A KEY TO THE WHIRLIGIG BEETLES OF MINNESOTA AND ADJACENT STATES AND CANADIAN PROVINCES (Coleoptera:Gyrinidae)

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A KEY TO THE WHIRLIGIG BEETLES OF MINNESOTA AND ADJACENT STATES AND CANADIAN PROVINCES

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William D. Ferkinhoff and Ralph W. Gundersen

ABSTRACT — This paper presents adult keys, descriptions, and distributions for the four species of *Dineutus* and the 27 species of *Gyrinus* found in Minnesota and adjacent states and Canadian provinces. Twenty species of *Gyrinus* have definitely been recorded from Minnesota. An adult key to the four North American genera is included. Besides the keys and descriptions, life history, habits, taxonomic characters, and preparation of specimens are discussed.

No new species are described, but nine specimens of *G. gehringi*, previously represented by only the pair of type specimens, were identified. One male *G. nigrior* from Cass County, North Dakota, was also identified. This is the first record of this species from that state. *Gyrinus parcus, G. wallisi,* and *G. marginellus* have been added to the list of species occurring in Minnesota.

Bionomics – The family Gyrinidae is a small group of beetles uniquely adapted to life on the surface of most freshwater habitats. They often form large schools near shore or emergent vegetation. Gyrinids seek out shady areas on hot bright days and seek shelter or submerge on windy days. Most species are diurnal, but in unfavorable habitats some become nocturnal (Leech and Chandler, in Usinger, 1956). Generally the species of *Gyretes* prefer the swift current found in rivers. *Spanglerogyrus* and most species of *Dineutus* are stream inhabitants. No *Gyretes* or *Spanglerogyrus* are found in the Minnesota region, and of the four species of *Dineutus* found here, only *D. discolor* is a stream inhabitant. The majority of *Gyrinus* are found in lakes and ponds (Leech and Chandler, in Usinger, 1956; Folkerts, 1979).

Gyrinids float on the water aided by a water repellent body surface and a fringe of bristles around the head and on the antenna (Hatch, 1925). They must swim actively or grasp submerged plants to remain below the surface. Air taken in under the elytra near the tip of the abdomen is stored in a dorsal reservoir which greatly improves bouyancy. Because the abdominal spiracles are inside this reservoir, the beetles can remain submerged for extended periods.

On the water surface, gyrinids are very fast swimmers, with species of *Gyrinus* attaining speeds of 1 M/sec (Tucker, 1969; Gibbs and Hinton, 1971). They easily swim below the surface but at greatly reduced speeds. The highly modified paddle-like middle and hind legs are used for propulsion. The recently described genus, *Spanglerogyrus,* does not have the typical paddle-like middle and hind legs. The front legs are used to grasp food, which consists of insects that happen to get caught in the surface film. Besides being excellent swimmers gyrinids are strong fliers, but they must climb out of the water to take off (Osborn, 1886).

Gyrinids are unique in having their eyes completely divided into dorsal and ventral parts. The dorsal part is used for above water vision, and the considerably larger ventral part is used for simultaneous vision below the surface (Hatch, 1925).

The larvae are creamy white except for the head and dorsal plates of the prothorax which are dark brown. When fully grown, *Dineutus* larvae are 25 to 30 mm long, and *Gyrinus* larvae are approximately 14 mm long (Wilson, 1923). They breathe by means of ten pair of lateral tracheal gills (one pair of gills on each of the first eight abdominal segments and two pair on the ninth abdominal segment). The larvae swim by a dorsoventral motion of the abdomen, which is greatly aided by their heavily fringed gills. The larvae have been known to attack and kill small fish under stress conditions, but normally they prey on Odonata and Ephemeroptera nymphs and larvae of Dipterans (Wilson, 1923). Once caught, the body fluids of the prey are sucked out through the gyrinid's hollow mandibles, leaving the prey's exoskeleton as waste.

Life History – In temperate regions winter is passed in the adult state either in the mud and bottom debris or by clinging to submerged vegetation (Leech and Chandler, in Usinger, 1956). There are some species which remain active all year. Numerous specimens of *G. maculiventris* have been collected as early as 15 March, from below

sheets of ice along the edges of the Sauk River, southwest of St. Cloud, Minnesota. Wallis (1920's unpublished) also reported this species being taken from the Assiniboine River near Treesbank, Manitoba on 9 January 1928.

Copulation begins in the spring and may extend into August for some species (Istock, 1966). Shortly after copulation, eggs are deposited in rows or clumps on submerged vegetation. For *Dineutus,* 20 to 50 eggs are laid; and it is believed *Gyrinus,* on the average, lay fewer (Hatch, 1925). After egg deposition the adults soon die (Smith, 1926). Depending on the species and environmental conditions, incubation takes 5 to 17 days, after which the larvae hatch and move to the bottom and begin feeding (Hatch, 1925). For *D. nigrior* the larval stage takes 20 to 25 days; the larvae then leave the water and build a pupal case of mud and other debris beneath a piece of wood or on the undersurface of dead grass (Wilson, 1923). *Gyrinus* larvae make their cocoons from the scum and mud which accumulates near the water line on emergent plants, and have been found attached to these plants anywhere from 2 inches to 4 feet above the water (Butcher, 1930). Eight to ten days after pupation the adults emerge (Wilson, 1923). There is normally one generation per year, but Istock (1966) has reported limited breeding by the new generation in species of *Dineutus*.

The time from copulation and egg deposition by the old generation to the emergence of new generation beetles is approximately six weeks. Offspring of species which began breeding around the middle of May will begin to emerge near the first of July. Because some species continue to breed into August, their offspring will continue to emerge well into September.

TAXONOMY OF GYRINIDAE

Early studies of the Gyrinidae utilized size, shape, color, and elytral sculpturing (LeConte, 1868). Species differences are often slight resulting in some difficulty in accurately distinguishing species. The utilization of male genitalia makes identifying males to the species level relatively easy. When identifying females, or males without the genitalia extracted, one must still rely on shape, color, and sculpturing.

The four species of *Dineutus* found in this region exhibit enough differences to pose few problems taxonomically, but the 27 species of *Gyrinus* in many cases are quite difficult to distinguish. To make the

separation of *Gyrinus* species easier, similar species have been grouped and a brief description given for each group's distinguishing characters.

TAXONOMIC CHARACTERS

Size – The genus *Gyrinus* ranges in length from 3.3 to 7.8 mm. Females are 8 to 10 percent larger than males with the exception of *G. impressicollis,* where males are about 5 percent larger than females. In the Minnesota region both sexes of *Dineutus* are of nearly equal size.

Color – Dorsally all species are totally black. Some species, such as *D. assimilis* and *G. confinis,* also show varying degrees of bronzing, especially in the head region and along the elytral margins.

Ventrally there are three major color patterns: 1) black, 2) reddish-orange to straw yellow, and 3) combinations of black and reddish-orange to straw yellow. In species with black ventral surfaces the epipleura and hypomera (Fig. 3) sometimes appear slightly reddish. These species should not be confused with the species of the *G. maculiventris* group which have very distinct reddish-orange epipleura and hypomera. It is also important to note that heating specimens in water to relax them for removal of genitalia and preserving specimens in alcohol often detaches underlying tissue from the integument, causing a darker ventral color (Wood, 1968).

