	Mississippi	Harrison	Biloxi	20-May-1978	Sara Hurdle	UMIC ethanol
15	Mississippi	Harrison	Seaman Road 1/2 miNOcean Springs	18-May-05	J King, W Bet-Sayad, N. Prescott	UMIC
1	Mississippi	Hinds	Pearl River @ Byram	10-Sep-2004	J. Kazery	UMIC
9	Mississippi	Hinds	4 mi. N Clinton Bogue Chitto Creek	21-May-1977	B.P. Stark	UMIC ethanol
1	Mississippi	Jackson	Horn Island			NMNH
20	Mississippi	Jackson	West bank of Pascagoula River@I-10	24-Jul-05	Jonas G. King	UMIC
2	Mississippi	Jackson	Ocean Springs	3-Sep-1983	Paul K. Lago	UMIC
15	Mississippi	Jackson	3 mi. E Ocean Springs	22-May-1983	Paul K. Lago	UMIC ethanol

12	Mississippi Jackson	T5S-R7W-sec.18	19-May-1978	M.O. Mann	UMIC ethanol
50	Mississippi Jackson	Ocean Springs	17-Jun-1978	Sara Hurdle	UMIC ethanol
10	Mississippi Jackson	Ocean Springs	23-May-1983	Paul K. Lago	UMIC ethanol
3	Mississippi Jasper	4 mi. SE Heidelberg	14-Jun-1987	Paul K. Lago	UMIC
12	Mississippi Jasper	6 mi NW Montrose	7-May-1980	Paul K. Lago	UMIC
1500	MS Jefferson	Flathead Lake,	26-May-05	Jonas G. King	UMIC
2	Mississippi Jefferson	American Legion Lake	25-Jun-1987	Sam Testa III	UMIC
7	Mississippi Lafayette	Bagley Bottoms	18-Jun-05	J.G. King, S.E. Murray	UMIC
1	Mississippi Lafayette	6 mi ENE Oxford	15-Jul-1986	Sam Testa III	UMIC
1	Mississippi Lafayette	8 mi NE Oxford	17-Sep-1987	Paul K. Lago	UMIC
2	Mississippi Lafayette	8 mi NE Oxford	17-Sep-1987	S. Rosado	UMIC
2	Mississippi Lafayette	8 mi NE Oxford	12-Sep-1991	M. Caterino	UMIC
1	Mississippi Lafayette	7 mi. NW Oxford	31-Jul-1986	Paul K. Lago	UMIC
1	Mississippi Lafayette	5 mi NW Oxford	23-Jul-1984	D.F. Stanford	UMIC
1	Mississippi Lafayette		29-Apr-1989	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	6-Jun-1981	Paul K. Lago	UMIC
2	Mississippi Lafayette	Oxford	11-Jun-1981	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	16-Jun-1981	Paul K. Lago	UMIC
4	Mississippi Lafayette	Oxford	10-Sep-1982	Paul K. Lago	UMIC
8	Mississippi Lafayette	Oxford	26-May-1982	Paul K. Lago	UMIC
14	Mississippi Lafayette	Oxford	15-Apr-1981	Paul K. Lago	UMIC
2	Mississippi Lafayette	Oxford	19-May-1982	Paul K. Lago	UMIC
8	Mississippi Lafayette	Oxford	20-Jul-1981	Paul K. Lago	UMIC
7	Mississippi Lafayette	Oxford	17-Aug-1982	Paul K. Lago	UMIC
2	Mississippi Lafayette	Oxford	7-Jul-1982	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	15-Jun-1981	Paul K. Lago	UMIC
4	Mississippi Lafayette	Oxford	30-Jun-1983	Paul K. Lago	UMIC
1	Mississippi Lafayette	Oxford	18-Mar-1984	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	14-Jul-1982	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	2-Aug-1982	Paul K. Lago	UMIC ethanol
9	Mississippi Lafayette	Oxford	23-Jul-1981	Paul K. Lago	UMIC ethanol
13	Mississippi Lafayette	Oxford	13-Jul-1982	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	23-Jul-1982	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	7-Aug-1981	Paul K. Lago	UMIC ethanol
