INTRODUCTION

Taxonomy of North American Hydrochidae, containing only the nearly cosmopolitan genus *Hydrochus*, has been in a state of disarray for nearly a century. This was true during the first part of the 1900’s primarily because species descriptions were poorly written, keys were not available or not diagnostic, types were either inaccessible or ignored by authors, and the importance of male genitalia in diagnosing species was not yet recognized. More recently, the problem was exacerbated by the various works of Dewanand Makhan involving North American members of the genus (Makhan 1994, 1995a, 1995b, 1996, 2000, 2001, 2004a, 2004b, 2005). Makhan’s continuous application of poor taxonomic concepts, intellectual misappropriation, and lack of scientific professionalism is well known and has extended well beyond *Hydrochus* into several other groups (Hansen 1998, 1999; Jäch 2000; Short and Hebauer 2003; Steiner et al. 2003; Oliva 2000; Watts 1999). Taxonomic confusion within the genus has been created primarily by great variation in external features, eg. color, size and surface sculpturing, which is often readily apparent within individual populations of the various species. In most cases, positive species identification requires examination of male genitalia, while females can, generally, be identified only by association with males from the same locality or collecting event.

In 1975, Hellman produced a comprehensive study of the North American members of the genus *Hydrochus* as a dissertation project. Prior to this work, 31 species had been described from the Western Hemisphere. As a consequence of his
study, 50 species were recognized as occurring in North America, 28 of which were considered to be new, and six synonyms were established. While the production of the dissertation represented a significant advancement in Hydrochus taxonomy, the work was never published. Names ascribed to new species were unavailable for taxonomic purposes and the synonyms never recognized. Some of the new species have been subsequently described by others (Smetana 1988; Makhan 1994, 1995a, 1995b, 1996, 2000, 2001, 2004a, 2004b, 2005). Several of Hellman’s undescribed species have received numerical designations in keys to Florida (Epler 1996, 2010) and South Carolina (Ciegler 2003) water beetles. Prior to the current work, Hydrochus comprised 34 described species in the United States and Canada, with 16 occurring in the southeastern United States. As now configured, the genus comprises 31 described species in the United States and Canada, with 16 occurring in the southeastern United States.

The stimulus for this work was a rather large collection of specimens available through previous research and collecting efforts in and around aquatic habitats throughout Mississippi. Preliminary examination of specimens revealed significant problems with available keys and a few obviously new species, as well as species fitting some of Hellman’s (1975) descriptions. Problems with the work of Makhan were similarly apparent.

In this study, our first goal was to validate one new species set forth in Hellman’s dissertation. Secondly, by examination and imaging of all related type materials, we hope to bring some stability to Hydrochus taxonomy through verification of species ambiguously described by Makhan. Lastly, we review the Hydrochus found in the state of Mississippi, provide a key to species, record available biological data, and note seasonal and geographic distributions of the species occurring here.

**MATERIALS AND METHODS**

**Study Area** — A great diversity of aquatic habitats occurs within Mississippi, ranging from small to large swamp systems, bogs, seeps, woodland ponds, flowing springs, and myriad rivers and streams. Though there are numerous small to large man-made impoundments, the state lacks natural lakes aside from oxbows formed by the remnants of old river channels. The state lies principally within the Gulf-Atlantic Coastal (Eastern) Plain physiographic region of North America, with only the extreme northeastern corner exhibiting an Appalachian influence. Eleven physiographic regions are represented in the state (Figure 1) (Cross et. al. 1974; ESRI 2011; Lowe 1915; Mississippi Dept. of Environmental Quality 2013; U.S. Dept. of Commerce 2014), and are referenced in our discussions of species distributions. See Testa and Lago (1994) for a more detailed discussion of aquatic habitats and descriptions of physiographic regions.

**Specimens Examined** — The diversity of aquatic habitats in Mississippi has spawned equally diverse surveys of aquatic arthropods in the state, most of which occurred during the past 40 years. All of these surveys, particularly for Trichoptera, have involved many hours of light-trapping throughout the state and the bycatch of specimens from these activities has resulted in numerous opportunities to explore portions of our fauna not specifically targeted by the collecting activities. Such is the case with Hydrochus. In total, 1,019 specimens were examined during this study, including many collected by the authors, as well as specimens from University of Mississippi Insect Collection (UMIC), Auburn University Entomology Collection (AUEC), and the Mississippi Entomological Museum (Mississippi State University, Mississippi, MEM). Holotypes and paratypes were borrowed from the Illinois Natural History Survey Insect Collection; the Natural History Museum, London; the Museum of Natural History, Berlin; and Museum of Natural History, Vienna.

Photographs were taken using a Leica DFC digital camera mounted on a Leica Z16 Macroscope. Images were stacked using Leica Application Suite vs. 4.1 with an Automontage module. All measurements were made using a Wild M5 stereomicroscope with a Wild MMS235 digital length measuring set.

Male genitalia were extracted by placing specimens in warm, distilled water for one minute.
Insect pins (Size 00) with hooked tips were used to open the pygidium and separate the genitalia from the surrounding connective tissue. Genitalia were preserved in glycerine in polyethylene plastic microvials (10 mm long x 4 mm diameter), which were mounted below specimens on the insect pin. The authors would like to stress the importance of preserving male genitalia in glycerine rather than applying genitalia to cards using adhesive. Adhesive badly distorts the genitalia, and carded genitalia of all specimens examined during this study were removed and stored in glycerine as described above, including those of types.

**Family Hydrochidae**

Family Hydrochidae Thomson

Hydrochidae Thomson, 1860, p. 75.
Type genus: *Hydrochus* Leach, 1817, p.75, by monotypy.

Small to moderate beetles, elongate to sub-

elongate in form, with protuberant eyes; antennae with seven antennomeres, three antennomeres distal to cupule densely pubescent; maxillary palpi with four palpomeres, labial palpi with three palpomeres; pronotum narrowed at base, always narrower than base of elytra. Venter with five visible abdominal sternites, pubescent, apex of fifth visible sternite with a small non-hydrofuge pubescent plaque, basal portion of plaque bearing numerous stout setae in various patterns, terminal portion appearing thin, hyaline and smooth. Male genitalia trilobed with parameres articulating with a basal piece. Tarsi with bisetose empodium. Eggs are laid singly or in groups, all eggs surrounded with a silken sac and cemented to various submerged materials. Larvae with mandible possessing large retinaculum and small mola; stipes with rudimentary lacinia; palpiger without galea; abdomen parallel sided with eight fully developed segments; terminal segments forming a stigmatic atrium.

Figure 1. Physiographic regions of Mississippi. I= Coastal Meadows, II= Southern Pine Hills, III= Jackson Prairie, IV= Loess Hills, V= Alluvial Plain, VI= North-Central Hills, VII= Flatwoods, VIII= Pontotoc Ridge, IX= Black Prairie, X= Tombigbee-Tennessee River Hills, XI= Paleozoic Bottoms.
Genus *Hydrochus* Leach (1817)

Type species: *Elophorus elongatus* Fabricius, 1792 (≡ *Silpha elongata* Schaller, 1783), by subsequent designation by Curtis 1831, p. 359.

Members of this genus superficially resemble members of the hydrophiloid genus *Helophorus*, but upon closer examination, species of *Hydrochus* differ in having the pronotum more or less equally as long as wide with the base much narrower than elytral base. The pronotal disc in *Hydrochus* species is rugose, deeply and coarsely punctate and foveate. *Helophorus* species have the pronotum much wider than long and with five distinct longitudinal sulci on the disc.

Mississippi species of *Hydrochus* range in length from 2.2 mm to 6.1 mm.

Head as long as wide and with very large, rounded protuberant eyes. Dorsally, clypeus large, convex and densely punctate; epistomal sulcus either lacking or distinct. Mid-occipital region of head constricted, more narrow than interocular region. Maxillary palpi with four palpomeres, basal palpomere very small and terminal palpomere largest and swollen subapically. Labial palpi with three palpomeres, the first two very short and together subequal in length to ultimate palpomere. Antennae subequal in length to maxillary palpi. Mentum pentagonal with disc often depressed or foveate medially; submentum much broader than long, rectangular, with disc flat or foveate.

Thorax with pronotum convex, usually as long as greatest width, widest in apical half, and distinctly narrowed basally; anterior margin may be arcuate, straight or recurved just behind the eyes so that anterolateral angles are anteriorly produced; posterior margin arcuate; disc generally coarsely, densely punctate or granulate-punctate; pronotal disc exhibits various stages of foveal development, ranging from nearly obscured to having nine prominent foveae. Foveae arranged across the disc in three series: anterior series with two small or indistinct anterolateral foveae; medial series with a median fovea and two adjacent mediolateral foveae near lateral margins; third, or posterior, series with four foveae, two elongate basomedial foveae on each side of midline and two much smaller basolateral foveae near posterolateral angles. Prosternum very irregularly foveate and moderately densely punctate; venter completely covered with a dense hydrofuge pubescence, including the coxae, trochanters and extending a short distance onto base of femora. Coxal cavities closed behind. The mesosternum coarsely punctate, irregularly foveate with hydrofuge pubescence as on the prosternum. Mesocoxae divided on the midline by a carinate posterior mesosternal process that frequently appears posteriorly continuous with apex of the similarly carinate metasternal process. Metasternum convex medially, very unevenly and irregularly foveate, coarsely punctate and with pubescence similar to that of the prosternum and mesosternum. Legs generally unmodified. All tarsi bear a pair of large, strong curved claws.

Elytra strongly convex, elongate to sub-elongate, occasionally very broad. Humeral umbones distinct, frequently elevated. Each elytron has ten rows of coarse, deep, regular punctures. The intervals usually vary from costate to flat, occasionally callosed or tuberculate. Each interval bears a series of very fine setae. Intervals typically vary in degree of elevation.

Abdomen with five sternites fully visible, first with a broad medial and two shorter sub-lateral longitudinal carinae of varying elevations; carinae coalesce near base, with a broad, transverse, irregularly raised area. Remaining sterna broadly carinate or raised to varying degrees across the sternum along the anterior margin.

The male genitalia are trilobed, characterized by a phallobase, median lobe (aedeagus), and paired, symmetrical lateral lobes (parameres). Shape of the aedeagus and parameres varies greatly between species, but appears uniform within species, thus both structures are useful diagnostically. The shape of the apicoventral space of the phallobase shows less variation between species, but can be equally diagnostic.

The male genitalia of *Hydrochus* are of three basic types. The form most commonly seen is characterized by an elongate phallobase, median lobe, and paired, symmetrical lateral lobes. The basoventral opening of the phallobase, which receives the ejaculatory duct, is terminally located.

The second genital form is limited to
Hydrochus species in North and South America and bears a set of accessory lateral lobes. These accessory lobes, called pseudoparameres, are weakly sclerotized membranous sheets appressed to a portion of the ventral and lateral surface of the parameres. Pseudoparameres attach at the junction of the phallobase and parameres. The shape and size of the pseudoparameres usually parallels that of the parameres. The presence or absence of pseudoparameres is more useful diagnostically than the length, size or shape of these structures.

The third genital form is characteristic of the *H. scabratus* group of North America and the *H. brevis* group of northern Europe. In this form, the parameres are expanded basally and the phallobase is two to five times the length of the parameres. The basoventral opening that receives the ejaculatory duct in the phallobase is not terminal as in the other forms, but is subapical. The apex of the phallobase is closed and typically rounded. The aedeagus is generally half the length of the parameres and rarely overlaps the anterior edge of the phallobase.


Examination of large series of several species known to exhibit the structures in question has revealed great variability in size and shape of these membranous structures. Individuals of the same species from the same series may lack or possess the structures. This has led to the conclusion that these structures represent the internal sac of the aedeagus in various states. As they are variable in size and shape, we have chosen to exclude them as diagnostic characters for identification.

### Key to the species of Mississippi Hydrochus

1. Epicranial suture absent, if present epicranial stem present, lateral arms absent; two large pits evident in interocular space; epipleura impunctate. ......... 2

1’. Epicranial suture present; interocular space lacking pits; epipleura variable ......... 4

2. Male parameres abruptly narrowing beyond basal third; parameres parallel when viewed dorsally, never diverging or converging to the point of contact apically; parameres straight when viewed laterally; size larger, 3.4–5.6 mm ............ *H. callosus*

2’. Male parameres gradually tapering; parameres diverging apically or converging to the point of contact when viewed dorsally; parameres curved when viewed laterally; size smaller, 2.6–3.9 mm ............. 3

3. Elytral apices slightly produced with sutural angles nearly acute; incurved portion of male parameres in lateral view with sub-apical notch ............. *H. jiawanae*

3’. Elytral apices at sutural angles rounded; incurved portion of male parameres in lateral view lacking sub-apical notch, entirely smooth ............. *H. falsus n. sp.*

4. Length 4.8–6.1 mm; phallobase approximately equal to length of parameres; parameres, lateral view, ventral surface flat, dorsal surface equal in elevation to dorsal surface of phallobase, parameres beyond junction with phallobase raised and rounded one-half length of parameres, apical half of parameres tapering gradually to apex; apex blunted, straight; aedeagus extending seven-eighths length of parameres; aedeagus, lateral view, ventral surface flat, dorsal surface with three swellings decreasing in size towards apex, two apical swellings extending above dorsal surface of parameres, apex weakly acuminate; epipleura impunctate and smooth ............. *H. rugosus*

4’. Length <4.6 mm; genitalia not as figured; epipleura bearing some punctuation ......... 5

5. Male genitalia with phallobase much shorter than parameres .............. 6

5’. Male genitalia with phallobase longer or subequal in length to parameres .......... 8

6. In lateral view, aedeagus nearly reaching apex of parameres, phallobase two-thirds length of parameres; epipleura moderately, coarsely punctate, punctures becoming indistinct in apical fourth ............. *H. simplex*

6’. In lateral view, phallobase approximately three-
Hydrochidae of Mississippi

7. In lateral view, aedeagus approximately two-thirds length of parameres with submedial, dorsal swelling; epipleural punctures occasionally coalescing ........... H. pajnii

7'. In lateral view, aedeagus extending nearly to apex of parameres and lacking submedial, dorsal swelling; epipleural punctures arranged in a single series, not coalescing ............ H. excavatus

8. In lateral view, aedeagus lacking swelling or strong undulation on dorsal margin ........ 9

8'. In lateral view, aedeagus with swelling or strong undulation on dorsal margin .......... 10

9. In dorsal view, apicoventral space of phallobase triangular in shape, dorsal margin of aedeagus straight; epipleura shallowly, finely punctate on basal three-fourths .............. H. rufipes

9'. In dorsal view, apicoventral space of phallobase not triangular in shape, space occurs across full width of phallobase, dorsal margin of aedeagus narrowing toward apex; epipleural punctures large, irregular, and shallow from base to apical fourth ..................... H. neosquamifer

10. In lateral view, ventral surface of parameres flattened; in dorsal view, parameres widening into rounded projections, then tapering to apex; epipleura coarsely punctate on basal half, then between middle and apical fourth punctures shallower and smaller, absent in apical fourth ........................................ H. jaechi

10'. In lateral view, ventral surface of parameres concave; in dorsal view, parameres tapering to apex, but lacking rounded projections .......... 11

11. In lateral view, swellings of dorsal margin of aedeagus subequal in size, not deeply incised dorsally; epipleura irregularly punctate ............................. H. inaequalis

11'. In lateral view, swellings of dorsal margin of aedeagus varying greatly in size, sub-medial swelling larger, aedeagus deeply incised apically of sub-medial swelling; epipleura moderately, coarsely punctate on basal three-fourths, punctures moderately deep near base then gradually shallower until disappearing on apical half, punctures absent beyond apical half ........ H. schereri

Hydrochus callosus LeConte, 1855

Hydrochus callosus LeConte, 1855: 359.
Hydrochous callosus LeConte; Zaitzev, 1908a: 334.