Elytral Markings – In the genus *Gyrinus* the minute, nonstrial punctures are of little taxonomic value; but the presence, type, and density of elytral sculpturing is diagnostically useful in identifying many species. In some species the sculpturing is quite different in the two sexes, making male-female associations difficult.

The position of the eleventh punctate striae and the size of the lateral strial punctures are important in separating species groups. These characters are difficult to interpret, however, without an adequate collection for comparisons.

In the genus *Dineutus* the species vary in the shape of their elytral apices. This character, like sculpturing in the genus *Gyrinus,* is expressed somewhat differently in the two sexes, and species determinations should not be based solely on this character.

Anterior Legs – For the species of *Gyrinus* anterior legs are of limited diagnostic value, but for the species of *Dineutus* the anterior legs are of major importance. Three characteristics are useful in *Dineutus:* 1)

shape of the front tibia, especially the outer apical angle; 2) the presence of a tooth on the femora of male *D. discolor;* 3) number of setigerous punctures on the dorsal surface of the femora. (This character is somewhat unreliable, in that it may vary plus or minus one puncture.)

Genitalia – The genitalia of female *Gyrinus* are very similar in all species and are of little-to-no diagnostic value. Wood, (1968) found the female genitalia of some value in separating species of *Dineutus,* but we have not made use of them because the species of this region are readily separated by other means.

Males of *Gyrinus* and *Dineutus* are easily identified to species by examining their genitalia. For some species of *Gyrinus* this is the only dependable distinguishing character. Females in such cases can only be tentatively identified by matching them with males taken from the same location on the same date. Until one is very familiar with each species and this key, reference to the genitalia drawing is strongly advised before putting a species name on a specimen. Females, unless members of very distinctive species, should not be assigned to a species without accompanying males.

PREPARATION OF SPECIMENS

These procedures will greatly simplify identification and avoid confusion.

Cleaning Elytra – Mounted specimens rapidly collect dust which obscures elytral sculpturing and dulls surface lustre. A cotton swab dipped in 95 percent ethanol and gently rubbed on the elytra will remove these deposits.

Extracting Male Genitalia – Genitalia are easily extracted from alcoholic or resoftened specimens with the use of a dissecting microscope and a pin with a rolled-over point. All but very old specimens can be resoftened by soaking them for a few minutes in boiling water or Barber's fluid. Many specimens become soft enough to remove the genitalia if, when cleaning the elytra, a drop of alcohol is applied to the tip of the abdomen and allowed to stand for a short time.

Mounting – When mounting members of the genus *Dineutus,* the front legs should be positioned so that the dorsal row of femoral setigerous punctures and the exterior angle at the apex of the tibia are visible.

KEY TO THE NORTH AMERICAN GENERA OF THE FAMILY *GYRINIDAE*

1. Meso- and metatibiae paddle-like, about as long as broad. 2

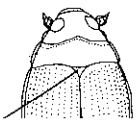
1′. Meso- and metatibiae not paddle-like, about 4 times as long as broad (not recorded from Minnesota) . .*Spanglerogyrus*

Dineutus

Spanglerogyrus (redrawn from Folkerts, 1979)

2. Scutellum visible; length less than 8.0 mm. .....*Gyrinus*

2′. Scutellum not visible; length variable. 3



Gyrinus

Dineutus

3. Length 9.0 mm or more; last abdominal segment dorso-ventrally compressed, rounded at tip. .....*Dineutus*

3′. Length not over 7.0 mm; last abdominal segment elongated and conical (not recorded from Minnesota). .....*Gyretes*

Dineutus

Gyretes

Descriptions of the North American Genera of the Family Gyrinidae.

Genus *Spanglerogyrus* Folkerts, 1979.

TAXONOMIC CHARACTERS: Mean length 2.9mm; scutellum visible; elytra without striae, margins pubescent; dorsal and ventral eyes contiguous along margin of head, separated by only a narrow ridge; meso- and metatibiae about four times as long as broad (Folkerts, 1979).

DISTRIBUTION: This genus is represented by one species, *Spanglerogyrus albiventris*, which has been taken from only two sites in southwest Alabama (Folkerts, 1979). All specimens were collected from beneath overhanging banks of slow-moving streams (Folkerts, 1979).

Genus *Gyrinus* Geoffroy, 1762.

TAXONOMIC CHARACTERS: Size small, less than 8.0 mm; scutellum visible; last abdominal segment dorso-ventrally compressed, rounded at tip; elytra and pronotum not pubescent; eleven punctate striae per elytron; meso- and metatibiae paddle-like. (Fig. 2,3).

DISTRIBUTION: Worldwide except the Pacific Islands beyond New Guinea, New Caledonia, and New Zealand (Leech and Chandler, in Usinger, 1956). North of Mexico this genus is represented by 39 species, with 20 being found in Minnesota.

Genus *Dineutus* MacLeay, 1825.

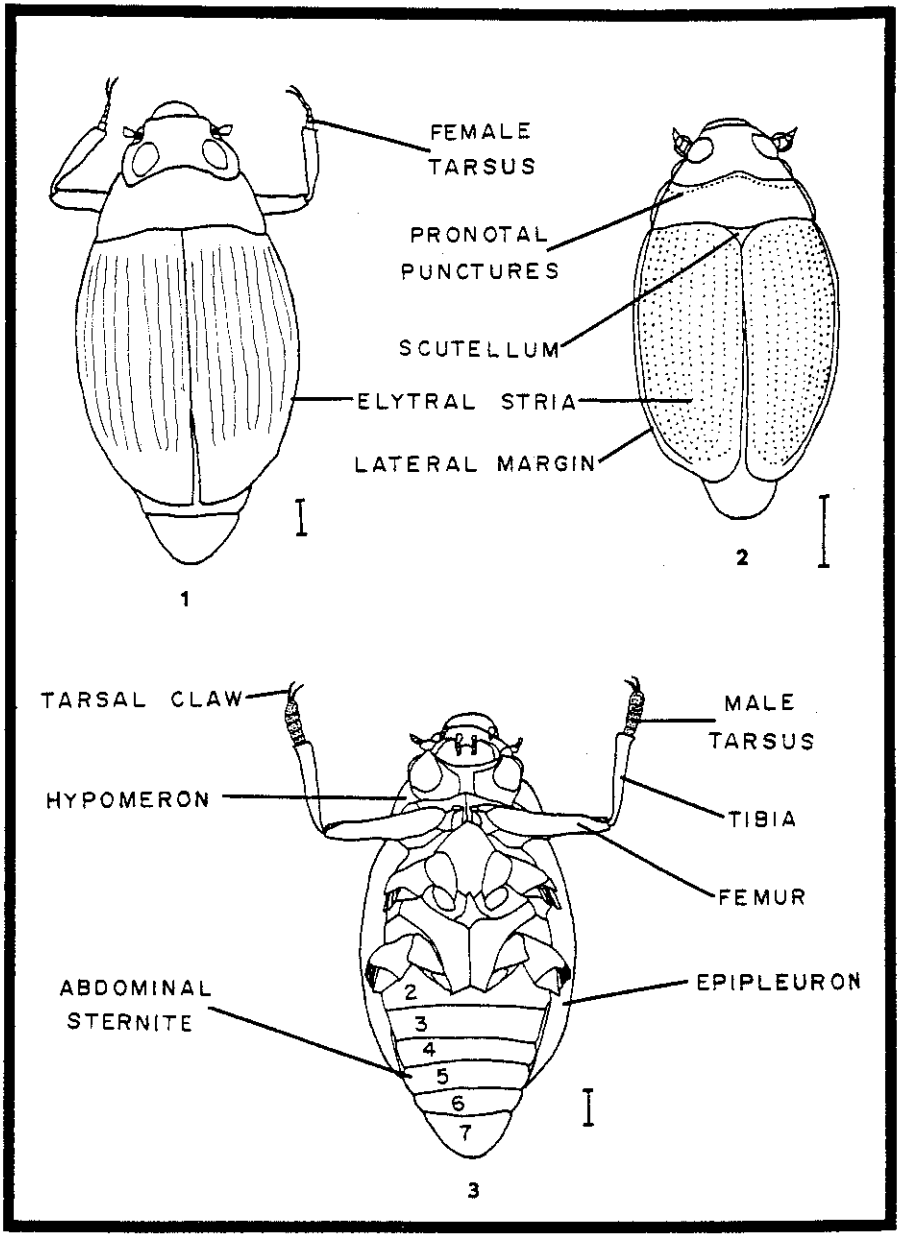
TAXONOMIC CHARACTERS: Size large, over 9.0 mm; scutellum not visible; last abdominal segment dorso-ventrally compressed, rounded at tip; elytra and pronotum not pubescent; nine nonpunctate striae per elytron; meso- and metatibiae paddle-like. (Fig. 1,3).