9	Mississippi Lafayette	Oxford	25-Sep-1981	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	8-Jun-1981	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	2-May-1982	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	2-Jul-1982	Paul K. Lago	UMIC ethanol
4	Mississippi Lafayette	6 mi. E Oxford	30-Apr-1980	S.C. Elliott	UMIC ethanol
3	Mississippi Lafayette	Oxford	20-Jun-1982	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	4-Jun-1982	Paul K. Lago	UMIC ethanol
7	Mississippi Lafayette	Oxford	28-May-1982	Paul K. Lago	UMIC ethanol
3	Mississippi Lafayette		17-Jul-1978	D.F. Stanford	UMIC ethanol
30	Mississippi Lafayette	5 mi. NW Oxford	31-May-1978	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	7-Jun-1978	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	30-May-1978	Paul K. Lago	UMIC ethanol
15	Mississippi Lafayette	Oxford	25-Aug-1981	Paul K. Lago	UMIC ethanol
2	Mississippi Lafayette	Oxford	7-Jul-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	30-Jul-1978	Paul K. Lago	UMIC ethanol
6	Mississippi Lafayette	Oxford	14-Jun-1979	Paul K. Lago	UMIC ethanol
75	Mississippi Lafayette	Oxford	19-Jul-1978	Paul K. Lago	UMIC ethanol
1	Mississippi Lafayette	Oxford	19-May-1982	Paul K. Lago	UMIC ethanol
5	Mississippi Lafayette	Oxford	17-Mar-1982	Paul K. Lago	UMIC ethanol
4	Mississippi Lafayette	7 mi. W Oxford	29-May-1982	Paul K. Lago	UMIC ethanol
9	Mississippi Lafayette	Oxford	23-Apr-1981	Paul K. Lago	UMIC ethanol
1	Mississippi Lamar	5 mi. N Baxterville	27-Jun-1986	Paul K. Lago	UMIC
7	Mississippi Lamar	5 mi. N Baxterville	23-May-1980	Paul K. Lago	UMIC ethanol
14	Mississippi Lamar	5 mi. N Baxterville	9-Apr-1981	Paul K. Lago	UMIC ethanol
5	Mississippi Lamar	5 mi. N Baxterville	9-Apr-1981	Paul K. Lago	UMIC ethanol
10	Mississippi Leflore	3 mi NNW Swiftville	4-Aug-04	Jonas G. King	UMIC
2	Mississippi Lowndes	2.5 mi. W Columbus	11-Aug-1987	Sam Testa III	UMIC
18	Mississippi Lowndes	Lowndes St. Park	23-Jun-1981	Paul K. Lago	UMIC ethanol
2	Mississippi Madison	10 mi. NE Canton	6-May-1980	Paul K. Lago	UMIC
1	Mississippi Marion	Lake Columbia	27-Jun-1986	Sam Testa III	UMIC
5	Mississippi Marshall	Trib. into Tallahatchie Riv.	24-Jul-05	Jonas G. King	UMIC
1	Mississippi Marshall	Wall Doxey St Park	30-Jul-1986	Sam Testa III	UMIC
1	Mississippi Marshall	T3S-R3W-sec.13	30-May-1978	Sara Hurdle	UMIC ethanol
40	Mississippi Marshall	T3S-R3W-sec.13	1-Jun-1978	Sara Hurdle	UMIC ethanol
5	Mississippi Montgomery	3 mi. NE Winona	26-Jun-1996	James P. Key	UMIC
1	Mississippi Oktibbeha				CASC
3	Mississippi Oktibbeha	Adaton	3-Jun-1981	W.H. Cross	MEMU
6	Mississippi Oktibbeha	Starkville	8-Aug-1981	R.L. Brown	MEMU
9	Mississippi Oktibbeha	Starkville	22-Jun-1982	R.L. Brown	MEMU
2	Mississippi Oktibbeha	Starkville	6-May-1982	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	30-May-1982	W.H. Cross	MEMU
2	Mississippi Oktibbeha	Starkville	21-Apr-1980	P. Ramey	MEMU