Description — Male—Very robust, sub-elongate, very strongly convex; maximum length 4.4 mm, maximum width 1.8 mm; maximum width of head across eyes 1.0 mm, minimum interocular distance 0.6 mm; maximum length of pronotum 1.0 mm, maximum width 1.2 mm, minimum width at base 1.0 mm; maximum length of elytra 3.0 mm.

Dorsum dull, head piceous, pronotum and elytra dark reddish brown; however, entire dorsum with variably shining metallic green, gray, blue-gray, and brassy reflections obscuring nearly all ground color. Mentum and submentum shiny rufopiceous with dull metallic reflections similar to those of dorsum. Antennae and palpi reddish brown with apex of ultimate maxillary palpomere slightly darkened or piceous. Legs reddish brown with tibiofemoral joints and apex of ultimate tarsomeres dark brown or piceous; ground color of femora and tibiae somewhat obscured by dull metallic green reflections. Head across eyes subequal to width of pronotum; lateral margins of clypeus slightly raised, disc gradually, shallowly, broadly, ridged on midline, ridge more broadly expanded basally; clypeal punctures moderately large, similar to those on interocular region, deep, dense, most irregularly spaced in close groups of twos, threes, or fours and separated within groups by less than one-third width of a puncture; epistomal sulcus lacking; interocular region very scabrous; midcranial depression replaced by a broad, elevated ridge which separates and extends length of submedial depressions; submedial interocular depressions elongate, deeply foveate, coarsely punctate, punctures scattered, occasionally coalesced, and generally closer than on surrounding elevated areas of disc; most punctures coarse, same density but larger than those on base of clypeus; elevated areas between eyes and submedial
depression unevenly but strongly elevated, nearly tuberculate; mid-occipital region between posterolateral margin of eyes not constricted but broadly raised and anteriorly continuous with ridge on midline separating submedial depressions; mentum finely, densely punctate, with nearly entire discal surface strongly foveate medially; submentum very minutely and sparsely punctate with only two very small, deep foveae on disc.

Pronotum very strongly, unevenly convex, wider than long, widest in apical third; anterior margin straight; lateral margins slightly inflexed in apical half; punctuation on inflexed surface same as on dorsum; sides viewed from above, round, very strongly sinuate with apical half slightly arcuate, basal half incurved, strongly narrowed to base behind middle; posterior margin strongly arcuate medially; disc rugose; outline of midline in lateral view very prominently raised in apical fourth just anterior to median fovea, then broadly depressed before middle, basal half slightly raised near middle then flattened on basal third; punctures very dense, very deep, coarse, irregularly spaced, most separated by one-half to one-third width diameter of a single puncture, denser and finer toward anterolateral margins; middle of median fovea distinctly impunctate, smooth. Anterolateral foveae indistinct; median fovea large, elongate, nearly twice as long as wide and equal to one-half length of pronotum at midline, foveal margins anterolaterally shallow, interrupted, basally mostly indistinct and open to basomedial foveae; mediolateral foveae round, moderately deep, nearly equal to one-third length of median fovea; basomedial fovea very feeble; basolateral foveae small, deep, larger and more distinctly developed than anterolateral foveae; middle of pronotum slightly impressed just anterior to scutellum.

Venter with posterior mesosternal process between mesocoxal cavities sharply carinate and elevated slightly above level of metasternal carina.

Elytron strongly convex, sub-elongate with strongly deflexed sides; lateral margin medially explanate, and strongly arcuate behind middle to apical fourth, apical fourth constricted subapically; apex slightly angulate behind 4th interval, then abruptly rounded to suture; serial punctures large, deep, those on disc separated by slightly less than width of a puncture, punctures in apical third and near lateral margin smaller and denser; fine setigerous punctures of intervals arranged on each interval in single series except where doubled on elevated portions of interval, setigerous punctures denser in apical fourth and along sutural intervals; sutural interval in basal half flat, twice width of other intervals, becoming gradually wider and costate in apical third; remaining intervals broad, separated by nearly twice their width, most appear flat and uniform in width except as follows: 2nd, 3rd, 6th, 7th, and 8th intervals slightly raised in basal fourth, with basal third of 3rd interval subcostate, 2nd and 3rd intervals slightly raised from just before middle to the beginning of the apical third where 2nd, 3rd, and to a lesser degree 4th intervals become strongly thickened and raised together (callused), the three calli coalesce and together form an obliquely transverse prominent callus with 3rd interval raised higher than any other interval; 2nd interval in apical fourth only slightly raised from behind callus to margin; 4th interval in apical fourth briefly costate at midlength between callus on beginning of apical third and apical margin of elytron; 6th interval briefly and slightly costate just anterior to the adjacent callus on 4th interval; 8th interval unevenly raised, and only slightly costate near middle, costa on 8th interval nearly twice length but not elevated above costa of 6th interval; epipleuron impunctate, smooth, basal third slightly impressed on midline.

Male genitalia. Figure 2. Entire genital structure dorso-ventrally compressed. Phallobase greater than two times length of parameres; apex round, closed; widest medially, at narrowest point equal to width of parameres; basoventral opening subapical. Apicoventral space widest at junction of parameres and phallobase, narrowing to acuminate point. Parameres symmetrical, widest at base, anterior two-thirds straight-sided, greatly narrowed; apices weakly deflexed. Aedeagus short, two-fifths length of parameres; viewed laterally, constricted medially with apex unevenly rounded; in dorsal view, with two basal projections visible posterior to parameres in apicoventral space of phallobase.

Female — Indistinguishable from males.
Variation — The specimens vary in length from 3.4–5.6 mm and in width from 1.7–2.3 mm. The
metallic colors vary from a bright brassy golden green to dull green, gray-green or lead gray. The elytral intervals show considerable variation in the degree of reflected coloration.

**Distribution** — *Hydrochus callosus* is distributed from Florida and Georgia, and west to Texas. According to Young (1954), this species is abundant throughout the Apalachicola lowlands of northern Florida. In Mississippi, *H. callosus*, occurs in most physiographic regions, but is apparently absent from the regions of higher elevation in the northeastern corner of the state (Fig. 3).

**Material Examined** — We have examined 46 specimens from Mississippi localities, including: Amite Co. 7 mi ENE Liberty [UMIC], Clarke Co. 1.5 mi N Enterprise [UMIC], George Co. 12 mi SW Lucedale, Pascagoula WMA [UMIC], Hancock Co. 4 mi NW Kiln [UMIC], Lamar Co., Lauderdale Co. 3 mi S Arundel [UMIC], Noxubee Co. 10 mi W Macon [UMIC], Stone Co. UM Forest Lands, Henley Park; 2 mi N Perkinston; T4S-R1W-Sec. 6 [UMIC], Tallahatchie Co. 5 mi WNW Charleston [UMIC], and Tate Co. 2 mi N Coldwater [UMIC].

**Seasonal Distribution** — Mid-April through mid-August.

**Diagnosis** — Externally, *H. callosus* is most similar to *H. falsus* and *H. jiawanae*; however, *H. callosus* can be distinguished from these species by having both enlarged elytral calli and a greater body width. The male genitalia (Fig. 2) narrow abruptly at the basal third of the parameres, while those of *H. falsus* (Fig. 20) and *H. jiawanae* (Fig. 23) taper gradually.

**Biology** — *Hydrochus callosus* may be found in lentic habitats (Epler 2010), as well as in slow flowing streams (Young 1954). Mississippi specimens were collected near swamps, woodland ponds and moderately large rivers, some sandy, others with muddy bottoms.

**Hydrochus excavatus** LeConte, 1855

*Hydrochus excavatus* LeConte 1855: 360.
*Hydrochous excavatus* LeConte; Zaitzev, 1908a: 334.

**Description** — Male—Elongate; maximum length 3.3 mm, maximum width 1.3 mm, maximum width of head across eyes 0.8 mm, minimum interocular distance 0.6 mm; maximum length of pronotum 0.8 mm, maximum width 0.8 mm, minimum width near base 0.75 mm; maximum length of elytra 2.3 mm.

Dorsum dull, head piceous; pronotum and elytra brown; however, various metallic green to gray-green reflections obscure most of ground color. Mentum and submentum rufopiceous with metallic green and violet puncture reflections. Antennae and palpi reddish brown with only tibiofemoral joints and apex of ultimate tarsomeres piceous.

Head across eyes equal to width of pronotum; clypeus rugose, punctures very dense, moderately coarse, most punctures slightly smaller than on interoculular region; with fine setae obscured by metallic reflections; epistomal sulcus fine near lateral margins, gradually broadened and deeply impressed toward middle, punctures within medial epistomal impression frequently coalesced and often obscuring sulcus; interoculular region rugose, gradually, irregularly raised behind epistomal sulcus to vertex; midcranial depression moderately, deeply sulcate, coarsely punctate, punctures nearly coalesced; submedial interocular depressions very irregular, shallow; elevated areas at vertex smooth to irregularly and more sparsely punctate than on surrounding integument; punctures moderately large, very irregularly spaced, with several coalesced or nearly coalesced pairs scattered over discal surface; setae as on clypeus; mid-occipital region broadly constricted between posternal margin of eyes. Mentum finely, very densely punctate, basal two-thirds of disc deeply foveate medially; submentum very sparsely punctate, punctures slightly denser along lateral margin, disc nearly completely covered by two very large, deep foveae.

Pronotum strongly convex, slightly wider than long, widest in apical third; anterior margin straight; lateral margins very strongly and narrowly inflexed; inflexed surface moderately coarsely punctate without the rugose interspaces typical of the dorsal surface; sides of pronotum viewed from above angulate, crenate, teeth coarse and close, very shallowly sinuate in outline with apical half parallel, then slightly incurved behind middle and moderately narrowed to base; posterior margin arcuate medially; punctures moderately coarse,
irregularly spaced and generally separated by one-half width of puncture, denser and slightly finer toward lateral margins; punctures within median fovea less dense than on surrounding discal surface; elevated areas of disc here and there with very small sparsely punctate or smooth areas; discal surface anterolaterally becoming slightly granulate, granules generally small, not very high or well formed. Anterolateral and basolateral foveae moderately deep, rounded, median fovea equal to nearly one-fourth length of pronotum at midline; basomedial foveae much more irregular in form than others, moderately deep, slightly elongate and convergent basally.

Elytron strongly convex, elongate; lateral margin narrowly explanate medially, moderately arcuate medially to apical third, then feebly constricted subapically; apex slightly angulate behind 4th interval and then abruptly rounded to suture; serial punctures very coarse, deep, those on disc separated by one-half width of a puncture, those in apical third becoming smaller and denser; sutural interval near base raised, and wider than others, posteriorly becoming gradually, but only slightly, wider and subcostate on apical third; remaining intervals on the elytron appear narrower than width of a serial puncture; several intervals are unequally raised and widened as follows: 2nd interval slightly costate on basal third, then interrupted to midlength where again becoming slightly raised from behind middle to beginning of the apical third; 3rd interval feebly raised near base, then interrupted, similar to 2nd interval, and becoming moderately costate from behind middle to beginning of the apical third; 4th interval unequally raised in basal half with interval behind basal fourth becoming slightly broadened and moderately costate to just before middle, interval then interrupted and flattened to where moderately broadened and callused on beginning of apical third, callus very prominent, high, much more elongate than wide; interval unevenly raised over most of its length, with a small, weak but distinct costa near middle; 8th interval elevated like 6th interval, but with a small weak costa near middle; 7th interval near middle slightly sinuate and nearly coalesced with small costa on 8th interval; epipleuron moderately coarsely punctate, punctures arranged in a single series, shallow and somewhat more irregularly spaced than on dorsum.

Male genitalia. Figure 4. Phallobase three-fourths length of parameres; apex round; widest at junction with parameres, tapering to apex; phallobase at junction with parameres equal to maximum width of parameres; basoventral opening terminal. Apicoventral space sagittate, widest anteriorly narrowed to acuminate angulation posteriorly. Parameres symmetrical, widest at base, tapering to apex, sinuate in dorsal view; in lateral view, tapering toward apex, ventral surface nearly flat (weakly concave) to apex; apices straight. Aedeagus five-sixths length of parameres; in lateral view, forked in apical fourth, apex acuminate; widest at junction with parameres and phallobase, tapering to apex. Apicoventral space of phallobase receiving two dorsal projections of aedeagus extending two-thirds length of apicoventral space.

Female — Indistinguishable from males.

Variation — Specimens vary in length from 2.8–3.3 mm and in width from 1.0–1.3 mm. Pronotal foveae vary from moderately deep to shallow. Those specimens exhibiting more shallow foveae have less distinct elevations on the elytral intervals.

Distribution — Hydrochus excavatus occurs from New York south to Florida and as far west as Louisiana and extends up the Mississippi River valley into southern Illinois and Indiana. (Arnett 1983; Notman 1919, White et al. 1985). Hydrochus excavatus is found in the Southern Pine Hills (II), North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), and Black Prairie (IX) regions of Mississippi (Fig. 5).

Material Examined — We have examined five specimens from Mississippi localities, including: Choctaw Co. 12.5 mi NNE Weir [UMIC], George Co. 12 mi SW Lucedale [UMIC], and Oktibbeha Co. 3 mi W of Adaton, 33°29'00"N, 88°58'13"W [MEM].

Seasonal Distribution — Late June through mid-August.

Diagnosis — Hydrochus excavatus most closely resembles H. inaequalis and H. pajnii; however, H. excavatus possesses epipleural punctation arranged in a single series, which distinguished it from the others, which have
coalescing epipleural punctures or irregular epipleural punctures. Additionally, *H. excavatus* can be separated from *H. pajnii* by the slightly larger size and higher, broader callus of the 4th elytral interval of the latter. Due to variation between the species in size and prominence of the calli on the 4th elytral interval, using this character might lead to misidentifications. The genitalia of *H. inaequalis* (Fig. 6) differ from those of *H. pajnii* (Fig. 26) and *H. excavatus* (Fig. 4) in having a concavity present on the ventral surface of the parameres, the apex of the parameres decurved, and the aedeagus with an extension below the ventral surface of the parameres. *Hydrochus pajnii* can be separated by the extension of the aedeagus above the dorsal surface of the parameres and a large swelling in the basal half of the aedeagus. *Hydrochus excavatus* lacks the large dorsal swellings of the aedeagus seen in *H. pajnii* and the aedeagus does not extend beyond the parameres ventrally, dorsally, or apically.