DISTRIBUTION: North and Central America; Ethiopian, Oriental, and Australian regions; also in the Fiji Islands (Leech and Chandler, in Usinger, 1956). North of Mexico this genus is represented by 14 species, four of which are found in Minnesota.

Genus *Gyretes* Brulle, 1834.

TAXONOMIC CHARACTERS: Size small, less than 7.0 mm; scutellum not visible; last abdominal segment elongate and conical; United States species without striae, margin of elytra and pronotum pubescent; meso- and metatibiae paddle-like.

DISTRIBUTION: A neotropical genus found in South and Central America. One species is found in Florida (Young, 1954) and two species have been described from California, although neither has been recorded since the early 1900's (Leech and Chandler, in Usinger, 1956). This genus is not represented in Minnesota.



Figures 1-3. 1. Dorsal view of female *Dineutus;* 2. Dorsal view of *Gyrinus;* 3. Ventral view of male *Dineutus*. Scale line represents 1.0 mm.

KEY TO THE MINNESOTA SPECIES OF THE GENUS *DINEUTUS*

1. Color of ventral surface reddish to yellow-brown. *discolor* **(p. 15)**

1′. Color of ventral surface predominantly dark brown or black. 2

2(1). Epipleura reddish-brown to yellowish-brown; elytral apices rounded in male (Fig. 9), produced and dehiscent in female (Fig. 10). .....*hornii* **(p. 16)**

2′. Epipleura dark brown to black; elytral apices produced in both male and female. 3

3(2). Anterior tarsi expanded (Fig. 3); male. 4

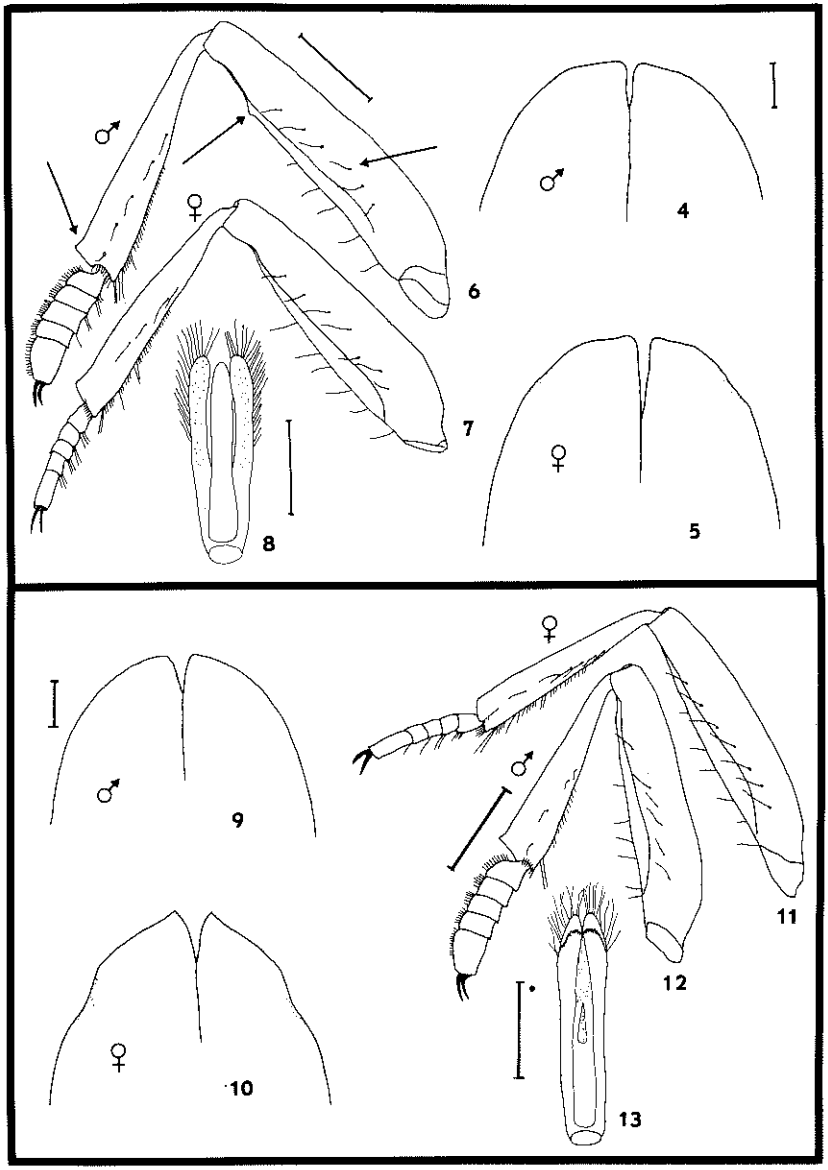
3′. Anterior tarsi not expanded (Fig. 1); female 5

4(3). Elytral apices slightly dehiscent and weakly produced at suture (Fig. 14); anterior legs light brown; exterior angle of anterior tibiae obtuse and weakly produced; setigerous femoral punctures usually seven (Fig. 16). .....*assimilis* **(p. 17)**