1	Mississippi Oktibbeha	Starkville	4-Sep-1981	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Craig Springs	1-Oct-1979	G.L. Snodgrass	MEMU
1	Mississippi Oktibbeha	Starkville	23-Aug-1981	W.H. Cross	MEMU
8	Mississippi Oktibbeha	Ag. College, Mississippi		H.E. Weed	MEMU
1	Mississippi Panola	4 mi. ENE of Como	20-Jun-1979	W.P. Scott	MEMU
3	Mississippi Panola	4 mi. ENE of Como	6-Jul-1979	W.P. Scott	MEMU
8	Mississippi Panola	Clear springs Nat. Area	18-May-04	J.G. King & W Bet-Sayad	UMIC
2	Mississippi Pearl River	4.5 mi. SSW Silver Run	12-Jul-1986	Sam Testa III	UMIC
2	Mississippi Perry	Lake Perry	28-Jun-1986	Paul K. Lago	UMIC
1	Mississippi Pontotoc				CASC
1	Mississippi Pontotoc	1 mi. SE of Ecu	5-Jun-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecu	4-Apr-1981	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecu	22-May-1980	P.R. Miller	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecu	12-Sep-1980	G.L. Snodgrass	MEMU

4	Mississippi Pontotoc	1 mi. SE of Ecru	22-May-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	16-Jul-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	13-Aug-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	19-Jun-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	17-Jul-1980	W.H. Cross	MEMU
2	Mississippi Pontotoc	1 mi. SE of Ecru	22-May-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	7-May-1980	PR. Miller	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	3-Jul-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	14-Aug-1980	W.H. Cross	MEMU
1	Mississippi Pontotoc	1 mi. SE of Ecru	31-Jul-1980	W.H. Cross	MEMU
3	Mississippi Rankin	N 32° 22.838', W -89° 57.795'	30-May-05	Jonas G. King	UMIC
15	Mississippi Rankin	NE Canton	6-May-1980	Paul K. Lago	UMIC
6	Mississippi Scott	Golden Memorial St. Park	21-Jun-1978	Sara Hurdle	UMIC ethanol
4	Mississippi Simpson	2 mi. W Pinola	24-Jun-1982	B.P. Stark	UMIC
1	Mississippi Simpson	2 mi. W Pinola	2-Jun-1986	B.P. Stark	UMIC
2	Mississippi Simpson	Mill Creek	1-May-1987	B.P. Stark	UMIC
1	Mississippi Stone	T35-R10W-Sec 24, Red Creek	26-Jun-1986	Sam Testa III	UMIC
1	Mississippi Stone	Red Creek X Hwy 15	29-Jun-1986	Paul K. Lago	UMIC
1	Mississippi Stone	13 mi. SE Wiggins	26-Jun-1986	Sam Testa III	UMIC
2	Mississippi Stone	Red Creek X Hwy 15	28-Jul-1986	Paul K. Lago	UMIC
3	Mississippi Stone	1 mi N Perkinson	30-Apr-1981	Paul K. Lago	UMIC
18	Mississippi Stone	13 mi. SE Wiggins	10-Apr-1981	Paul K. Lago	UMIC ethanol
3	Mississippi Stone	Red Creek X Hwy 15	24-May-1980	Paul K. Lago	UMIC ethanol
4	Mississippi Stone	UM Forest Lands	19-May-1978	Paul K. Lago	UMIC ethanol
2	Mississippi Stone	T45-R1W-sec.6	20-May-1978	Paul K. Lago	UMIC ethanol
4	Mississippi Su nflower	Macon Lake, N 33.35°, W -90.49°	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
1	Mississippi Tallahatchie	8 mi. ESE Charleston	14-Apr-1992	M. Caterino	UMIC
2	Mississippi Tallahatchie	8 mi. ESE Charleston	14-Apr-1992	Paul K. Lago	UMIC