**Biology** — Specimens have been collected at black light or ultraviolet light near ponds, streams, and pools (Ciegler 2003). Mississippi specimens were collected from a small stream and in black light traps set near a large river and a marsh.

**Hydrochus inaequalis** LeConte, 1855

*Hydrochus inaequalis* LeConte 1855: 359.

**Description — Male**—Elongate, moderate size; maximum length 2.6 mm, maximum width 1.2 mm, maximum width of head across eyes 0.8 mm, minimum interocular distance 0.4 mm, maximum length of pronotum 0.7 mm, maximum width 0.8 mm, minimum width near base 0.6 mm; maximum length of elytra 1.9 mm.

Dorsum shiny with mixed metallic green, brassy and scattered purple metallic reflections; ground color mostly hidden by reflections, but head piceous; pronotum and elytra brown. Mentum and submentum rufopiceous with scattered green and purple reflections. Antennae and palpi reddish brown with only apex of ultimate maxillary palpmere piceous. Legs reddish brown with tibiofemoral joints and apex of tarsi piceous.

Head across eyes equal to width of pronotum; clypeus very rugose, punctures moderately coarse and very dense; coarser punctuation with numerous fine setae interspersed, most setae obscured by the metallic reflections, epistomal sulcus fine near lateral margin, gradually broadened and moderately impressed mediadly; interocular region rugose, gradually, unevenly raised to vertex behind epistomal sulcus; mid-cranial depression short, deeply sulcate and coarsely punctate, punctures of mixed sizes and coalesced; submedial interocular depressions irregular, very shallow and with slightly closer punctuation than on adjacent discal elevated areas, which are slightly less densely punctate; punctures mixed, most moderately large and irregularly spaced; setae same as on clypeus; mid-occipital region broadly, moderately deeply constricted between posterolateral margin of eyes. Mentum finely, densely punctate, disc moderately deeply foveate medially in basal two-thirds, submentum sparsely, finely punctate, with disc nearly completely covered by two large foveae.

Pronotum rugose, convex, slightly wider than long, widest at anterolateral angles; anterior margin straight; lateral margins narrowly inflexed; sculpture on inflexed surface same as on dorsum; sides of pronotum angulate, sinuate in outline with apical half nearly parallel sided, basal half slightly incurved and narrowed to base; posterior margin arcuate medially, punctures dense, coarse, deep, nearly equal in size, irregularly spaced, those on middle of median fovea slightly less dense than on surrounding discal surface. Anterolateral and posterolateral foveae very shallow; median fovea moderately deep, rounded and approximately equal to one-third pronotal length; mediolateral foveae similar to median fovea; basomedial foveae slightly smaller and shallower than median fovea, and slightly convergent near base.

Elytron elongate, moderately convex; lateral margin feebly explanate medially then moderately arcuate behind middle to apex; apex abruptly rounded to suture; serial punctures large, deep, those on disc separated by nearly one-third width of a puncture, punctures in apical third gradually smaller and much closer; sutural interval in basal half flat and only slightly wider than other intervals, posteriorly becoming gradually wider and subcostate on apical third, remaining intervals
appear narrow, separated by nearly twice their width, with several unequally elevated as follows: 2nd interval narrowly costate on basal third, then interrupted and flattened behind costa to near mid-length where becoming briefly costate to beginning of apical third; 3rd interval raised similarly to 2nd; 4th interval unevenly raised on basal half with highest portion of elevation becoming strongly costate just before middle, interval then becoming briefly interrupted from mid-length, strongly callused on the beginning of apical third; 6th and 8th intervals are distinctly convex, with the 6th interval becoming very briefly costate just anterior to callus on 4th interval; 8th interval becoming briefly costate near mid-length; epipleuron irregularly punctate.

Male genitalia. Figure 6. Phallobase subequal in length to parameres; apex round; width equal throughout, except tapering basally and at junction with parameres, equal to parameres in maximum width; basoventral opening terminal, cordate. Apicoventral space triangular, widest at junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest at base, tapering to apex, widening in apical fifth before narrowing to apex; in lateral view, tapering toward apex, ventral surface concave in apical half, appearing weakly decurved; apices of parameres slightly deflexed. Aedeagus four-fifths length of parameres; in lateral view, tapering to apex, with apex terminating below ventral margin of parameres, acuminate, apical half of ventral surface concave; in lateral view, possessing three dorsal swellings, the swellings decreasing in size towards apex, sinuate dorsally; in dorsal view, forked in apical third, rounded and widest basally, apices parallel and fine. Aedeagus with single, posterior, median process extending one-half length of apicoventral space of phallobase.

**Female** — Indistinguishable from males.

**Variation** — The specimens examined varied in length from 2.7–3.5 mm and width from 1.2–1.4 mm. The elytral intervals show considerable variation in the degree of elevation and width. Some specimens have very narrow intervals with the serial punctures nearly touching across the interval.

**Distribution** — The known distribution of *H. inaequalis* is rather disjunct. The species occurs from New Jersey south to Florida and as far west as Louisiana, with limited records through the Mississippi River Valley north to Missouri and Indiana (Arnett 1983, White *et al.* 1985). This species is widely distributed in Mississippi, occurring in the Coastal Meadows (I), Southern Pine Hills (II), Jackson Prairie (III), North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), Black Prairie (IX), Tombigbee-Tennessee River Hills (X), and Paleozoic Bottoms (XI) physiographic regions (Fig. 7).

**Material Examined** — We have examined 63 specimens from Mississippi localities, including: George Co. 12 mi SW Lucedale, Pascagoula WMA [UMIC]; 7 mi S Benndale [MEM]; Mixon Lakes, 30°50’28”N, 88°45’11”W [MEM]; 3.2 mi S, 1.8 mi E Benndale [MEM], Jackson Co. MS Sandhill Crane NWR, 30°27’34”N, 88°41’28”W [MEM]; 11 mi NW Van Cleave [UMIC], Lafayette Co. 4 mi E Abbeville [UMIC], Lamar Co. 5 mi N Baxterville [UMIC], Lauderdale Co. 3 mi S Arundel [UMIC], Madison Co. 7.5 mi SE Canton [UMIC], Neshoba Co. 1.5 mi N Dixon [UMIC], Noxubee Co. Noxubee NWR, 33°16’08”N, 88°47’47”W [MEM]; Noxubee NWR, 33°15’31”N, 88°46’03”W [MEM]; Noxubee NWR, 33°14’04”N, 88°48’31”W [MEM]; Noxubee NWR, 33°15’22”N, 88°47’46”W [MEM]; Noxubee NWR, 33°16’19”N, 88°45’43”W [MEM]; Noxubee NWR, 33°16’24”N, 88°46’04”W [MEM]; Noxubee NWR, 33°16’23”N, 88°46’03”W [MEM], Okibbeha Co. 7 mi S Starkville, 33°20’04”N, 88°49’06”W [MEM]; 3 mi W of Adaton, 33°29’00”N, 88°58’13”W [MEM], Pontotoc Co. 1 mi SE Ecru [MEM], Simpson Co. 2 mi W Pinola [UMIC]; Tanyard Creek x Hwy 28 [UMIC], Stone Co. Red Creek x Hwy 15 [UMIC]; UM Forestlands [UMIC], Tishomingo Co. Tishomingo State Park [UMIC], and Winston Co. Tombigbee NF, 33°11’50”N, 89°03’20”W [MEM]; Noxubee NWR, 33°13’44”N, 88°54’34”W [MEM].

**Seasonal Distribution** — Early April through late September.

**Diagnosis** — *Hydrochus inaequalis* most closely resembles *H. excavatus* and *H. pajnii*. *Hydrochus inaequalis*, in general, is slightly smaller and has less elevated and narrower callli on the 4th elytral interval than seen in *H. pajnii*. *Hydrochus inaequalis* bears irregular epipleural punctation, unlike the punctation in *H. excavatus*, which is
arranged in a single series. Due to variability and character overlap between species in size and prominence of elytral calli on the 4th interval, this character is often unreliable for species discrimination; however, structure of the male genitalia will distinguish the species immediately (see diagnosis of H. excavatus).

**Biology** — Hydrochus inaequalis has been collected near ponds, ditches, and small pools using ultraviolet light (Ciegler 2003). Mississippi specimens were collected near ponds in coastal savannah, mixed mesic forest, mixed forest, pine forest, and bottomland hardwood forest, near swamps, and in a field of cultivated cotton, as well as various streams and rivers, using black lights, mercury vapor lights, and sun lamps.

**Notes** — Hydrochus inaequalis LeConte was considered by Young (1954) as a synonym of H. foveatus Haldeman, a status accepted by Hansen (1999). Examination of external characteristics formed the basis for Young’s synonymy. Examination of the holotype of H. inaequalis, a male, and a lectotype female of H. foveatus indicated that these are two distinct species. Young (1954) believed these two species to be sympatric in Florida based on information presented by Leng and Mutchler (1918) concerning manuscript notes of Schwarz. However, H. foveatus is recorded only from Texas and Mexico, while H. inaequalis has only been recorded as far west as Louisiana, and the two are not known to have overlapping ranges.

The following characters serve to differentiate H. inaequalis from H. foveatus. Externally, H. foveatus bears impunctate to sparsely punctate raised areas surrounding deep pronotal foveae. Hydrochus inaequalis possess evenly punctate raised areas encompassing shallow pronotal foveae. The epipleuron of H. inaequalis is irregularly punctate, while H. foveatus is impunctate, but bears minute granules on the distal lateral margin in the apical half, but sometimes these are evident basally. Anterior margin of pronotum medially arcuate in H. foveatus, but straight in H. inaequalis. Hydrochus inaequalis is typically smaller (length 2.7 to 3.5 mm), while H. foveatus is generally larger (3.3 to 3.9 mm). The characteristics of the male genitalia are dramatically different between the two species. Hydrochus foveatus possesses pseudoparameres, apically sagittate parameres, and, in lateral view, the dorsal surface of aedeagus is flattened. Hydrochus inaequalis lacks pseudoparameres, possesses acuminate, parallel parameres and, in lateral view, the dorsal surface of the aedeagus is sinuate with three swellings.

**Hydrochus neosquamifer** Smetana, 1988


**Description** — Male—Small, dark, elongate; maximum length 2.5 mm, maximum width 1.0 mm; maximum width of head across eyes 0.7 mm, minimum interocular distance 0.4 mm; maximum length of pronotum 0.6 mm, maximum width 0.7 mm, minimum width near base 0.6 mm; maximum length of elytra 1.7 mm.

Dorsum shiny, ground color of head and pronotum piceous with the granulate elevated areas marked with bright metallic green spots, spots occasionally coalesced, forming irregular metallic areas on disc; elytron rufopiceous with anterior and lateral margins and elevated areas on intervals conspicuously marked with metallic green coalesced spots in short stripes, remaining areas on intervals bear small to nearly imperceptible metallic spots arranged in linear series of varying lengths. Antennae and palpi reddish brown, with apex of ultimate maxillary palpomere darkened. Mentum and submentum piceous. Legs reddish brown with the tibiofemoral joints and apex of tarsi piceous or dark brown.

Head across eyes equal to width of pronotum; clypeus rugose with granulate-punctuation, punctures moderately dense, moderately coarse, occasionally coalesced; fine setae present, but frequently obscured by metallic green spot reflections; epistomal sulcus fine near lateral margins, then gradually broadened and deeply impressed toward middle, sulcus nearly obscured medially by coalesced punctuation; interocular region much more rugose and granulate than clypeus; mid-cranial and submedial depressions shallow but conspicuous, with coalesced punctures; elevated areas adjacent to depressions slightly less punctate than surrounding
discal surface; setae same as on clypeus; mid-occipital region slightly constricted between posterolateral margin of eyes. Mentum very finely, densely punctate, basal two-thirds of disc deeply foveate; submentum impunctate with disc nearly completely obscured by two very large, transverse, deep foveae.

Pronotum moderately convex, imperceptibly wider than long, widest just behind anterior angles; anterior margin straight; lateral margins very strongly, narrowly inflexed; inflexed surface rugose, and punctate, same as on dorsum; sides of pronotum viewed above shallowly crenate, angulate, sinuate with apical half arcuate, then recurved behind middle and narrowed to base; posterior margin arcuate; discal sculpture coarsely granulate punctate, granules flat on top, those near midline low to indistinct but gradually increasing in height toward lateral margin, punctures moderately coarse, irregularly spaced with most separated by one-half to one-third their width. Anterolateral and basolateral foveae small, moderately deep, open to anterior pronotal margin; mediolateral and basomedial foveae moderately deep, round and similar in outline; basomedial pair slightly more irregular and slightly smaller than others.

Elytron convex, elongate, subparallel; lateral margin feebly explanate medially, moderately arcuate medially to apex; apex rounded; serial punctures coarse, deep, those on disc separated by less than one-half their width, those in apical fourth becoming smaller and denser; setae same as on pronotum but obscured by shiny reflections; sutural interval wide and subcostate near base, then gradually becoming slightly wider posteriorly and costate on apical third; remaining intervals very narrow, most separated on disc by slightly more than twice their width, even numbered intervals slightly more convex and unequally costate; intervals unequally raised and widened as follows: 2nd interval slightly raised and broadened on basal fourth, then interrupted to mid-length where again becoming slightly raised and broadened to the beginning of apical third; 3rd interval raised like 2nd interval on the basal eighth, then again raised like 2nd just behind mid-length to beginning of apical third; 4th interval unevenly raised behind base to basal third where becoming slightly costate and broadened to mid-length, then interrupted and flat to beginning of apical third where slightly calloused, callus weakly elevated, elongate, slightly wider than anterior costa on interval; 6th and 8th intervals more strongly convex than adjacent odd numbered intervals; 7th interval sinuate near middle and nearly coalesced with 8th interval; epipleuron feebly concave and punctate from base to apical fourth, punctures rather large, irregular, very shallow.

Male genitalia. Figure 8. Phallobase subequal to parameres in length; apex round, open; widest medially, tapering to base and junction with parameres, always more narrow than parameres; basoventral opening terminal. Apicoventral space large, widest at junction of parameres and phallobase, sides straight before curving and narrowing to posterior, acuminate angulation. Parameres symmetrical, tapering to apex; in lateral view, tapering toward apex, ventral surface moderately flat to apex, dorsal surface rounded and approximately equal in elevation in basal two-thirds then tapering to apex; apices straight, inner margin straight, outer margins weakly sinuate. Aedeagus extending six-sevenths of parameres; in lateral view, ventral surface flattened, apex blunted, dorsum elevated above dorsal surface of paramere at junction with phallobase, flattened in apical half, gradually tapering to apex, apical fifth extending above dorsal surface of paramere; in dorsal view, forked in apical half, tines parallel and thin; posterior projection of aedeagus extending three-fourths length of apicoventral space of phallobase, forked in apical half of extension.