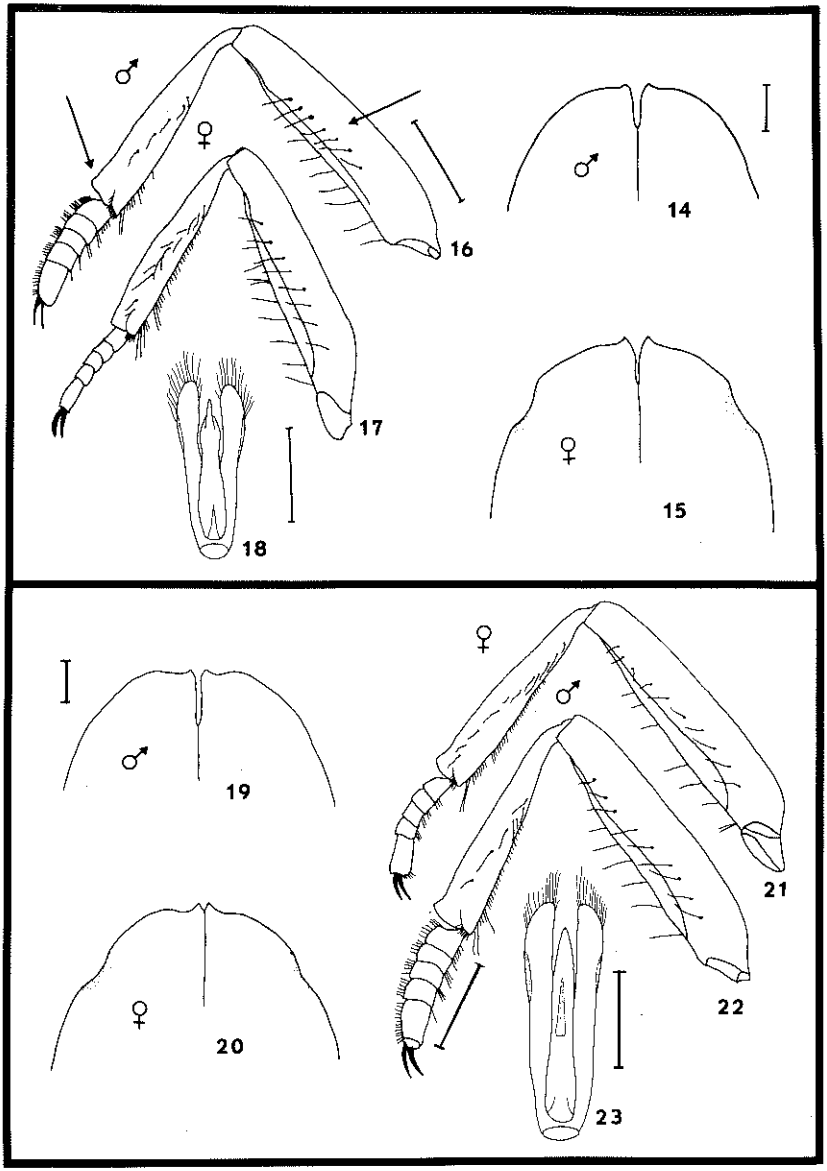
4′. Elytral apices not dehiscent and moderately produced (Fig. 19); anterior legs black; exterior angle of anterior tibiae acute and strongly produced; setigerous femoral punctures usually nine (Fig. 22). .....*nigrior* **(p. 19)**

5(3′). Elytral apices dehiscent (Fig. 15); anterior legs light brown exterior angle of anterior tibiae rectangular and not produced; setigerous femoral punctures usually eight (Fig. 17). .....*assimilis* **(p. 17)**

5′. Elytral apices not dehiscent (Fig. 20); anterior legs black; exterior angle of anterior tibiae acute and weakly produced; setigerous femoral punctures usually ten (Fig. 21). .....*nigrior* **(p. 19)**



Figures 4-13. Dorsal views of male and female elytra, male and female front legs, and male genitalia. 4-8. *D. discolor;* 9-13. *D. hornii*. Scale line represents 1.0 mm.



Figures 14-23. Dorsal view of male and female elytra, male and female front legs, and male genitalia. 14-18. *D. assimilis*. 19-23. *D. nigrior*. Scale line represents 1.0 mm.

Description of the Minnesota Species of the Genus *Dineutus*

Dineutus discolor Aube, 1838: 84. Figs. 4-8, 24.

LENGTH: Male 11.8 - 13.3 mm; female 11.3 - 13.3 mm. WIDTH: Male 6.2 - 7.1 mm; female 6.2 - 7.1 mm. COLOR: Dorsally black, highly bronzed; ventrally reddish-brown to yellowish-brown. ANATOMY: Slightly convex, narrowed anteriorly, head somewhat pointed; striae very faint; posterior lateral margins of female elytra weakly sinuate and depressed, apices rounded and slightly produced at suture (Fig. 5); posterior lateral margins of the male elytra not sinuate and slightly depressed, apices rounded and not produced at suture (Fig. 4); anterior tibiae cylindrical at base and regularly broadened towards apex, outer apical angle rectangular, weakly produced in female, produced in male; front femora of male toothed and usually with six setigerous punctures, female not toothed and usually with seven setigerous punctures (Figs. 6, 7). MALE GENITALIA: Figure 8.

DISCUSSION: Unlike the other *Dineutus* species in our fauna, *D. discolor* is found strictly in running water. Being narrowed anteriorly, it is well suited to flowing water. This species is easily distinguished because of its reddish-brown to straw colored ventral surface. In Minnesota this is the only species in which the male has toothed femora.

DISTRIBUTION: North and Middle Atlantic states, North and South Carolina, and Mexico (Roberts, 1895). Specimens from Minnesota, Wisconsin, and Michigan have been examined (Fig. 24). Specimens examined: 309.

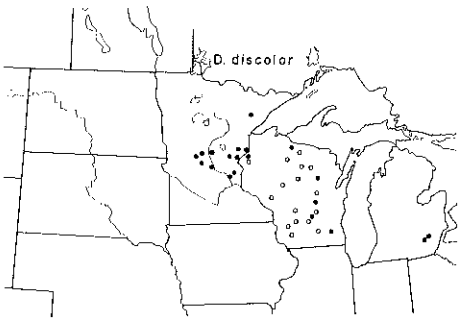


Figure 24. Distribution of *Dineutus discolor*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Dineutus hornii Roberts, 1895: 284. Figs. 9-13, 25.

LENGTH: Male 10.3 - 11.2 mm; female 10.7 - 12.0 mm. WIDTH: Male 5.7 - 6.3 mm; female 5.8 - 6.6 mm. COLOR: Dorsal surface dark black; ventral surface black; epipleura, anal sternite and lateral margins of abdominal sternites 4, 5, and 6 reddish-brown. ANATOMY: Slightly convex; striae faint to non-existent; posterior lateral margins of female elytra sinuate and depressed, apices highly produced and dehiscent at suture (Fig. 10); posterior lateral margins of male elytra arcuate, apices rounded and slightly dehiscent at suture (Fig. 9); anterior tibiae regularly widened from base to apex; outer apical angle obtuse and not produced in female, slightly produced in males; setigerous punctures of front femora usually seven in female and six in male (Figs. 11, 12). MALE GENITALIA: Figure 13.

DISCUSSION: This species can be distinguished from other ventrally black species because the epipleura is distinctly reddish-brown. It is the only species in which the elytral apices are grossly different in the male and female. Those of the male being rounded, while those of the female are produced and dehiscent.

DISTRIBUTION: Eastern half of the United States including parts of Texas (Istock, 1966). Large numbers of this species have been found in all but extreme southwest Minnesota. Specimens have been examined from Wisconsin, Michigan, and Ingolf, Ontario (Fig. 25). Specimens examined: 901.

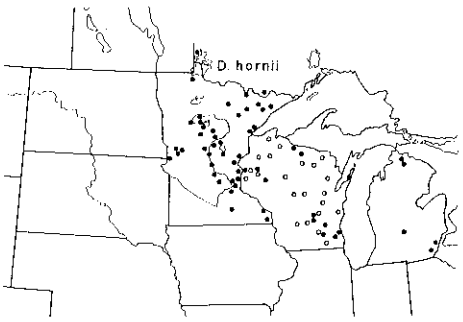


Figure 25. Distribution of *Dineutus hornii*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Dineutus assimilis Kirby, 1837: 78. Figs. 14-18, 26.