8	Mississippi Tippah	N 34.7440, W -89.0692	4-Aug-04	J.G. King & W Bet-Sayad	UMIC
2	Mississippi Tishomingo	Tishomingo St. Park	18-May-1992	Paul K. Lago	UMIC
4	Mississippi Tishomingo	Tishomingo St. Park	22-Jun-1981	Paul K. Lago	UMIC ethanol
3	Mississippi Tishomingo	Tishomingo St. Park	22-Jul-1978	Paul K. Lago	UMIC ethanol
10	Mississippi Tishomingo	Tishomingo St. Park	8-Sep-1980	Paul K. Lago	UMIC ethanol
3	Mississippi Tishomingo	Tishomingo St. Park	28-Jul-1983	P. Miller/S. Sibley	MEMU
5	Mississippi Tunica	Askew wildlife area 14 mi. SE Tunica	6-Jun-1993	E. Lago & S. Testa	UMIC
6	Mississippi Union	Darden Lake	28-Jul-1986	Sam Testa III	UMIC
5	Mississippi Union	2 mi NE Etta	12-May-1992	Paul K. Lago	UMIC
17	Mississippi Union	11 mi W New Albany	28-Jul-1986	Paul K. Lago	UMIC
4	Mississippi Warren	8 mi. NE Bovina	24-Jun-1981	Paul K. Lago	UMIC
10	Mississippi Washington	Yazoo Preserve, Horseshoe Lake	2-Oct-04	Jonas G. king	UMIC
4	Mississippi Wayne	Stateline	20-May-1983	Paul K. Lago	UMIC
11	Mississippi Wayne	3.5 mi. NW State Line	19-May-1983	Paul K. Lago	UMIC
19	Mississippi Wayne	Waynesboro	19-May-1983	Paul K. Lago	UMIC ethanol
10	Mississippi Wilkinson	Palmetto Point	24-May-05	Jonas G. King	UMIC
3	Mississippi Wilkinson	Buffalo River at Hwy 61	24-Jun-1982	Paul K. Lago	UMIC ethanol
1	Mississippi Yalobusha	Tillatoba Lake	22-May-04	J.G. King, P.K. Lago	UMIC
5	Mississippi Yalobusha	1 mi. S Coffeerville	28-Mar-1997	R.B. Bell	UMIC
1	Mississippi Jackson	11 mi NW Van Cleave	25-May-1987	Sam Testa III	UMIC
22	Mississippi Lamar	5 mi. N Baxterville	19-Apr-1979	Paul K. Lago	UMIC ethanol
1	Mississippi Oktibbeha	Starkville	26-May-1982	W.H. Cross	MEMU
1	Mississippi Oktibbeha	Starkville	25-Jul-1981	W.H. Cross	MEMU
2	Mississippi Stone	UMIC Forest lands	7-May-1987	Paul K. Lago	UMIC
3	Mississippi Stone	UMIC Forest lands	9-Apr-1992	Paul K. Lago	UMIC
2	Missouri Randolph				CASC
1	Missouri St Louis				CASC
1	Missouri Wayne	Williamsville			CASC
1	N Carolina Edgecombe	8 mi. WSW Tarboro	7-Sep-1979	W.H. Cross	MEMU
1	N Carolina Edgecombe	8 mi. WSW Tarboro	25-Jul-1979	W.H. Cross	MEMU
1	N Carolina Edgecombe	8 mi. WSW Tarboro	8-Sep-1979	W.H. Cross	MEMU
2	N Carolina Edgecombe	8 mi. WSW Tarboro	14-Jun-1979	W.H. Cross	MEMU
1	S Carolina Aiken				CASC
3	S Carolina Effingham	2 mi. W Melgrim	28-Jun-1982	A.C. Benke	UMIC
4	S Carolina Effingham	Okwakee Creek	11-Jun-1983	A.C. Benke	UMIC
1	S Carolina Florence	Florence			CASC
1	S Carolina Florence	Florence			CASC
2	S Carolina Florence	Florence	30-Mar-1977	W.H. Cross	MEMU
1	Tennessee Loudon				CASC
2	Tennessee Loudon	Sweetwater Valley	11-Aug-1982	W.H. Cross	MEMU
1	Tennessee Morgan	Burrville			CASC
2	Texas Cameron	Brownsville	17-Jun-1981	W.H. Cross	MEMU
1	Texas S. Patricio	Welder WR, 8 mi NE of Sinton	15-May-1985	Paul K. Lago	UMIC
1	W Virginia Cabell				CASC
2	W Virginia Hardy				CASC
1	W Virginia Mason				CASC
1	W Virginia Wayne				CASC