Females — Indistinguishable from males.

Variation — Specimens vary in length from 2.3–3.0 mm and in width from 0.8–1.3 mm. The density of metallic spots on the head and pronotal elevated areas varies considerably from nearly no spots to the spots appearing coalesced. Some specimens have little to no green metallic reflections. These specimens are dark, but retain a shiny appearance. Specimens from the southern end of the range lack the spots typical of northern forms of this species. Pronotal foveae may be more shallow, but are rarely deeper than described above.

Distribution — *Hydrochus neosquamifer* occurs from Virginia to Maine, into Canada (Ontario and Quebec), as far west as Wisconsin and
North Dakota and south from Indiana through the Mississippi River Basin to Mississippi. (Hilsenhoff 1995a, 1995b, Smetana 1988, White et al. 1985). This species is known from disjunct localities in the Loess Hills (IV), Alluvial Plain (V), North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), Black Prairie (IX), and Tombigbee and Tennessee River Hills (X) physiographic regions in Mississippi (Fig. 9).

**Material Examined** — We have examined eight specimens from Mississippi localities, including: Noxubee Co. Noxubee NWR, 33°16’34”N, 88°44’33”W [MEM]; Noxubee NWR, 33°16’19”N, 88°45’43”W [MEM], Tallahatchie Co., and Winston Noxubee NWR, 33°13’53”N, 88°54’32”W [MEM].

**Seasonal Distribution** — Late July to late August.

**Diagnosis** — *Hydrochus neosquamifer* most closely resembles *H. rufipes*; however, the former is generally smaller and the elytral calli are less prominent on 4th elytral interval than they are in *H. rufipes*. Examination of the male genitalia will provide positive identification, particularly following careful comparison of the shape of the apicoventral space of the phallobase. In *H. rufipes*, this space is smaller and sagittate or triangular, while in *H. neosquamifer* the space is larger with nearly parallel sides in basal half.

**Biology** — All Mississippi specimens were collected near water in bottomland hardwood or mixed forest using black light. Specimens from previous studies were collected around ponds and marshes (Hilsenhoff 1995a).

**Notes** — The name *Hydrochus neosquamifer* was first ascribed to Hellman in the checklist presented by White et al. 1985, though no description had been published. Smetana (1988) first formally described the species using the same specific epithet.

**Hydrochus rufipes** Melsheimer, 1844

*Hydrochus rufipes* Melsheimer 1844: 100.

*Hydrochus rufipes* Melsheimer; Zaitzev, 1908a: 335.


*Hydrochus impressus* Zimmermann; Zaitzev, 1908a: 335.

**Description** — Male—Elongate, slightly broadened; maximum length 3.4 mm, maximum width 1.3 mm; width of head across eyes 0.8 mm, minimum interocular distance 0.8 mm; maximum length of pronotum 0.8 mm, maximum width 0.8 mm, minimum width near base 0.75 mm; maximum length of elytra 2.3 mm.

Dorsum shiny, head piceous, pronotum and elytra brown, often with metallic green reflections obscuring nearly all ground color. Mentum and submentum same color as dorsum of head. Antennae and palpi reddish brown with base and apex of each tarsomere darkened. Legs reddish brown with tibiofemoral joints and apex of tarsus darkened.

Head across eyes as wide as pronotum; clypeal punctures moderately coarse, dense, irregularly spaced; coarser punctures with numerous fine setae interspersed, but setae often obscured by shiny reflections; epistomal sulcus fine near margins, gradually broadened and deeply impressed toward middle, coarse punctures within sulcus coalesced; interocular region rugose, gradually, irregularly raised to vertex behind epistomal sulcus; mid-cranial depression short, deeply sulcate and coarsely punctate, punctures coalesced; submedial interocular depression deep, broader than mid-cranial depression; elevated areas of disc more sparsely punctate than surrounding discal surface; most punctures moderately large, very irregularly and closely spaced, randomly coalesced; mentum finely, densely punctate, basal two-thirds of disc moderately, deeply foveate medially; submentum sparsely, finely punctate with disc bearing two large, deep foveae.

Pronotum moderately convex, as wide as long, widest in apical half; anterior margin straight medially with anterolateral angles indistinctly produced; lateral margins strongly, moderately broadly inflexed; inflexed portion punctate, similar to that on dorsum; sides of pronotum viewed from above rounded, feebly crenate, sinuate in outline with apical half arcuate, then slightly incurved behind middle and moderately narrowed to base; posterior margin moderately arcuate medially; punctures moderately coarse, slightly larger than on head, very irregularly, closely spaced, those near lateral and anterior margins denser and finer.
elevated areas laterally adjacent to median fovea with only a small impunctate area, remaining area punctate; setae same as on head. Anterolateral and basolateral foveae similar, small, moderately deep; median and mediolateral foveae shallow, rounded, with median fovea slightly less than one-fourth length of pronotum; basomedial foveae slightly smaller and more irregular than median fovea.

Elytron moderately strongly convex, elongate; lateral margin feebly constricted in basal third, slightly explanate medially then moderately arcuate to apex; apex rounded to suture; serial punctures coarse, deep, those on disc separated by nearly one-third width of a puncture, those on apical third smaller and denser; fine setae on intervals obscured by metallic reflections; sutural interval flat, wider than other intervals at base, then posteriorly becoming gradually wider and costate on apical third; remaining intervals on elytron narrower than serial rows of punctures, most separated by approximately twice width of an interval, intervals are unequally raised as follows: intervals 1-3 slightly raised on basal sixth, 2nd and 3rd intervals similarly moderately costate from mid-length to beginning of apical third, 3rd slightly costate just before mid-length, then interrupted, flat medially and then slightly callused on beginning of apical third; 6th and 8th unequally convex and raised above adjacent odd numbered intervals; 7th interval near middle slightly sinuate and nearly coalesced with 8th interval; epipleuron feebly concave and very shallowly, finely punctate on basal three-fourths.

Male genitalia. Figure 10. Phallobase equal to length of parameres; apex pointed; widest medially, tapering to base and junction with parameres, maximum width same as parameres; basoventral opening terminal, cordate. Apicoventral space triangular or sagittate in form, widest immediately behind junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest at base, tapering to apex, inner and outer margins sinuate; in lateral view, tapering toward apex, ventral surface mostly flat, but upturned in apical fifth, dorsal surface narrowed at junction with phallobase and extending to basal fourth of paramere, convex and highest medially, apical one-fourth tapering and reflexed to apex. Aedeagus six-sevenths length of parameres; in lateral view, dorsal surface flattened, ventral surface flat in basal half, tapering to apex in apical half, apex truncate; dorsally extended above dorsal surface of paramere in apical seventh; in dorsal view, forked in apical third, tines fine, parallel, converging at apex. Aedeagus with posterior, narrowed process extending two-thirds length of apicoventral space of phallobase, extension of aedeagus widening at apex producing small, apical concavity.

Female — Indistinguishable from males.

Variation — Length of specimens examined varies from 2.7–3.8 mm and width from 1.2–1.4 mm. The intensity of the metallic reflections varies from bright and shiny to the opposite extreme where specimens appear dull and dark. Frequently the brown ground colors will show through the metallic green reflections. Specimens often have two small, irregular maculae on each elytron, one just before middle on the 2nd interval and a second more variable macula just anterior to the callus on the 4th interval. As with most hydrochid species, there is some variation in the density of punctation, as well as width and height of the elytral intervals.

Distribution — The range of *Hydrochus rufipes* extends from Florida north to Michigan and west to Wyoming and Texas, making this one of the most widely distributed species of *Hydrochus* in North America (Arnett 1983; Hilsenhoff 1995a, 1995b; Hubbard et al. 1878; Smetana 1988; White et al. 1985). *Hydrochus rufipes* is widely distributed in Mississippi, occurring throughout the state with the exception of the coastal counties (Fig. 11).

Material Examined — We have examined 447 specimens from Mississippi localities, including: Adams Co. Natchez State Park [UMIC]; 14 mi E Sibley, Pipe Lake [UMIC]; Natchez [UMIC], Alcorn Co. 15.5 mi W Corinth [UMIC], Bolivar Co. 2 mi W Rosedale [UMIC]; Mississippi River Levee, 33°36′29″N, 91°07′34″W [MEM], Calhoun Co. 13 mi NE Bruce [UMIC]; Calhoun City [UMIC]; 4 mi SW Calhoun City [UMIC]; T11S-R3W-Sec.25 [UMIC], Carroll Co. Carrollton [UMIC], Choctaw Co. 12.5 mi NNE Weir [UMIC], Claiborne Co. Kennison Creek, 1.5 mi N Willows [UMIC]; Little Sandy Creek at Rocky Springs [UMIC]; Natchez Trace Parkway, mile 41.6 [MEM], Clarke Co. 1.5 mi N Enterprise [UMIC], Clay Co. 5 mi
Seasonal Distribution — Late February through mid-November.

Diagnosis — Hydrochus rufipes externally most closely resembles H. pajnii. Generally, H. pajnii has narrower, but more prominent calli on the 4th elytral interval than does H. rufipes. Examination of male genitalia, however, is required for positive identification. Configuration of the genitalia is most similar to those of H. neosquamifer and careful comparison of the shape and size of the apicoventral space of the phallobase is necessary to differentiate between these species. Externally, H. neosquamifer is smaller and has reduced elytral calli in comparison to H. rufipes.

Biology — Hydrochus rufipes inhabits a wide variety of aquatic habitats including rivers, streams, ponds, backwaters, sloughs, and ditches and are frequently collected using ultraviolet light
Mississippi specimens were collected in small streams, ponds, swamps, a field of cultivated cotton, oak-hickory forest, deciduous forest, bottomland hardwood forest, Jackson prairie remnants, Sweet Bay (*Magnolia virginiana* L.) bog in mixed mesic forest, and mixed forest using white pan traps, flight intercept traps, mercury vapor lights, sun lamps, and black lights.

**Notes** — Ciegler (2003) attributed the synonymy of *Hydrochus impressus* Zimmermann 1869: 249 with *H. rufipes* to Brigham (1982: 10.96). However, Brigham (1982) clearly indicated that the exclusion of *H. impressus* from the key was due to the lack of available specimens for examination and actually gave no indication of this specific synonymy in the text. The synonymy of *H. impressus* Zimmermann should be attributed to Smetana (1988: 18). Hellman (1975) was unable to locate the type of *H. rufipes*, however a single specimen of that species believed to have come from the Melsheimer collection was obtained from the MCZ, but proved to be a male of *H. subcupreus* Randall. The type of *H. rufipes* is deemed lost or destroyed, and so we here designate a neotype in its place. The neotype male with label data, stated verbatim, with line breaks indicated by “/”: “Sunflower Co. MS/5 mi. SE Indianola/Sam Testa”, is deposited in the Museum of Comparative Zoology, Harvard University.

**Hydrochus rugosus** Mulsant, 1844

*Hydrochus rugosus* Mulsant 1844c: 373.  
*Hydrochous rugosus* Mulsant; Zaitzev 1908a: 335.  
*Hydrochus grandis* Motschulsky 1860: 104.  
*Hydrochus hanoewanti* Makhan 1994: 42.  

**New Synonym**

**Description — Male**—Elongate, subparallel; maximum length 6.0 mm, maximum width of head across eyes 1.3 mm, minimum interocular distance 0.8 mm, maximum length of pronotum 1.3 mm, maximum width 1.4 mm, minimum width near base 1.3 mm, maximum length of elytra 4.1 mm.

Dorsum somewhat dull, head piceous; pronotum and elytra brown, but with bright green to gray-green and scattered violet metallic reflections obscuring nearly all ground color. Mentum and submentum with same metallic reflections as dorsal surface. Antennae and palpi reddish brown, with apical half of ultimate maxillary palpomere distinctly dark brown or piceous. Legs dark brown, with tibia and tarsi much paler, testaceous; the tibiofemoral joints, apex of tibiae, and apex of tarsi piceous. Epipleura with same metallic reflections as dorsum of elytra.

Head across eyes imperceptibly narrower than width of pronotum; clypeal punctures very dense, moderately coarse, those on base finer than those on interocular region; coarser punctures interspersed with numerous, nearly imperceptible fine setae, most very short and obscured by metallic reflections; epistomal sulcus fine near lateral margins; gradually broadened and coarsely punctate toward middle, punctures on middle two-thirds deep, coalesced; interocular region rugose, medially very gradually and unevenly raised to vertex behind epistomal sulcus; mid-cranial depression very deeply sulcate, and coarsely punctate, individual punctures coalesced so that sides of sulcus appear nearly straight; submedial interocular depressions irregular, moderately deep and wide, with closer punctures than on the surrounding punctate elevated areas on disc; most punctures moderately large, irregularly spaced, several near eyes coalesced; setae same as on clypeus; mid-occipital region broadly, moderately and shallowly constricted between posteronlateral margin of eyes. Mentum finely, very densely punctate, disc deeply foveate medially on basal half; submentum very sparsely and finely punctate, with disc nearly completely covered by two large, moderately deep foveae.

Pronotum moderately convex, slightly wider than long, widest in apical half; anterior margin arcuate in middle, and feebly incurved behind eyes so that anterior angles are very slightly produced anteriorly; lateral margins very sharply, broadly inflexed; sculpture on inflexed sides very smooth, impunctate; sides of pronotum viewed from above rounded, crenate teeth exceedingly fine, close with shallow interspaces, sides sinuate in outline with apical half subparallel then very shallowly incurved behind middle and moderately narrowed to base; posterior margin strongly arcuate medially; punctures moderately coarse, not much larger...
than those on interocular region, punctures deep, irregularly spaced, those on disc separated by one-half to nearly width of a puncture, denser and finer toward anterolateral margins; elevated areas of disc punctate. Anterolateral and basolateral foveae small, very deep with three or four coalesced punctures in middle; median fovea and mediolateral foveae shallow rather similar in size and form, median fovea slightly deeper than lateral foveae; basomedial foveae same depth as median fovea, elongate and convergent near base.

Elytron strongly convex, elongate; lateral margin moderately constricted on basal third, narrowly explanate medially, then moderately arcuate to apex; apex abruptly rounded to suture; serial punctures very coarse, very deep, those on disc separated by less than one-half width of a puncture, those on apical third smaller and denser; sutural interval near base flat, wider, and only slightly raised above others, posteriorly becoming very gradually wider and costate on apical third; remaining intervals narrow separated on disc by slightly more than their width, most appear flat and regular except as follows: 2nd interval slightly raised from midlength to beginning of apical third; 3rd interval appears moderately costate and elevated together with 2nd interval and part of 4th interval to form a broad low elongate keel from behind middle to just anterior to callus on apical third of 4th interval; 4th interval moderately callose on beginning of apical third, callus moderately high, short, moderately broad, primarily restricted to the 4th interval; 6th interval more strongly convex than adjacent odd numbered intervals; 7th interval near middle strongly sinuate and nearly coalesced with 8th interval; 8th interval irregularly subcostate except medially where slightly raised and widened; epipleuron smooth and impunctate.