LENGTH: Male 10.3 - 11.2 mm; female 10.5 - 11.0 mm. WIDTH: Male 5.6 - 6.1 mm; female 5.2 - 6.0 mm. COLOR: Dorsally black, margins heavily bronzed, especially on head and pronotum; ventrally dark brown to black, anal sternite and lateral margins of sternites 5 and 6 sometimes yellowish-brown; front legs light brown, femora medially darkened. ANATOMY: Rather convex; striae faint, becoming more noticeable posteriorly; posterior lateral margins of female elytra depressed and sinuate, apices moderately produced and dehiscent at suture (Fig. 15); posterior lateral margins of male elytra arcuate, apices weakly produced and slightly dehiscent at suture (Fig. 14). Anterior tibiae apically truncate; outer apical angle rectangular and not produced in female, slightly obtuse and weakly produced in male, setigerous punctures of front femora usually eight in female and seven in male (Figs. 16, 17). MALE GENITALIA: Figure 18.

DISCUSSION: This species superficially resembles *D. nigrior* but is slightly smaller, lighter in color ventrally, and more highly bronzed dorsally. It can be separated from *D. nigrior* by the differences in elytral apices, anterior tibiae, setigerous femoral punctures and male genitalia (Table 1).

Male *D. assimilis* with very weakly produced elytra are sometimes incorrectly identified as *D. hornii;* but if careful attention is given to examining the anterior legs and ventral coloration, this problem can be avoided.

DISTRIBUTION: Eastern half of the United States, extending southwest into Colorado and New Mexico (Roberts, 1895). Common in Minnesota, Wisconsin, Iowa, Michigan, the eastern half of South Dakota, and the southeastern part of North Dakota. Specimens have also been examined from southern Manitoba (Fig. 26). Specimens examined: 1729.

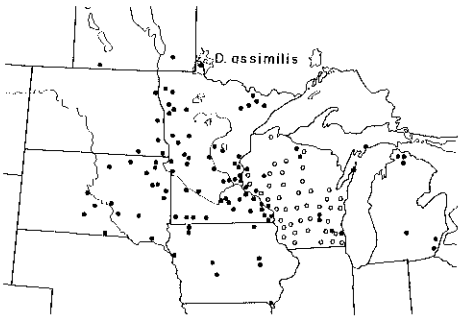


Figure 26. Distribution of *Dineutus assimilis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

TABLE 1. Comparison of distinguishing characteristics *D. assimilis* and *D. nigrior*.

Characters	*D. assimilis*	*D. nigrior*
	FEMALE	
Elytral Apices	moderately produced, dehiscent	highly produced, not dehiscent
Anterior Tibiae (Outer Angle)	rectangular, not produced	acute, weakly produced
Setigerous Femoral Punctures	8	10
	MALE	
Elytral Apices	weakly produced, slightly dehiscent	moderately produced, not dehiscent
Anterior Tibiae (Outer Angle)	obtuse, weakly produced	acute, highly produced
Setigerous Femoral Punctures	7	9

Dineutus nigrior Roberts, 1895:284. Figs. 19-23, 27.

LENGTH: Male 10.9 - 11.9 mm; female 10.8 - 12.1 mm. WIDTH: Male 6.0 - 6.8 mm; female 6.0 - 6.8 mm. COLOR: Dorsal surface black; ventral surface completely black, only tip of anal sternite sometimes yellowish-brown; front legs black. ANATOMY: Slightly convex; striae faint, more noticeable posteriorly; posterior lateral margins of female elytra sinuate and depressed, apices highly produced and not dehiscent at suture (Fig. 20); posterior lateral margins of male elytra sinuate and not depressed, apices moderately produced and slightly dehiscent at suture (Fig. 19); anterior tibiae apically truncate; outer apical angle acute and weakly produced in female, acute and highly produced in male; setigerous punctures of front femora usually ten in female and nine in male (Figs. 21, 22). MALE GENITALIA: Figure 23.

DISCUSSION: This species can only be confused with *D. assimilis*. If one looks at a series of both species, *D. nigrior* will be slightly larger, darker in color, and considerably less bronzed than *D. assimilis* (Table 1).

DISTRIBUTION: The northeast portion of the United States; from Virginia and Tennessee in the south to Hudson's Bay in the north, and from Manitoba and the southern tip of Illinois in the west to the Atlantic Ocean in the east (Istock, 1966). Common in eastern two-thirds of Minnesota and throughout Wisconsin and Michigan (Fig. 27). A male from Cass County, North Dakota is the first *D. nigrior* recorded from that state (North Dakota State University Collection). Specimens examined: 855.

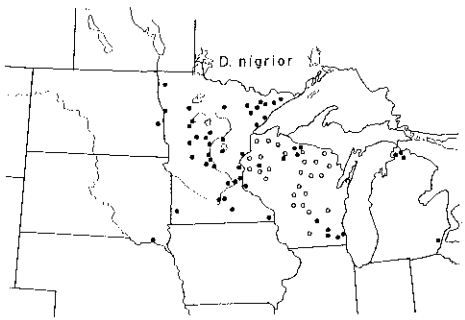


Figure 27. Distribution of *Dineutus nigrior*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

KEY TO THE MINNESOTA SPECIES OF THE GENUS *GYRINUS*

1. Ventral surface reddish-brown to yellowish-brown, abdominal sternites 3 thru 6 sometimes dark brown to black (Fig. 3). 2

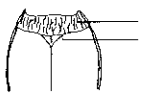
1′. Ventral surface metallic black; the hypomera, epipleura and sides of abdominal sternites sometimes reddish-brown. ..... .14

2(1). Abdominal sternites 3 thru 6 distinctly dark brown to black; length 3.3 mm to 4.5 mm (*G. minutus* Group). .3

2′. Abdominal sternites uniform in color; or if darkened medially then length over 4.9 mm. 4

3(2). Scutellum finely carinate at base, pronotum sculptured with numerous shallow longitudinal grooves, length 3.3 - 4.0 mm. ..... *.minutus* **(p. 27)**

3′. Scutellum not carinate, pronotum without sculpturing, length 3.9 - 4.5 mm. ..... *.dichrous* **(p. 27)**



G. minutus

G. dichrous

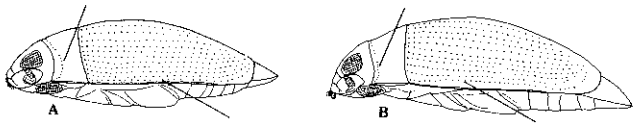
4(2). Transverse line of pronotal punctures laterally bowed away from anterior margin (A below); length 4.0 - 4.7 mm. ..... *.latilimbus* **(p. 28)**

4′. Transverse line of pronotal punctures not bowed away from anterior margin (B below); length variable. 5

5(4). Eleventh stria close to margin (A below); elytra highly polished, sculpturing and minute nonstrial punctures absent or only visible under high power (50X); abdominal sternites darkened medially, or if uniform in tint then length 5.8 mm or greater for male and 6.1 mm or greater for female (*G. lecontei* Group). ..... .12

5′. Eleventh stria remote from margin (B below); elytra either moderately polished with preceptible sculpturing and minute nonstrial punctures, or if highly polished

and without perceptible sculpturing and nonstrial punctures, then length 5.5 mm or less for male and 5.9 mm or less for female; abdominal sternites uniform in tint. 6