Male genitalia. Figure 12. Phallobase approximately equal to length of parameres; apex round; widest medially, tapering to base and junction with parameres, maximum width equal to parameres; basoventral opening terminal. Apicoventral space of phallobase deltoid to weakly sagittate, widest at junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest at base, tapering to apex, dorsal view, outer margin straight, curving to apex; in lateral view, ventral surface flat, dorsal surface equal in elevation to dorsum of phallobase, paramere beyond junction with phallobase raised and rounded one-half length of parameres, apical half of parameres tapering gradually to apex, apex blunted, straight. Aedeagus seven-eighths length of parameres; in lateral view, ventral surface flat, dorsal surface with three swellings decreasing in size towards apex, two apical swellings extending above dorsal surface of parameres, apex weakly acuminate; in dorsal view, forked in apical fifth; aedeagus with posterior process extending two-thirds length of apicoventral space of phallobase as a forked process, apices rounded.

Female — Indistinguishable from males.

Variation — Specimens vary in length from 4.8–6.1 mm and in width from 1.7–2.2 mm. Some specimens exhibit very dark to piceous color forms, while others show coarser and denser dorsal punctuation than is mentioned above. Additionally, some individuals exhibit wider elytral intervals with much finer serial punctures than described.

Distribution — Hydrochus rugosus is found from Massachusetts to Florida and as far west as Texas (Ciegler 2003; Young 1954), and has been reported from Cuba (Blackwelder 1944). The species occurs as far north in the Mississippi River Valley as Arkansas (Hellman 1975), who also stated that a single specimen from Indiana had been identified as this species, but questioned the validity of the locality and remained skeptical of the potential northern range extension of the species until further material could be examined. Young (1954) noted that H. rugosus was commonly encountered in the peninsular uplands of Florida. This species is widely distributed throughout Mississippi, with the exception of the coastal counties (Fig. 13).

Material Examined — We have examined 128 specimens from Mississippi localities, including: Adams Co. 14 mi E Sibley, Pipe Lake [UMIC], Amite Co. Homochitto NF, 3.5 mi E Rosetta, Mt. Nebo Camp [UMIC], Choctaw Co. Ackerman [UMIC], Desoto Co. Southaven [UMIC], Forrest Co. 1 mi N Fruitland Park [UMIC], George Co. 12 mi SW Lucedale [UMIC, MEM]; 7 mi S Benndale [MEM]; Pascagoula River WMA, 30°52’40”N, 88°46’05”W [MEM], Greene Co. Stateline [MEM],
Grenada Co. T22N, R3E, Sec. 31NW [MEM], Hancock Co. Stennis Space Center [UMIC], Harrison Co. 8 mi NE Saucer [UMIC]; 12.5 mi E Saucer [UMIC], Jackson Co. 4 mi SW Hurley [UMIC]; MS Sandhill Crane NWR, 30°27'34"N, 88°41'28"W [MEM]; Grand Bay Savannah, 30°27'31"N, 88°25'14"W [MEM]; 11 mi NW Van Cleave [UMIC], Kemper Co. 2 mi N Scooba, T12N, R18E, Sec. 29,20 [MEM], Lafayette Co. T7S-R2W-Sec. 34 [UMIC]; Oxford [UMIC]; 5 mi E Oxford [UMIC], UM Field Station [UMIC], Lamar Co. 5 mi N Baxterville [UMIC, MEM], Lowndes Co. T17N, R16E, Sec. 5 [MEM], Madison Co. 7.5 mi SE Canton [UMIC], Marshall Co. Wall Dockey State Park [UMIC], Neshoba Co. 7 mi SW Philadelphia [UMIC], Newton Co. 4 mi E Newton [UMIC], Okitibbeha Co. Sessums, 33°23'31"N, 88°2'40"W [MEM]; 5 mi S of Starkville, 33°22'47"N, 88°49'44"W [MEM]; 3 mi W of Adaton, 33°29'00"N, 88°58'13"W [MEM]; T18N, R14E, Sec. 33SE [MEM]; Craig Spring [MEM], Pearl River Co. 1 mi SW Silver Run [UMIC], Pike Co. Percy Quinn State Park [UMIC], Scott Co. Golden Memorial State Park [UMIC], Stone Co. U.M. Forest Lands [UMIC]; 11 mi E Perkinston, Red Creek [MEM]; Red Creek x Hwy 15 [UMIC], Tishomingo Co. Tishomingo State Park [UMIC], Walthall Co. 6 mi NE Tylertown [UMIC], Wayne Co. 3.5 mi NW State Line [UMIC], Winston Co. Noxubee NWR, T16N, R14E, Sec. 138E [MEM], and Yazoo Co. 1 mi W Bentonia [UMIC].

Seasonal Distribution — Early March through mid-November.

Diagnosis — The large, elongate form of *H. rugosus* and the unique male genitalia will differentiate this species from all others in Mississippi.

Biology — This species is known to occur in sink hole ponds, along the margins of lakes, cypress swamps, and small streams found on or near aquatic vegetation or floatage and has been collected using ultraviolet lights (Ciegler 2003; Young 1954). Mississippi specimens were collected in mixed pine-oak forest, coastal savannah, near streams, rivers, marshes and swampy areas, as well as small and large impoundments. Most were collected using black light traps, but some were taken in flight intercept traps and at mercury vapor lights.

Notes — Although he had not seen the holotype, Epler (1996) suggested that *Hydrochus hanoewanti* Makhan (1994), described from a single specimen collected near Jacksonville, FL, was a junior synonym of *H. rugosus*. Following examination of the holotype bearing the label data, stated verbatim, with line breaks indicated by “/”:

“St. John’s Bluff/East Florida/R. Foster/Hist.-Coll./Nr. 10744”, deposited in the Berlin Natural History Museum collection, we agree that *H. hanoewanti* Makhan, 1994 is a typical form of *H. rugosus* Mulsant, thus confirming Epler’s conclusion. Hellman (1975) was unable to locate the type of *H. rugosus*, which is deemed lost or destroyed, and so we designate a neotype in its place. The neotype male, bearing the verbatim label, with line breaks indicated by “/”:


*Hydrochus simplex* LeConte, 1855

*Hydrochus simplex* LeConte 1855: 361.

*Hydrochous simplex* LeConte; Zaitzev, 1908a: 335.

*Hydrochus equicarinatus* Blatchley 1928: 62. New Synonym

Description — Male—Small, elongate, subparallel; maximum length 2.7 mm, maximum width 1.0 mm, maximum width of head across eyes 0.7 mm, minimum interocular distance 0.3 mm; maximum length of pronotum 0.6 mm, maximum width 0.7 mm, minimum width near base 0.6 mm; maximum length of elytra 1.8 mm.

Dorsum shiny, head piceous; pronotum and elytra dark reddish brown with bright metallic green and golden-green reflections obscuring nearly all ground color. Mentum and submentum piceous with reddish copper reflections on disc. Antennae and palpi reddish brown with apex of ultimate maxillary palpomere darkened. Legs reddish brown, tibia slightly paler, base of femora darkened, tibiofemoral joints and apex of ultimate tarsomeres piceous.

Head across eyes as wide as pronotum; clypeal punctures moderately coarse, dense, not much finer than on interocular region; exceedingly fine setae
interspaced between coarser punctures frequently obscured by bright metallic reflections; epistomal sulcus fine near lateral margin, gradually broadened and deeply impressed on middle two-thirds; coarse punctures within epistomal depression coalesced; interocular region rugose, medially behind epistomal sulcus very gradually irregularly raised to vertex; midcranial depression deeply sulcate and coarsely punctate, punctures coalesced; submedial interocular depressions very irregular, shallow with slightly closer punctures than on surrounding, punctate elevated areas on disc; most punctures moderately large, very irregularly spaced with random groups of 2’s, 3’s and rarely 4’s nearly coalesced; setae same as on elytrum; midoccipital region broadly, moderately constricted between posterolateral margins of eyes. Mentum finely, very densely punctate, basal ½ of disc deeply foveate medially; submentum very sparsely and very finely punctate, with disc nearly completely covered by two large deep transverse, elongate foveae.

Pronotum moderately convex, as wide as long, apical half widest, anterior margin nearly straight; lateral margins coarsely crenate, teeth rounded and regular; in dorsal view, appearing sinuate, with lateral margins parallel in apical half, then weakly inflexed in basal half; posterior margin moderately arcuate; punctures moderately coarse, irregularly spaced, most punctures separated by more or less one-half width of puncture, denser and finer toward lateral margins; sculpture on elevated areas of disc without smooth and impunctate areas. Anterolateral and basolateral foveae small, deep, irregularly rounded; median and mediolateral foveae moderately shallow, round, with median fovea equal to one-fourth length of pronotum at midline; basomedial foveae elongate, much shallower than median fovea, convergent near base.

Elytron convex, elongate; lateral margins slightly constricted, straight in apical third, then slightly arcuate medially to apical third where perceptibly constricted subapically; apex abruptly rounded to suture; serial punctures very coarse, deep, those on disc separated by approximately one-half width of a puncture, those in apical fourth gradually smaller and denser; sutural interval near base wider than other intervals, posteriorly becoming gradually, slightly wider and moderately costate on apical third; remaining intervals on elytron narrow, flat, separated on disc by nearly twice their width, most appear very regular in height without any distinct interruptions except on middle of 8th interval where only feebly raised; epipleuron flat, moderately, coarsely punctate, punctures on basal half rather shallow and regular, then behind middle becoming gradually finer and shallower before becoming indistinct in apical fourth.

Male genitalia. Figure 14. Phallobase two-thirds length of parameres; apex pointed; widest in anterior third, tapering to base and junction with parameres, wider than parameres at junction with phallobase; basoventral opening terminal. Apicoventral space of phallobase sagittate with rounded basal lobes, widest at junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest in basal half, tapering to apex; in lateral view, tapering toward apex, ventral surface weakly concave in basal two-thirds, flat in apical third, dorsum lower than dorsal surface of phallobase at junction with parameres, highest dorsal elevation at middle before tapering to apex; apices straight. Parameres widely separated by aedeagus. Aedeagus seven-eighths length of parameres; in lateral view, base elevated above dorsal surface of parameres, tapering to apex, ventral surface flat extending below ventral surface of parameres, ventral portion of aedeagus visible in concavity of paramere; aedeagus forked in apical two-fifths, tines fine, parallel, apices nearly contiguous; aedeagus wide with posterior process extending three-fourths length of apicoventral space of phallobase, forked at apex with tines short, broadly rounded.

Female — Indistinguishable from males. Variation — Specimens vary in length from 2.5–3.0 mm and in width from 0.9–1.1 mm. Metallic reflections typically variable. Minor differences in depth of pronotal foveae and punctation density are apparent among the series of specimens examined.

Distribution — Hydrochus simplex ranges from North Carolina south to Florida and west to Louisiana. Ciegler (2003) indicated the species is known from Arizona, but the latter requires confirmation. Young (1954) found H. simplex to be common throughout upland peninsular Florida.
and occasionally present in flatwood areas of the panhandle and peninsula. *Hydrochus simplex* occurs primarily in the southern third of Mississippi (Fig. 15), including the Coastal Meadows (I) and Southern Pine Hills (II), physiographic regions, with a few northern localities in the North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), and Black Prairie (IX) regions.

**Material Examined** — We have examined 64 specimens from Mississippi localities, including: Greene Co., Hancock Co. Pt. Clear Island [UMIC]; 6 mi WNW Waveland [UMIC]; Stennis Space Center [UMIC]; 2 mi N Waveland, Bayou La Croix [MEM], Harrison Co. W Ship Island [MEM], Jackson Co. Grand Bay Savannah, 30°27′31″N, 88°25′14″W [MEM]; MS Sandhill Crane NWR, 30°27′34″N, 88°41′28″W [MEM]; Ocean Springs [UMIC], Jeff Davis Co. [MEM], Lamar Co. 3.5 mi WNW Purvis [UMIC]; 5 mi N Baxterville [UMIC], Oktibbeha Co. 8 mi NE Starkville [MEM]; 3 mi W of Adaton, 33°29′00″N, 88°58′13″W [MEM]; Adaton [MEM]; Osborn Prairie [MEM], and Stone Co. U.M. Forestlands [UMIC]; 13 mi SE Wiggins [UMIC].

**Seasonal Distribution** — Mid-March through mid-September.

**Diagnosis** — *Hydrochus simplex* is most readily confused with *H. schereri* when examining external characteristics. Both species have densely punctate head and pronotal surfaces in comparison to other *Hydrochus* species in Mississippi. Both species have reduced elytral calli, but in our opinion external characters are inadequate for differentiation. The phallobase in *H. simplex* is two-thirds the length of the parameres, while the phallobase in *H. schereri* is one and one-half times the length of the parameres.

**Biology** — Blatchley (1928) noted that *H. simplex* (as *H. equicarinatus*) was collected from stems and debris of water purslane, *Didiplis diandra* (Nutt. ex. DC.) Alph. Wood. Specimens were previously known to be collected from rivers, ponds, ditches, and at ultraviolet lights (Ciegler 2003). In Mississippi, specimens were collected in artesian ponds, coastal savannas, on beaches, at marsh edges, and by sweeping and black lighting.

**Notes** — Examination of the holotype of *Hydrochus equicarinatus* Blatchley confirmed this species as a junior synonym of *H. simplex*, a position previously suggested by Epler (1996).

**Hydrochus jaechi Makhan, 1995**


**Description** — Holotype Male—Large, elongate; length 4.06 mm, width 1.58 mm; width of head across eyes 0.89 mm, interocular distance 0.53 mm; length of pronotum 0.85 mm, width 0.95 mm, minimum width near base 0.73 mm, maximum length of elytra 2.72 mm.

Dorsum shiny, bicolored; ground color of head piceous with scattered metallic blue, violet, and green reflections; pronotum and elytra very light yellow brown with more metallic green and bronze reflections than on head; sutural intervals and elevated areas on elytral intervals slightly paler. Mentum and submentum rufopiceous with some metallic reflections as on dorsum of head. Antennae, palpi and legs yellow brown with only the tibiofemoral joints and apex of ultimate tarsomeres slightly darkened.

Head across eyes as wide as pronotum; clypeal punctures dense, moderately coarse, same as on interocular region; epistomal sulcus fine near margins, gradually broadened and slightly impressed toward middle; interocular region rugose, and gradually, irregularly raised to vertex medially behind epistomal sulcus; midcranial depression deeply sulcate and coarsely punctate, punctures coalesced; submedial interocular depressions irregular, shallow, rather broad with punctures only slightly closer than on surrounding elevated areas; punctures moderately large, very dense, most separated by less than one-half width of puncture, some irregularly spaced; setae indistinct; mid-occipital region broadly, moderately constricted between posterolateral margins of eye. Mentum finely, densely punctate, basal half of disc deeply foveate mediadly; submentum nearly completely covered by two large, deep foveae.

Pronotum moderately convex, imperceptibly wider than long, apical half widest near middle; anterior margin straight mediadly, then nearly imperceptibly recurved behind eyes so that anterolateral angles are slightly produced anteriorly,
angles even with midline; lateral margins of pronotum sharply, moderately broadly inflexed; inflexed surface slightly concave near middle and moderately, coarsely punctate, punctures same as on dorsum but arranged in a single linear series; sides of pronotum angulate in dorsal view, coarsely crenate, slightly sinuate in outline with apical half parallel, then shallowly incurved behind middle and slightly narrowed to base; posterior margin moderately arcuate medially; punctures very dense, moderately coarse, rather uniform in size but irregularly spaced with most separated by less than one-third width of a puncture, becoming slightly closer and finer toward anterolateral margins; elevated areas adjacent to median fovea slightly more closely punctate than within fovea. Anterolateral foveae small, moderately deep, irregular in form, anteriorly open to anterior margin of pronotum; median and mediolateral foveae somewhat similar in form with median fovea slightly deeper, round and equal to one-fourth length of pronotum at midline; basomedial foveae elongate, slightly more irregular and shallower than median fovea and convergent near base; basolateral foveae similar to anterolateral pair but open posteriorly to margin of pronotum.

Elytron strongly convex, elongate; lateral margin slightly constricted, straight in basal third behind humeral angles, feebly explanate medially then moderately arcuate to apex; apex behind 5th interval feebly angled before becoming abruptly rounded to suture; serial punctures very coarse, deep, on disc separated by slightly more than one-third width of a puncture, those in apical third becoming smaller and denser; serial puncture rows appear to be feebly doubled and spaced closer between even intervals, punctures nearly touching across odd numbered intervals; setae on intervals same as on head and pronotum, and regularly arranged in close linear series, setae often obscured by metallic reflections; sutural interval subcostate, wider than others at base, becoming gradually, slightly wider posteriorly and costate on apical third; remaining intervals narrow, separated on disc by slightly more than twice their width, even intervals on basal two-thirds unevenly costate or raised above odd intervals as follows: 2nd interval unequally subcostate on basal third, then interrupted and only slightly raise behind basal third to just before middle where interval appears costate and slightly widened to the beginning of the apical third, 3rd interval only feebly raised in basal fourth, then interrupted and flat to just before middle where interval appears costate to beginning of the apical third, costa similar to adjacent costa on 2nd interval; 4th interval unevenly costate over basal half but elevated higher from basal fourth to midlength where interval interrupted, and only slightly raised to beginning of the apical third, where moderately callose, callus elongate and only moderately developed but higher than any costa on elytron; 6th interval uniformly subcostate on basal third, interrupted and depressed just behind midlength to beginning of the apical third where briefly but strongly costate, costa similar and adjacent to those on 2nd and 3rd intervals but slightly shorter in length; 7th interval near middle sinuate and nearly coalesced with 8th interval; 8th interval unevenly costate over most of its length, and only near middle becoming prominently raised and widened; epipleuron coarsely punctate and concave on basal half, then between middle and apical fourth gradually less concave and punctures becoming shallower and smaller until disappearing.

Male genitalia. Figure 17. Phallobase one and one-half times length of parameres; apex with ventral angulate projection; width uniform throughout most of length, tapering basally and at junction with parameres, wider than parameres at junction; basoventral opening terminal. Apicoventral space of phallobase sagittate with rounded basal lobes, space widest at junction of parameres and phallobase and narrowing to acuminate angulation. Parameres, in dorsal view, symmetrical, widest at base, tapering in basal two-thirds, widening into rounded projections then tapering to apex; in lateral view, tapering toward apex, ventral surface weakly concave medially, dorsal surface with highest elevation immediately beyond junction with phallobase; apices slightly reflexed. Aedeagus seven-eighths length of parameres; in lateral view, with two swellings on dorsal surface, swelling at junction of phallobase and paramere equal in elevation to paramere, decreasing in elevation to second swelling, which is half the elevation of basal swelling, then tapering.
to narrow, tubular process. One-fifth of aedeagus extending beyond dorsal surface of parameres. Aedeagus forked in apical eighth, tines thin, nearly converging at apices; posterior process extending three-fourths length of apicoventral space of phallobase, forked in apical half.

**Female** — Indistinguishable from males.

**Variation** — Specimens vary in length from 2.53–4.03 mm and in width from 1.09–1.48 mm. Metallic reflections typically variable. Minor differences in depth of pronotal foveae and punctation density are apparent.

**Distribution** — Outside of Mississippi, *Hydrochus jaechi* is known from five male specimens: one from Florida, two from Louisiana, and two from Texas (Epler 1996, 2010; Hellman 1975; Makhan 1995a). The species is relatively common in Mississippi, including localities in the Coastal Meadows (I), Southern Pine Hills (II), Jackson Prairie (III), North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), Black Prairie (IX), and Tombigbee and Tennessee River Hills (X) physiographic regions (Fig. 17).

**Material Examined** — We have examined 176 specimens from Mississippi localities, including: Covington Co. Okatoma River, near Lux [UMIC], Forrest Co. 5 mi S Brooklyn [UMIC], Greene Co. Stateline [MEM], Hancock Co. Stennis Space Center [UMIC]; 1 mi SSW Lakeshore [UMIC]; 4 mi NW Kiln [UMIC], Harrison Co. 3.5 mi NE Saucier [UMIC], Kemper Co. 2 mi N Scooba, T12N, R18E, Sec. 29,30 [MEM], Lamar Co. 5 mi N Baxterville [UMIC, MEM], Madison Co. Lake Barnett, NE of Jackson [MEM], Marion Co. Lake Columbia [UMIC], Noxubee Co. Noxubee NWR, 33°16′24″N, 88°46′08″W [MEM]; Noxubee NWR, 33°15′22″N, 88°47′46″W [MEM]; Noxubee NWR, 33°15′31″N, 88°46′03″W [MEM]; Noxubee NWR, 33°14′04″N, 88°48′31″W [MEM]; Noxubee NWR, 33°16′19″N, 88°45′43″W [MEM], Oktibbeha Co. 3 mi W of Adaton, 33°29′00″N, 88°58′13″W [MEM]; T18N, R14E, Sec. 33SE [MEM]; Craig Spring [MEM]; Adaton [MEM]; 6 mi SW Starkville [MEM]; 7 mi S Starkville, 33°20′04″N, 88°49′06″W [MEM]; Noxubee NWR, 33°21′23″N, 88°52′56″W [MEM], Scott Co. Pinkston Hill, 32°16′06″N, 89°23′33″W [MEM], Smith Co. Bienville NF, 32°10′06″N, 89°20′54″W [MEM], Stone Co. 11 mi E Perkinston, Red Creek [MEM]; Red Creek x Hwy 15 [UMIC], and Winston Co. Noxubee NWR, T16N, R14E, Sec. 135E [MEM]; Noxubee NWR, 33°13′59″N, 88°49′42″W [MEM]; Noxubee NWR, 33°14′29″N, 88°49′03″W [MEM]; Noxubee NWR, 33°16′56″N, 88°49′12″W [MEM]; Tombigbee NF, 33°11′50″N, 89°03′20″W [MEM]; Noxubee NWR, 33°13′44″N, 88°54′34″W [MEM]; Noxubee NWR, 33°13′48″N, 88°54′28″W [MEM].

**Seasonal Distribution** — Late February through mid-November.

**Diagnosis** — This species most closely resembles *H. excavatus* and *H. inaequalis* externally. The larger size and granulate surface at the anterolateral margins of the pronotum help to differentiate *H. jaechi* from *H. excavatus* and *H. inaequalis*, but positive identification requires examination of male genitalia.

**Biology** — *Hydrochus jaechi* has been collected from creeks, lakes, rivers, swamps, bottomland hardwood forest, mixed mesic forest, pine forest, and in a Jackson prairie remnant using mercury vapor lights, flight intercept traps, and black lights.

**Notes** — *Hydrochus jaechi* was described as “*Hydrochus caumatis*” Hellman (1975) in his dissertation, this species was keyed as *Hydrochus* sp. 8 in Epler (1996, 2010).

---

**Hydrochus falsus** Hellman n. sp.

*urn:lsid:zoobank.org:act:45C401DC-41E5-40BA-8466-67C01F621886*

**Holotype** — Male, bearing label data, stated verbatim, with line breaks indicated by “/” and separate labels indicated by “[]”: “[Crescent/ City Fla] [Coll Hubbard/ & Schwarz]”, deposited in the National Museum of Natural History, Smithsonian Institute.

**Paratypes** — Alabama: Macon Co.: 7.2 miles N.W. Huntsboro on Co. 10, 15 February 1970, Folkerts and Jordan, 3 male, 2 female (AUEM); Mississippi: Forrest Co.: P.B. Johnson State Park, 23 June 1986, P.K. Lago, 1 female (UMIC), George Co.: 7 mi SSE Lucedale, 26 May 1987, P.K. Lago, 6 male, 5 female (UMIC), Jackson Co.: Ocean Springs, 12 August 1977, S. Hurdle, 1 female (UMIC), Lamar Co.: 2 mi SW Bellevue, 8 March 1973, Folkerts & Jordan, 1 male, 1 female (AUEM),
Oktibbeha Co.: 1.2 mi SE of Adaton, 33°28'05"N, 88°54'18"W, 8 August 1996, T.L. Scheifer, 1 male (MEM), Scott Co.: Harperville, 28 February 1988, S. Testa, 1 male (UMIC); Georgia: “Geo”[Georgia], 43 specimens (not sexed) (USNM); Florida: Crescent City (same label as holotype), 4 male, 3 female (USNM); Texas: Belfrage, F.C. Bowditch, 2 male, 1 female (MCZ).

**Male** — Sub-elongate, rather broad; maximum length 3.6 mm, maximum width 1.2 mm; maximum width of head across eyes 0.8 mm, minimum interocular distance 0.6 mm; maximum length of pronotum 0.8 mm, maximum width 0.9 mm, minimum width near base 0.8 mm, maximum length of elytra 2.5 mm.

Dorsum shiny, head piceous, pronotum and elytra brown with apices of elytra much paler, with metallic gray, green, blue-green and purple reflections obscuring most ground color. Mentum and submentum shiny rufopiceous with same metallic reflections as on dorsum. Antennae and palpi brown with ultimate segment of maxillary palpomere slightly darkened. Legs brown with tibiofemoral joints only very narrowly piceous or dark brown.

Head across eyes slightly less than width of pronotum; clypeal punctures very dense, moderately coarse, those near base very similar to punctures on interocellar region, midline of disc feebly raised; epistomal sulcus indistinct; interocellar region evenly raised on midline and rugose; mid-cranial depression indistinct; submedial interocellar depressions foveate, foveae deep and large with closer punctures than on surrounding elevated areas of disc, several punctures nearly coalesced; remaining punctures on disc moderately large, regular in size and spacing, most separated by less than width of a single puncture; mid-occipital region broadly elevated near base of head. Mentum finely, densely punctate, basal half of disc moderately deeply foveate medially; submentum more finely punctate than mentum, disc non-foveate.

Pronotum moderately convex, slightly wider than long, widest just behind anterior angles; anterior margin slightly arcuate; lateral margins only feebly and narrowly inflexed in apical half; sides viewed above subparallel on apical fourth, then straight and moderately narrowed to base behind middle; posterior margin moderately arcuate medially; punctures very dense, very coarse, deep, somewhat regular in size, nearly equal in size to those on elytra, most punctures on disc separated by nearly one-half width of puncture, becoming slightly closer and smaller toward anterior and lateral margins; discal surface uneven and slightly elevated on apical half, then behind median fovea flattened and less convex than on apical half. Anterolateral foveae small, very shallow, open to anterior margin of pronotum; median fovea very prominent, moderately deep, somewhat elongate, equal to one-third length of pronotum at midline; mediolateral foveae moderately deep, somewhat rounded, and much smaller than median fovea; basomedial foveae indistinct; basolateral foveae small, much deeper and closer to adjacent margins of pronotum than anterolateral foveae; base of pronotum on midline irregularly and slightly depressed.

Elytron moderately strongly convex, sub-elongate, moderately broad; lateral margin feebly explanate medially then moderately arcuate to apical third and feebly constricted subapically; apices subtruncate; serial punctures very coarse, deep, those on disc very regular and separated by nearly one-third width of a puncture; punctures in apical fifth and in last three serial rows gradually becoming smaller and closer nearing margin; sutural interval near base only slightly wider than other intervals, very slightly wider and subcostate on apical third; remaining intervals on elytron narrow, separated on disc by nearly twice their width, most intervals appear uniformly narrowed and regular in height, except as follows: even numbered intervals perceptibly more convex than odd numbered, 4th interval slightly broadened and very briefly costate on beginning of the apical third, 6th interval with a small costa just behind middle and anterior to and only slightly less prominent than costa on 4th interval; 7th interval near middle slightly sinuate and nearly coalesced with 8th; 8th interval unevenly raised on basal two-thirds, and slightly more prominently raised and swollen medially; epipleuron impunctate and only feebly impressed in basal half. Figure 18.

Venter with dense hydrofuge pubescence
throughout, with additional long, curved, fine, sparse yellow setae; long setae sparse on prosternum, increasing in density posteriorly. Prosternum irregularly foveate, moderately densely punctate. Mesosternum and metasternum coarsely punctate, irregularly foveate. Metasternum convex medially. Coxae, trochanters, femora (in basal fourth) bearing dense hydrofuge pubescence. Legs bearing curved, recumbent, fine yellow setae; legs with metallic reflections above dense hydrofuge pubescence.

Male genitalia. Figure 19. Phallobase two times length of parameres; apex round and closed; phallobase widest medially, tapering to base and junction with parameres, wider than parameres at junction with phallobase; basoventral opening subapical. Apicoventral space widest at junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest at base, tapering to apex, apices diverging; in lateral view, tapering toward apex, ventral surface entirely concave to apex, thus appearing deflexed, concavity entirely smooth, lacking projections or notches; apices straight (usual) or slightly reflexed (rarely). Aedeagus one-half length of parameres; in lateral view, dorsal surface rounded medially, tapering at the junction of phallobase and parameres and at apex, apex with a short acuminate process ventrally; aedeagus greatly constricted at junction with phallobase. Two projections of aedeagus extending posteriorly into apicoventral space of phallobase.

Female — Indistinguishable from males.

Variation — Specimens vary in length from 2.7–3.5 mm and in width from 0.9–1.4 mm. Reflective coloration of the elytra can vary considerably in specimens of *H. falsus*. Some specimens exhibit a more shallowly, broadly depressed submentum, while other individuals are clearly foveate.

Etymology — ‘falsus’ Latin, deceive. Named in reference to the similarity of morphological characteristics and general appearance shared with *H. prolatus*.

Distribution — *Hydrochus falsus* ranges from Georgia and Florida west to Texas and northward through the Mississippi River Valley to Indiana. The species occurs mostly in the southern third of Mississippi, with collection localities in the Coastal Meadows (I), Southern Pine Hills (II), Jackson Prairie (III), North-Central Hills (VI), Flatwoods (VII), Pontotoc Ridge (VIII), and Black Prairie (IX) (Fig. 20).