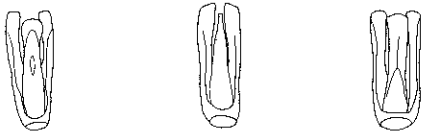


6(5). Length less than 5.0 mm, some females rarely as large as 5.1 mm (*G. aeneolus* Group). 7

6′. Length greater than 5.0 mm, some males rarely as small as 4.9 mm. 9

7(6). Middle lobe of male genitalia apically expanded and broadly rounded at tip, upper surface not bronzed; length 4.2 - 4.3 mm. .....*marginellus* **(p. 30)**

7′. Middle lobe of male genitalia either narrow or sharp cornered; elytral surface bronzed. 8



G. marginellus *G. aeneolus* *G. hatchi*

8(7). Middle lobe of male genitalia regularly narrowed and truncate at tip; length 4.0 - 5.1 mm. .....*aeneolus* **(p. 29)**

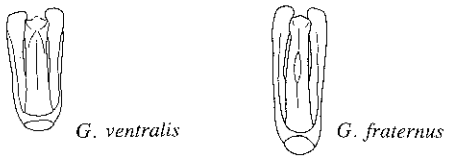
8′. Middle lobe of male genitalia spatulate, tip arcuate and strongly angulate at corners; length 4.5 mm (not recorded from Minnesota). .....*hatchi* **(p. 31)**

9(6). Elytra highly polished, without sculpture and minute nonstrial punctures, or only visible under high power (50X). (*G. ventralis* Group). 10

9′. Elytra finely sculptured and moderately shiny with minute nonstrial punctures, more noticeably so in female. (*G. confinis* Group). 11

10(9). Apex of middle lobe of male genitalia truncate with a small central projection, lateral angles produced; length 4.9 - 5.8 mm. ..... *.ventralis* **(p. 31)**

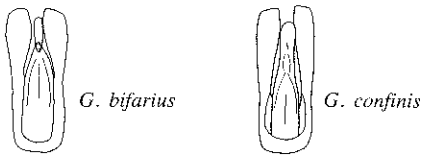
10′. Apex of middle lobe of male genitalia broadly angulate, lateral angles rounded; length 5.5 - 5.9 mm. (not recorded from Minnesota. ..... *.fraternus* **(p. 32)**



G. ventralis *G. fraternus*

11(9). Middle lobe of male genitalia constricted at apical third; length 5.2 - 6.3 mm. ..... *.bifarius* **(p. 33)**

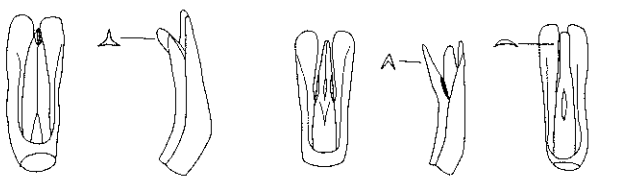
11′. Middle lobe of male genitalia not constricted at apical third, parallel sided with tip broadly rounded; length 5.0 - 6.3 mm. ..... *.confinis* **(p. 32)**



G. bifarius *G. confinis*

12(5). Abdominal sternites nearly uniform in color; median lobe of male genitalia lamellate, with a distinct apical projection: length 5.8 - 6.6 mm (not recorded from Minnesota). ..... *.gehringi* **(p. 36)**

12′. Abdominal sternites normally darker medially than along margins; median lobe of male genitalia carinate or convex, without apical projection. 13



G. gehringi *G. lecontei* *G. aquiris*

13(12). Middle lobe of male genitalia reddish-brown, apically convex, slightly rounded at tip; length 5.0 - 5.9 mm. ..... *aquiris* **(p. 35)**

13′. Middle lobe of male genitalia dark brown to black, superiorly carinate, tip bluntly pointed; length 5.1 - 6.0 mm. ..... *lecontei* **(p. 34)**

14(1). Hypomera and epipleura distinctly reddish-brown (*G. maculiventris* Group). 15

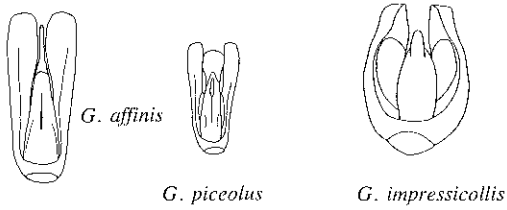
14′. Hypomera and epipleura dark brown to black, although the epipleura in some species and the sides of the abdominal sternites in *G. pugionis* are obscurely reddish-brown. 17

15(14). Sides of abdominal sternites reddish-brown to orange, distinctly lighter than rest of abdomen; length 5.3 - 6.5 mm. ..... *maculiventris* **(p. 36)**

15′. Abdominal sternites uniformly dark brown to black. .. 16

16(15). Elytra densely sculptured with fine short oblique scratches; length 6.0 - 7.0 mm; middle lobe of male genitalia pointed. ..... *affinis* **(p. 37)**

16′. Elytra without sculpturing and minute nonstrial punctures; length 4.7 - 5.5 mm; median lobe of male genitalia broadly rounded; (not recorded from Minnesota). ..... *piceolus* **(p. 38)**



17(14). Anal sternite at least twice the length of the first complete (3rd) abdominal sternite; basal segment of male front tarsi nearly as long as following two segments combined; length usually over 7.0 mm; male genitalia massive; length 6.5 - 7.8 mm. ..... *impressicollis* **(p. 38)**

17′. Anal sternite approximately equal in length to the first complete (3rd) abdominal sternite; length of basal segment of male front tarsi about equal to the following segment; length rarely attaining 7.0 mm; male genitalia of normal proportions. 18

18(17). Anterior margin of mesosternum emarginate and impressed on each side, giving a trilobed outline; length 4.7 - 5.8 mm. .....*pectoralis* **(p. 39)**

18′. Anterior margin of mesosternum not emarginate and impressed. 19

G. pectoralis

19(18). Lateral strial punctures of elytra much larger than those near suture; lateral striae canaliculate (*G. parcus* Group). 20

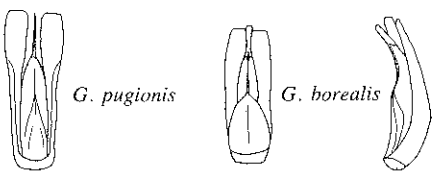
19′. Lateral strial punctures of elytra not appreciably larger than those near suture; lateral striae not or scarcely impressed. 22

20(19). Eleventh stria so nearly marginal as to be scarcely visible when viewed from the side; length 4.6 - 5.1 mm. .*parcus* **(p. 40)**

20′. Eleventh stria less marginal, easily visible from the side; length over 5.5 mm. 21

21(20). Sides of abdominal sternites obscurely reddish; tip of middle lobe of male genitalia finely pointed, one-sixth width of lateral lobes; length 5.8 - 6.8 mm. ....*pugionis* **(p. 41)**

21′. Abdominal sternites totally black; tip of middle lobe of male genitalia narrowly rounded, one-fourth width of lateral lobes; length 5.7 - 5.9 mm (not recorded from Minnesota). .....*borealis* **(p. 42)**



G. pugionis *G. borealis*

22(19). Elytra polished and without or with scarcely detectable sculpturing in the males, females usually perceptibly but finely sculptured (*G. lugens* Group). 23