Material Examined — We have examined 17 specimens from Mississippi localities, including: Forrest Co. P.B. Johnson State Park [UMIC], George Co. 7 mi SSE Lucedale [UMIC], Jackson Co. Ocean Springs [UMIC], Lamar Co. 2 mi SW Bellevue [UEM], Oktibbeha Co. 1.2 mi SE of Adaton, 33°28’05”N, 88°54’18”W [MEM], and Scott Co. Harperville [UMIC].

Seasonal Distribution — Late February through mid-August.

Diagnosis — The absence of an epicranial suture will separate *H. falsus* from all other Mississippi species except *H. callosus* and *H. jiawanae*. *Hydrochus falsus* is much smaller in size, both length and width, than *H. callosus*. *Hydrochus jiawanae* and *H. falsus* are nearly identical, including genital structure. *Hydrochus falsus* possesses rounded elytral sutural angles, but in some specimens the angles appear to be right angled. *Hydrochus jiawanae* has elytral sutural angles that are produced slightly, thus appearing acute. Male genitalia are nearly identical in both species, however *H. falsus* lacks a subapical notch in the concavity on the ventral surface of the parameres, when viewed laterally, which is present in *H. jiawanae*. Examination of male genitalia should be done in order to accurately separate these species.

Biology — *Hydrochus falsus* has been collected at black lights, but specific aspects of the species’ biology remain unknown. Aquatic habitats present at Mississippi collection sites include a large river (the Pascagoula), a fairly large recreational impoundment and a slough.

Notes — *Hydrochus falsus* was keyed as *Hydrochus* sp. 1 in Epler (1996, 2010).

*Hydrochus jiawanae* Makhan, 1996

**Description** — Holotype Male—Elongate, broad; maximum length 2.77 mm, maximum width...
1.11 mm; maximum width of head across eyes 0.63 mm, minimum interocular distance 0.4 mm; maximum length of pronotum 0.65 mm, maximum width 0.7 mm, minimum width near base 0.58 mm, maximum length of elytra 1.81 mm.

Dorsum shiny with light green, blue-green, scattered purple and blue reflections obscuring nearly all ground color; ground color of head piceous, pronotum and elytra brown. Mentum and submentum shiny rufopiceous. Antennae and palpi reddish brown with apex of ultimate maxillary palpomere piceous. Legs reddish brown with tibiofemoral joints and apical fourth of ultimate tarsomeres piceous.

Head across eyes equal to width of pronotum; clypeus slightly more convex on midline, punctures moderately fine, dense, very similar to those on interocular region; epistomal sulcus lacking; interocular region very uneven, only slightly elevated to vertex; mid-cranial depression lacking; submedial interocular depressions broadly foveate; punctures moderately coarse, irregularly spaced, most separated by less than width of a puncture to nearly coalesced; mid-occipital region not constricted. Mentum finely, moderately densely punctate; basal half of disc broadly, deeply foveate medially; submentum more finely and sparsely punctate than mentum; disc with two small, deep, foveal pits.

Pronotum quadrate in form, convex, apical half widest; anterior margin feebly arcuate; lateral margins only feebly inflexed in apical half; sides viewed above shallowly sinuate, apical half subparallel, then shallowly incurved behind middle and slightly narrowed to base; posterior margin moderately arcuate; disc rugose on basal half, rather flat on midline; punctures moderately coarse, rather regular in size, irregularly spaced with most punctures separated by less than one-half width of a puncture, only slightly denser and finer toward anterior and anterolateral margins. Anterolateral foveae indistinct; median fovea prominent, shallow, somewhat round, equal to slightly more than one-fourth length of pronotum at midline; mediolateral foveae irregularly round, only slightly shallower than median fovea; basomedial foveae indistinct; basolateral foveae small, deep, with posterior margin open and nearly confluent with posterior pronotal margin.

Elytron moderately convex, apical third gradually sloping to apex; lateral margins moderately constricted on basal third, then moderately arcuate mediadly to apical third and moderately constricted preapically; apex subtruncate, feebly explanate and produced near suture; sutural angle acute; serial punctures coarse, deep, those on disc regular, separated by one-third width of a puncture, becoming gradually smaller and denser on apical third; serial rows 7, 8, 9, and 10 slightly more impressed than others; sutural interval near base slightly wider than others, gradually becoming wider and costate on apical third; intervals narrow, separated on disc by one and one-third their width, slightly convex, and regular in height except as follows: 4th, 6th, and 8th intervals near margin in apical third becoming gradually more convex; 4th interval perceptibly wider and subcostate at beginning of the apical third; 6th interval very feebly raised and broadened just behind middle, and slightly raised anterior to subcosta on 4th interval; 7th interval near middle sinuate and nearly coalesced with 8th interval; 8th interval on basal half irregularly raised above others, and perceptibly broader near middle; epipleuron impunctate, smooth.

Male genitalia. Figure 21. Phallobase two and one-fourth times length of parameres; apex round, closed; widest medially, tapering to base and junction with parameres, wider than parameres at junction with phallobase; basoventral opening subapical. Apicoventral space of phallobase widest immediately behind junction of parameres and phallobase and narrowing to acuminate angulation. Parameres symmetrical, widest at base, tapering to apex, apices nearly contiguous; in lateral view, tapering toward apex, ventral surface entirely concave to apex, appearing deflexed, ventral concavity with subapical notch in apical third of paramere; apices straight (usual) or slightly reflexed (rarely). Aedeagus two-thirds length of parameres; in lateral view, apical half of dorsal surface flattened, apex a concavity with short acuminate process at ventral surface; aedeagus greatly constricted at junction with phallobase. Two projections of aedeagus extend posteriorly into apicoventral space of phallobase.
Female — Indistinguishable from males.

Variation — Specimens vary in length from 2.6–3.9 mm and in width from 1.1–1.3 mm. Ground color may vary from piceous to dark reddish brown. Metallic variation on elytra varies in intensity. Punctures on head, pronotum, and elytra may be closer together than herein described. Mediolateral and median foveae may be indistinct in some individuals. The depth of small depressions on the submentum varies from indistinct to very shallow and broad.

Distribution — Hydrochus jiawanae ranges from Vermont to Florida and west to Texas. In Mississippi, this species seems restricted to the southeastern counties in the Coastal Meadows (I) and Southern Pine Hills (II) regions (Fig 22).

Material Examined — We have examined 37 specimens from Mississippi localities, including: George Co. Lucedale, Hancock Co. 4 mi NW Kiln [UMIC]; 6 mi WNW Waveland [UMIC], Harrison Co. 3.5 mi NE Saucier [UMIC]; 2 mi Lyman E Saucier [UMIC]; 13 mi E Saucier [UMIC], and Stone Co. Red Creek x Hwy 15 [UMIC]; U.M. Forestlands [UMIC].

Seasonal Distribution — Late February through early July.

Diagnosis — The base of the epicranial suture is normally absent, although in some specimens, it is vaguely indicated, but lateral arms are absent. The absence of an epicranial suture will separate most specimens of H. jiawanae from all other Mississippi species, except H. callosus and H. falsus. Hydrochus jiawanae has elytral sutural angles that are produced slightly, appearing acute, while in Hydrochus falsus the sutural angles are rounded, although some specimens have these nearly right angled. Male genitalia are near identical in both species; however, H. falsus lacks a subapical notch in the concavity on the ventral surface of the parameres when viewed laterally, while a notch is present in H. jiawanae. Examination of male genitalia is essential for positive identification.

Biology — Nothing has been published concerning the biology of H. jiawanae. Mississippi habitats that produced specimens included small to medium black water rivers and woodland ponds.

Notes — Hydrochus jiawanae was described as “Hydrochus prolatus” by Hellman (1975) in his dissertation. This species was keyed as Hydrochus sp. 2 in Epler (1996, 2010) and Ciegler (2003).

Hydrochus pajnii Makhan, 2000

Description — Holotype Male—Elongate; maximum length 3.13 mm, maximum width 1.1 mm; maximum width of head across eyes 0.7 mm, minimum interocular distance 0.41 mm; maximum length of pronotum 0.74 mm, maximum width 0.74 mm, minimum width near base 0.6 mm; maximum length of elytra 2.05 mm.

Dorsum dull, head piceous, pronotum and elytra brown, ground color nearly obscured by metallic green and faint scattered violet reflections. Mentum and submentum rufopiceous with same metallic reflections as dorsum. Antennae and palpi yellow-brown with apex of ultimate maxillary palpomere piceous. Legs yellow-brown with tibiofemoral joints and apex of ultimate tarsomeres piceous.

Head across eyes imperceptibly wider than width of pronotum; clypeal punctures moderately coarse, exceedingly dense, much closer than on interocular region with many nearly coalesced; coarse punctures interspaced with numerous, nearly imperceptible fine setae; epistomal sulcus fine laterally, gradually broadened and moderately impressed toward middle; interocular region behind epistomal sulcus gradually and moderately raised to vertex; mid-cranial depression short, deeply sulcate and coarsely punctate, punctures coalesced; submedial interocular depressions vague; elevated areas of disc near vertex somewhat more sparsely and irregularly punctate than surrounding integument; most punctures moderately large, very irregularly but very closely spaced, many nearly coalesced. Mentum finely, very densely punctate, basal half of disc moderately, deeply foveate medially; submentum sparsely, finely punctate, with disc nearly completely covered by two large, deep foveae.
Pronotum convex, very slightly wider than long, apical half widest; anterior margin straight; lateral margins moderately strongly inflexed; inflexed sides narrow and irregularly punctate, punctures shallow, fine; sides viewed from above round, moderately, densely crenate, moderately sinuate in outline, with apical half subparallel, then slightly incurved behind middle and moderately narrowed to base; posterior margin moderately, strongly arcuate medially; punctures moderately coarse, irregular, dense punctures on disc separated by nearly one-third less width of puncture, denser and finer toward lateral margins; elevated areas of disc medially adjacent to foveae occasionally more sparsely punctuate than surrounding integument; setae tiny and indistinct. Anterolateral and basolateral foveae similar, moderately deep, small and slightly open to adjacent pronotal margin; median and mediolateral foveae round, deep with median fovea equal to one-fourth length of pronotum at midline; basomedial foveae elongate, deep and convergent near base.

Elytron strongly convex, elongate; lateral margin slightly constricted and straight on basal third, then moderately arcuate medially to apical third where feebly constricted subapically; apex nearly imperceptibly angled behind 4th interval, then sharply rounded to suture; serial punctures coarse, deep, those on disc separated by nearly one-third width of a puncture, those in apical third becoming gradually smaller and denser; setae on intervals obscured by metallic reflections; basal half of sutural interval flat and only slightly wider than other intervals, posteriorly becoming gradually wider and costate on apical third; remaining intervals on elytron narrow, most separated on disc by one and one-third their width; several intervals appear unequally raised as follows: 2nd interval on basal third subcostate and more strongly raised than any other interval at base; 3rd interval moderately, strongly costate from midlength to the beginning of apical third; 4th interval unevenly raised in basal half but decidedly costate just before middle, costa same height as costate area on 3rd interval; 4th interval then interrupted and flattened behind midlength to where slightly callused on the beginning of apical third; 6th interval feebly raised just anterior to callus on 4th interval; 8th interval unequally and slightly raised, with only a short, narrow costate area on middle; 7th interval near middle slightly sinuate and nearly coalesced with costa on 8th interval; epipleuron moderately coarsely punctate, punctures shallow, occasionally nearly coalesced.

Male genitalia. Figure 23. Phallobase less than half total length of genitalia; apex round; phallobase approximately uniform in width throughout, subequal to width of parameres; basoventral opening terminal. Apicoventral space of phallobase widest at junction of parameres and phallobase and narrowing to obtuse angulation. Parameres symmetrical, widest at base, narrowing in anterior third, outer margins convex; in lateral view, tapering towards apex, ventral surface concave to apical fourth, then flat to apex; apices straight. Aedeagus long, two-thirds length of parameres, in lateral view, with two dorsal swellings, basal swelling larger, located at junction of phallobase and parameres, second swelling subequal to basal swelling. Aedeagus greatly constricted beyond secondary swelling, tapering gradually to apex; apical two-fifths of aedeagus extending above dorsal surface of parameres; aedeagus, in dorsal view, between parameres, deeply forked, fork originating beyond base of parameres; aedeagus extending posteriorly three-fourths apicoventral space of phallobase, forked in apical half.

Female — Indistinguishable from males.

Variation — Specimens vary in length from 2.7–3.6 mm and in width from 1.1–1.3 mm. Dorsal metallic reflections vary from green, blue-green to golden green and occasionally violet. Specimens lacking metallic reflections are rare, but do occur. The elytra may be maculate. The maculae, when present, are generally irregular, large, reddish brown or rufopiceous. The largest and most consistent macula is located on 2nd and 3rd intervals just before middle and anterior to costa on 3rd interval. The second largest macula is centered on 4th and 5th intervals in a small median depression just anterior to callus on 4th interval.

Distribution — *Hydrochus pajnii* occurs from Maryland south to Florida, west to Texas and north through the Mississippi River basin as far as Illinois and Indiana. This species is known from scattered localities in every physiographic region, except the Coastal Meadows (I) and Paleozoic Bottoms (XI).
regions of Mississippi (Fig. 24).

**Material Examined** — We have examined 18 specimens from Mississippi localities, including: Adams Co. Natchez [UMIC], Clay Co. 5 mi W West Point [UMIC], George Co. 12 mi SW Lucedale [UMIC]; 3.2 mi S, 1.8 mi E Benndale [MEM], Jasper Co. 6 mi NW Montrose [UMIC], Noxubee Co. Noxubee NWR [MEM]; Noxubee NWR, 33°16’19”N, 88°45’43”W [MEM]; Noxubee NWR, 33°16’23”N, 88°46’03”W [MEM], Oktibbeha Co. Dorman Lake [MEM], Sharkey Co. Delta NF, 32°52’39”N, 90°45’36”W [MEM]; Rolling Fork [UMIC], and Washington Co. Stoneville [MEM].

**Seasonal Distribution** — Most records from April through August, with one collection in November.

**Diagnosis** — *Hydrochus pajnii* possesses distinctive genitalia and examination of them is necessary for positive identification, see diagnosis of *H. excavatus*. Externally *H. pajnii* closely resembles *H. inaequalis* and *H. excavatus*. *Hydrochus pajnii* generally can be distinguished by its larger size, more prominent elytral calli, and reduced cranial and pronotal punctuation in comparison to either *H. inaequalis* or *H. excavatus*. Additionally, *Hydrochus pajnii* often has coalesced epipleural punctures, while in *H. excavatus* the epipleural punctures are arranged in a single series.

**Biology** — *Hydrochus pajnii* has previously been collected at ponds, rivers, streams, ditches, and at ultraviolet lights (Ciegler 2003). Specimens collected during this study were found mostly at black lights placed near swamps and a large river, as well as various aquatic habitats in pine woods, mixed forest, and bottomland hardwood forests.