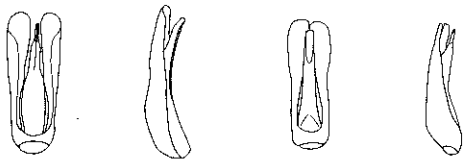
22′. Elytra less shiny to dull, sculpturing evident in both sexes. (*G. wallisi* Group). 25

23(22). Anal sternite conspicuously reddish-brown; elytra with aeneous lustre; length 4.2 - 5.5 mm. .....*analis* **(p. 43)**

23′. Anal sternite not conspicuously reddish-brown; elytra without aeneous lustre except along margins. 24

24(23). Form rather broad, especially in female; elytra moderately shiny in male, dull in female; middle lobe of male genitalia laterally compressed so that the width of the tip when seen from the side is greater than when seen from above; length 5.2 - 6.4 mm. .....*lugens* **(p. 42)**

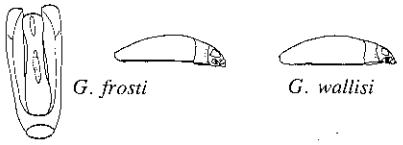
24′. Form narrower, elytra highly polished in both sexes; middle lobe of male genitalia flattened so that the width of the tip when seen from the side is less than when seen from above; length 5.2 - 5.9 mm (not recorded from Minnesota). .....*picipes* **(p. 43)**



G. lugens *G. picipes*

25(22). Form moderately gibbous in profile; middle lobe of male genitalia apically expanded and broadly rounded; anal sternite distinctly reddish-brown; length 4.7 - 5.9 mm. .....*frosti* **(p. 45)**

25′. Form not gibbous in profile; middle lobe of male genitalia either narrowed or parallel sided apically; anal sternite sometimes obscurely reddish-brown. 26

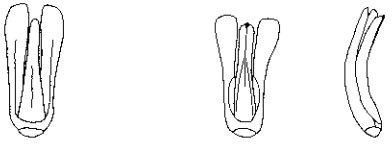


26(25). Anterior tarsi expanded (Fig. 3); male. 27

26'. Anterior tarsi not expanded (Fig. 1); female. 28

27(26). Tarsal claws dark brown to black; elytra finely sculptured, nonstrial punctures coarse and numerous; middle lobe of male genitalia less than; half as wide at tip as lateral lobes, flattened above, and tip narrowly rounded; length 5.4 - 5.8 mm. .....*wallisi* **(p. 44)**

27'. Tarsal claws yellowish; elytra densely sculptured, especially posteriorly, nonstrial punctures fine and numerous; middle lobe of male genitalia nearly as wide apically as lateral lobes, carinate, tip angulate and produced; length 5.0 - 5.5 mm (not recorded from Minnesota). .....*opacus* **(p. 46)**



28(26). Tarsal claws dark brown to black; elytra with coarse dense reticulate sculpturing, nonstrial punctures obscured; length 5.6 - 6.2 mm. .....*wallisi* **(p. 44)**

28'. Tarsal claws yellowish; elytra with fine dense sculpturing, nonstrial punctures fine and numerous; length 5.4 - 5.9 mm (not recorded from Minnesota). .....*opacus* **(p. 46)**

Descriptions of the Minnesota Species of the Genus *Gyrinus*

Gyrinus minutus Group: *G. minutus* and *G. dichrous*. Both species are less than 4.5 mm in length and have light ventral surfaces except for abdominal sternites 3 thru 6 which are dark brown to black. *G. minutus* can be distinguished from *G. dichrous* by the presence in *G. minutus* of a small carina at the base of the scutellum and shallow longitudinal grooves on the pronotum.

Gyrinus minutus Fabricius, 1801:276. Figs. 28, 49.

LENGTH: Male 3.3 - 3.9 mm; female 3.7 - 4.0 mm. WIDTH: Male 1.7 - 2.0 mm; female 2.0 - 2.2 mm. COLOR: Elytra dull black, bronzed at margins; ventral surface reddish-brown, abdominal sternites 3 thru 6 black. ANATOMY: Rather narrow, moderately convex; pronotum sculptured with numerous shallow longitudinal grooves; scutellum carinate; elytra with dense reticulate sculpturing; strial punctures heavily impressed laterally, shallower and not as large at suture. MALE GENITALIA: Figure 49.

DISTRIBUTION: Abundant in northern Nearctic, including Minnesota and surrounding area (Fig. 28), and Palearctic regions (Fall, 1922, Young, 1954). Specimens examined: 1337.

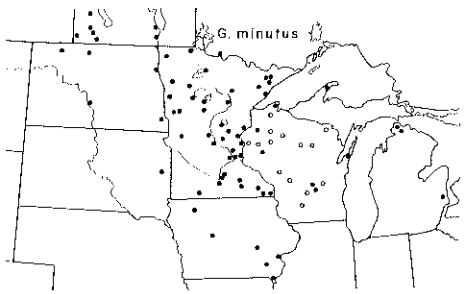


Figure 28. Distribution of *Gyrinus minutus*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus dichrous LeConte, 1868:368-371. Figs. 29, 50.

LENGTH: Male 3.9 - 4.0 mm; female 4.0 - 4.5 mm. WIDTH: Male 2.2 - 2.4 mm; female 2.5 - 2.6 mm. COLOR: Elytra black, moderately

shiny; ventral surface reddish-brown, abdominal sternites 3 thru 6 black. ANATOMY: Moderately convex; sculpturing not evident; elytra with minute nonstrial punctures especially posteriorly which are more apparent in the female; eleventh stria close to the margin; strial punctures larger at the lateral margins than near the suture. MALE GENITALIA: Figure 50.

DISTRIBUTION: Great Lakes Region from Maine to Minnesota (Fall, 1922). One specimen was examined from Michigan and none from Manitoba, North Dakota, South Dakota or Iowa (Fig. 29). Specimens examined: 265.

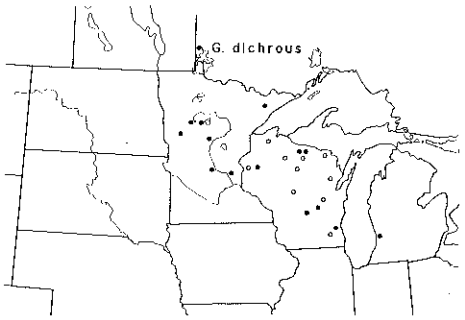


Figure 29. Distribution of *Gyrinus dichrous*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus latilimbus Group: *G. latilimbus*. In general appearance it closely resembles the species of the *G. aeneolus* group. It is easily separated from these species because its eleventh stria is strictly marginal and the transverse row of pronotal punctures is laterally removed from the front margin (Fig. 82).

Gyrinus latilimbus Fall, 1922:286. Figs. 30, 56, 82.

LENGTH: Male 4.0 - 4.3 mm; female 4.5 - 4.7 mm. WIDTH: Male 2.2 - 2.4 mm; female 2.4 - 2.6 mm. COLOR: Male elytra very shiny, not bronzed, female rather dull with bronzed margins; ventral surface uniformly reddish-brown. ANATOMY: Transverse row of pronotal punctures laterally bowed away from anterior margin (Fig. 82); male not sculptured, female highly sculptured; eleventh stria close to margin, strial punctures much larger laterally. MALE GENITALIA: Figure 56.