**Notes** — *Hydrochus pajnii* was described as “*Hydrochus undulatus*” by Hellman (1975) in his dissertation. “*Hydrochus undulatus*” Hellman is *nomina nudum* as it was ascribed to Hellman in White et al. 1985: 363 (Hansen 1999). The locality information published in the original description of *Hydrochus pajnii* Makhan (2000) was incorrect (Short & Heuber 2006) and should have read “Ill. Ham. Co./5.2 mi N., 1.8 mi E./McLeansboro/VIII-16-1969 Bk. Lt./ J.K. Bouseman”. This species was keyed as *Hydrochus* sp. 5 in Epler (1996, 2010) and Ciegler (2003).

---

**Hydrochus schereri** Makhan, 1995


**Description** — Male—Moderately small, elongate; maximum length 2.8 mm, maximum width 1.0 mm; maximum width of head across eyes 0.7 mm, minimum interocular distance 0.4 mm; maximum length of pronotum 0.6 mm, maximum width 0.7 mm, minimum width near base 0.65 mm; maximum length of elytra 1.9 mm.

Dorsum shiny; head piceous, pronotum and elytra reddish brown with pronotum slightly paler near anterior and posterior margins, ground colors generally obscured by green and golden green metallic reflections. Mentum and submentum rufopiceous with scattered metallic reflections similar to those on dorsum. Antennae and palpi reddish brown with apex of ultimate maxillary palpomere darkened or piceous. Legs reddish brown with tibiofemoral joints and apex of tarsi piceous.

Head across eyes equal to pronotum, clypeal punctures moderately coarse, dense, very irregularly spaced and irregularly coalesced near base; fine setae obscured by metallic reflections; epistomal sulcus very fine laterally, gradually broadened and moderately, deeply impressed on middle half, coarse punctures within depression coalesced; interocular region very rugose, medially behind epistomal sulcus very gradually, irregularly raised to vertex; mid-cranial depression deeply sulcate and coarsely punctate, punctures coalesced; submedian interocular depressions very irregular, deep, with punctures nearly coalescent; discal elevated areas punctate; punctures moderately large, generally much larger than on clypeus, very irregularly spaced with most separated on disc by less than one-half width of a puncture; setae same as on clypeus; mid-occipital region broadly, moderately constricted between postero lateral margins of eyes. Mentum finely, densely punctate, basal two-thirds of disc moderately, deeply foveate medially; submentum very sparsely punctate with disc nearly completely obscured by two large, very deep, transverse foveae.

Pronotum moderately convex, slightly wider than long, widest in apical half; anterior margin straight; lateral margins narrowly, sharply inflexed in basal two-thirds; inflexed surface with
a single row of moderately fine punctures; sides of pronotum viewed from above angulate, feebly crenulate, sinuate, with apical half parallel, then slightly incurved behind middle and moderately narrowed to base; posterior margin moderately arcuate; punctures coarse, dense, very irregularly spaced with most separated on disc by one-fourth to one-third their width, denser and finer toward lateral margins; elevated areas punctate similar to surrounding discal surface. Anterolateral and basolateral foveae very shallow; median, mediolateral and basomedial foveae shallow. Elytron convex, elongate; lateral margin slightly constricted in basal two-fifths, then moderately arcuate to apex; apex rounded to suture; serial punctures deep, large, those on disc regular, separated by one-third their width, those in apical third and in rows 8, 9, and 10 gradually becoming smaller and denser near the elytral margin; sutural interval near base slightly wider than other intervals, then posteriorly becoming gradually, slightly wider and moderately costate on apical third; remaining intervals on elytron appear feebly convex, regular in height except as follows: 2nd interval slightly more convex on basal fourth; 4th interval slightly widened and slightly raised on beginning of apical third; 7th interval medially sinuate and nearly coalesced with 8th interval; 8th interval feebly more convex than adjacent odd numbered intervals and medially raised where nearly coalesced with 7th interval; epipleuron moderately, coarsely punctate on basal three-fourths, punctures moderately deep near base then becoming gradually shallower until disappearing on apical half.

Male genitalia. Figure 25. Phallobase approximately one and one-half times length of parameres; apex round; phallobase concave when viewed laterally, widest in posterior third, at narrowest point less than width of parameres at base; basoventral opening terminal, appearing cordate. Apicoventral space of phallobase widest at junction of parameres and phallobase and narrowing to acuminate point. Parameres symmetrical, widest at base, narrowing towards apex, widened at apical two-fifths length, then gradually tapering to apex, sides of paramere sinuate; apices straight. Aedeagus three-fourths length of parameres; in lateral view, with ventral surface flattened, dorsal surface with three swellings, basal swelling subequal in elevation to dorsal surface of paramere, second swelling medial on aedeagus subequal to basal swelling in elevation, preapical swelling minute; in dorsal view, forked in apical third. At base, aedeagus with posterior process extending half of apicoventral space of phallobase, process bifurcate in apical third.

Female — Indistinguishable from males.

Variation — Specimens vary in length from 2.2–2.8 mm and in width from 0.8–1.1 mm. As might be expected, variation in metallic coloration occurs.

Distribution — Hydrochus schereri occurs from Massachusetts south to Florida and as far west as Mississippi. Like, H. jiawanae, this species occurs in the most southeastern counties in Mississippi (Coastal Meadows (I) and Southern Pine Hills (II) physiographic regions) (Fig. 26).

Material Examined — We have examined 41 specimens from Mississippi localities, including: George Co. Mixon Lakes, 30°50'28"N, 88°43'11"W [MEM], Hancock Co. Stennis Space Center [UMIC], Harrison Co. 8 mi NE Saucier [UMIC], Jackson Co. Grand Bay Savannah, 30°27'31"N, 88°25'14"W [MEM]; MS Sandhill Crane NWR, 30°27'34"N, 88°41'28"W [MEM], and Stone Co. T4S-R1W Sec. 6 [UMIC]; Red Creek x Hwy 15 [UMIC].

Seasonal Distribution — April through June, August and early September.

Diagnosis — Hydrochus schereri most closely resembles H. simplex. Hydrochus schereri usually possesses more prominent elytral calli on the 4th interval, while H. simplex lacks raised calli entirely. This diagnostic feature is generally unreliable on its own, due to variability between species, and positive identification requires examination of the male genitalia. Hydrochus simplex possesses a phallobase two-thirds the length of the parameres, while H. schereri has a phallobase one and one half times the length of the parameres.

Biology — Hydrochus schereri has previously been collected in streams and at ultraviolet lights. Specimens were collected during this study near ponds in coastal savannah at sun lamps, mercury vapor light, and black lights, and at black lights...
set near Red Creek, a moderately large, sandy bottomed, blackwater river.

Notes — This species was described as “Hydrochus woodi” by Hellman (1975) in his dissertation and was keyed as Hydrochus sp. 6 in Epler (1996, 2010) and Ciegler (2003).

Notes on extralimital species

The poor quality of genitalic illustrations produced by Makhan in his descriptions of Hydrochus species descriptions prompted us to examine several Makhan types with distributions that overlapped those of Mississippi species. Makhan (2004a) described Rishihydroius soesae from Rhode Island. Short and Hebauer (2006) subsequently synonymized the genus Rishihydroius with Hydrochus, thus creating a new combination Hydrochus soesae (Makhan). The examination of the type of Hydrochus (Rishihydroius) soesae (Makhan) was not possible as the specimen has not been deposited in the Peabody Museum as indicated by Makhan (2004a). Correspondence with curators at Peabody Museum of Natural History, Yale University, New Haven, Connecticut indicated that they do not possess nor have they received any types of this species. We have contacted the author in an attempt to locate the type, but have received no correspondence. We assume the types are still possessed by the author, or deposited at another institution, or lost. A combination of the locality information (NE United States), the written description and the general characters of the illustrated male genitalia (Makhan 2004a, Fig. 2), however poor, has led us to believe that the holotype is a typical form of Hydrochus scabrus Mulsant and should be considered a junior synonym. Two unsuccessful attempts (1975 & 2016) were made to locate the type of H. scabrus. The holotype is not in the Mulsant collection in Paris (MNHN). The holdings at Musée des Confluences, Lyon, France were also searched after indications that syntypes of some Mulsant material may have been deposited there when Mulsant lived in Lyon (pers. comm. A. Mantilleri), but no type material was found. The holotype is deemed lost or destroyed, and a neotype is here designated. The neotype male with label data, stated verbatim, line breaks indicated by “\": "Md. CalvertCo/Dunkirk/IX-29-1968/ J.L. Hellman", is deposited in the National Museum of Natural History, Smithsonian Institute.

The holotype and twenty-three paratypes of H. daviniae Makhan, 1995a, were examined from the Naturhistorisches Museum, Wien, Austria (NHMW). The spelling as Hydrochus daviniae Makhan (1995b) stands as an unjustified emendation to Hydrochus daviniae Makhan (Hansen 1999). All specimens were from five Texas localities. The holotype male and three male paratypes were examined and found to be typical representatives of Hydrochus vagus LeConte, and thus H. daviniae should be considered a junior synonym of H. vagus. The label data for the holotype male, stated verbatim, with line breaks designated by “\": “USA-TEXAS 1991\Santa Ana WR’S Mc Allen (4)/20./21.XI. lg. Jäch”. The twenty paratype females contained series of three different species. Makhan’s illustration of the male genitalia provide no aid in identification. Hydrochus vagus LeConte is externally most readily confused with H. simplex LeConte in the U.S. However, H. simplex LeConte possesses a punctate epipleuron, while the epipleuron of H. vagus LeConte is impunctate. Examination of the male genitalia, which are very distinctive, is required to confirm proper identification.

The male holotype of H. bakkeri Makhan, 1995a, from the Naturhistorisches Museum, Wien, Austria (NHMW) was examined and is clearly a male of H. obscurus Sharp, thus Hydrochus bakkeri Makhan should be considered a junior synonym. The label data, stated verbatim, with line breaks designated by “\": “USA – TEXAS 1991\Santa Ana WR’S McAllen (4)/20./21.XI. lg. Jäch”. This is a new country record and range extension for H. obscurus Sharp of approximately 400 miles north of its currently known range, which extends from the Mexican state of San Luis Potosi to Argentina (Hellman 1975; Oliva 1996). Examination of male genitalia is necessary for identification. A combination of the following characteristics will separate H. obscurus from all other U.S. Hydrochus: 1) parameres weakly sagittate near apex, 2) genitalia lacking pseudoparameres, 3) basoventral opening terminal with four-sided, shield-like
projection extending from phallobase and 4) sclerotized portion of aedeagus truncate at apex.

Makhan (2004a) stated that the holotype of *Hydrochus jasodae* Makhan was deposited in two museums, the Illinois Natural History Survey, Champaign, Illinois, USA and Museum National d’Histoire Naturelle, Paris, France. The holotype, a female, which we examined, is deposited in the former collection.

*Hydrochus foveatus* Haldeman lacks a holotype. Haldeman (United States et al. 1852) did not designate a holotype of *H. foveatus* and subsequent authors have not dealt with this issue. There is a single female specimen in the LeConte collection bearing the following label data (given verbatim with line breaks indicated by “/”): “H. foveatus Hd./Ft. Gates Texas.” After comparison of the female with Haldeman’s original description of the species, the authors are confident that this specimen was used by Haldeman for his description of the species and so designate this individual as the lectotype. This specimen is deposited in the Museum of Comparative Zoology, Harvard University.

Upon examination of the holotype of *Hydrochus monishi* Makhan, 1995a, from the Naturhistorisches Museum, Wien, Austria (NHMW), we concluded that it is a typical male of *Hydrochus foveatus* Haldeman, thus *H. monishi* is here considered a junior synonym of that species. Following is the label data, stated verbatim, with line breaks designated by “/”:

```
USA-TEXAS 1991/ Palmetto State P/70km S Austin (13)/26.XI. leg. Jach."
```

The genitalia of the holotype male possess pseudoparameres, which are entirely lacking in Makhan’s illustration. The sagittate form of the parameres, presence of pseudoparameres, and collection locality in Texas will separate *Hydrochus foveatus* from all other species in the United States.

**Acknowledgements**

The authors would like to express their gratitude to Philip Perkins at MCZ, Charyn Micheli at the United States National Museum, Terry Schiefer at Mississippi State University, Charles Ray at Auburn University, Chris Grinter at the Illinois Natural History Survey, Christine Taylor and Max Barclay at the Natural History Museum of London, Bernd Jaeger at Berlin Natural History Museum, Antoine Mantilleri at Museum National d’Histoire Naturelle-Paris, Harold Labrique at Musée des Confluences-Lyon, France, Raymond Pupeedis at Peabody Museum of Natural History-Yale University, and Manfred Jäch and Michaela Brojer at the Natural History Museum of Austria for the loan of types, additional specimens, and valuable input. Joe McGowan is gratefully acknowledged for his assistance in imaging specimens. We thank JoVonn Hill for his editorial assistance and two anonymous reviewers for providing valuable feedback on this manuscript.

**Literature Cited**


Research Institute.


Mississippi Department of Environmental Quality (2013) MS Physiographic Regions 2013.


Figure 2. *Hydrochus callosus* LeConte male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 3. *Hydrochus callosus* LeConte distribution by county in Mississippi.
Figure 4. *Hydrochus excavatus* LeConte male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 5. *Hydrochus excavatus* LeConte distribution by county in Mississippi.
Figure 6. *Hydrochus inaequalis* LeConte male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 7. *Hydrochus inaequalis* LeConte distribution by county in Mississippi.
Figure 8. *Hydrochus neosquamifer* Smetana male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 9. *Hydrochus neosquamifer* Smetana distribution by county in Mississippi.
Figure 10. *Hydrochus rufipes* Melsheimer male genitalia. Left, ventral aspect; right, lateral aspect. Illustration modified from Hellman (1975).

Figure 11. *Hydrochus rufipes* Melsheimer distribution by county in Mississippi.
Figure 12. *Hydrochus rugosus* Mulsant male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 13. *Hydrochus rugosus* Mulsant distribution by county in Mississippi.
Figure 14. *Hydrochus simplex* LeConte male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 15. *Hydrochus simplex* LeConte distribution by county in Mississippi.
Figure 16. *Hydrochus jaechi* Makhan male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 17. *Hydrochus jaechi* Makhan distribution by county in Mississippi.
Figure 18. *Hydrochus falsus* Hellman, **n. sp.**, dorsal habitus of holotype male.
Figure 19. Hydrochus falsus Hellman, *n.sp.*, male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 20. Hydrochus falsus Hellman, *n.sp.*, distribution by county in Mississippi.
Figure 21. *Hydrochus jiawanae* Makhan male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 22. *Hydrochus jiawanae* Makhan distribution by county in Mississippi.
Figure 23. *Hydrochus pajnii* Makhan male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 24. *Hydrochus pajnii* Makhan distribution by county in Mississippi.
Figure 25. *Hydrochus schereri* Makhan male genitalia. Left, ventral aspect; right, lateral aspect. Illustration from Hellman (1975).

Figure 26. *Hydrochus schereri* Makhan distribution by county in Mississippi.