DISTRIBUTION: Northern United States and southern Canada from Maine to eastern North Dakota; also in British Columbia (Fall, 1922). Specimens have been examined from Minnesota, Michigan, and southeastern North Dakota (Fig. 30). Specimens examined: 241.

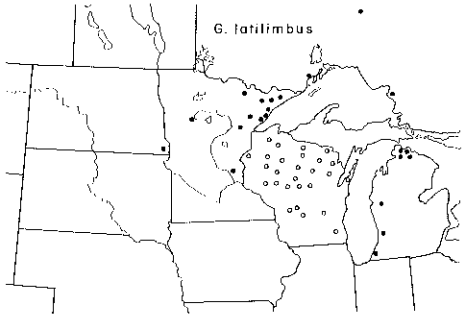


Figure 30. Distribution of *Gyrinus latilimbus*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus aeneolus Group: *G. aeneolus, G. marginellus,* and *G. hatchi*. These species are characterized by their small size, highly polished elytra, and the eleventh stria being well removed from the margin (a little closer to the margin in *G. hatchi*). *G. aeneolus* and *G. hatchi* both have bronzed elytra. The surest way of separating these two species is by examining male genitalia. *G. marginellus* can be distinguished by its elytra which are totally devoid of any bronzed lustre, sculpturing or nonstrial punctures.

Gyrinus aeneolus LeConte, 1868:368,370. Figs. 31, 52.

LENGTH: Male 4.0 - 4.3 mm; female 4.5 - 5.1 mm. WIDTH: Male 2.2 - 2.3 mm; female 2.4 - 2.7 mm. COLOR: Elytra black, highly polished, distinctly bronzed; ventral surface reddish-brown. ANATOMY: Rather narrow and slightly convex; elytra without noticeable sculpturing or nonstrial punctures, lateral margins narrow; strial punctures slightly larger laterally; eleventh stria removed from margin. MALE GENITALIA: Figure 52.

DISTRIBUTION: Illinois, Indiana, Pennsylvania, New York, Maine, and Montreal, Canada (Fall, 1922). Specimens have been examined from Minnesota, Michigan, Ontario, Kansas, Manitoba and Wisconsin (Fig. 31). Specimens examined: 105.

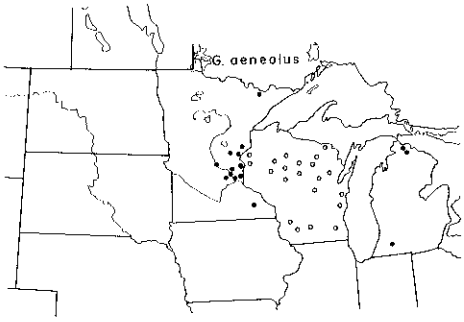


Figure 31. Distribution of *Gyrinus aeneolus*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus marginellus Fall, 1922:283. Figs. 32, 51.

LENGTH: Male 4.3 mm; female 4.2 mm. WIDTH: Male 2.2 mm; female 2.2 mm. COLOR: Elytra black, highly polished, not bronzed; ventral surface uniformly dark reddish-brown. ANATOMY: Narrow and strongly convex; elytra without sculpturing or nonstrial punctures, lateral margins narrow; strial punctures slightly larger laterally; eleventh stria well removed from margin. MALE GENITALIA: Figure 51.

DISTRIBUTION: Connecticut, New Jersey, Michigan, Minnesota and Wisconsin. Chamberlain (1929a) collected this species from beneath the overhanging banks of slow moving streams in Connecticut, and it has been collected from the same habitat in Wisconsin (Hilsenhoff, pers. comm.) and Minnesota (Fig. 32). Specimens examined: 19.

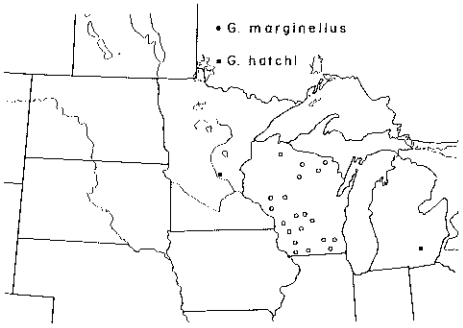


Figure 32. Distribution of *Gyrinus marginellus* and *Gyrinus hatchi*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus hatchi Wallis, 1926:93-94. Figs. 32, 53

LENGTH: Male 4.5 mm. WIDTH: Male 2.4 mm. No females examined. COLOR: Elytra black, highly polished and distinctly bronzed; ventrally reddish-brown. ANATOMY: Broadly rounded and slightly convex; elytra with small nonstrial punctures, and a fine sculpturing which is more visible laterally and posteriorly; eleventh stria removed from margin; strial punctures larger and more impressed laterally. MALE GENITALIA: Figure 53.

DISTRIBUTION: Little is known of this species distribution. It has not been collected in Minnesota, but William Hilsenhoff (1978, pers. comm.) has collected a female from Wisconsin which he tentatively believes to be *G. hatchi*. The type series was collected in Washtenaw County, Michigan (Fig. 32), and is in the Canadian National Collection. Specimens examined: 1 (Paratype No. 6988).

Gyrinus ventralis Group: *G. ventralis* and *G. fraternus*. These species have highly polished elytra, the eleventh stria removed from the margin, an average length over 5.5 mm, and no elytral bronzing. These species can be separated only by difference in male genitalia.

Gyrinus ventralis Kirby, 1837:80. Figs. 33, 54, 83.

LENGTH: Male 4.9 - 5.5 mm; female 5.2 - 5.8 mm. WIDTH: Male 2.7 - 2.8 mm; female 2.9 - 3.1 mm. COLOR: Elytra highly polished, black; ventral surface reddish-brown; the epipleura and hypomera sometimes of a lighter shade. ANATOMY: Regularly oval and of average convexity; elytral sculpturing and nonstrial punctures almost lacking, visible only under high power (50X); eleventh stria well up from margin; strial punctures larger laterally than near suture. MALE GENITALIA: Figure 54.

DISTRIBUTION: Maine, Massachusetts, Connecticut, New York, Michigan, and Ontario (Fall, 1922). Specimens were examined from Minnesota, Wisconsin, "Iowa", Michigan, Ontario (Fig. 33). Specimens examined: 278.

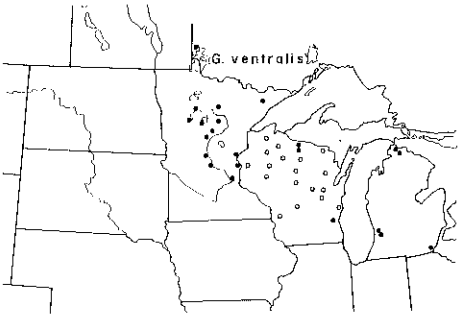


Figure 33. Distribution *Gyrinus ventralis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus fraternus Couper, 1865:60. Fig. 55.

LENGTH: Male 5.5 mm; female 5.9 mm. WIDTH: Male 2.9 mm; female 3.3 mm. COLOR: Elytra highly polished black; ventrally reddish-brown. ANATOMY: Of average roundness and convexity; elytra without detectable sculpturing or nonstrial punctures except under high power (50X); eleventh stria well up from the margin, punctures at the side a little larger than those at the suture. MALE GENITALIA: Figure 55.

DISTRIBUTION: All six specimens examined were from Algonquin Park, eastern Ontario, Canada. Fall (1922) reports the species from Maine, New Hampshire, Massachusetts, and New York. Specimens examined: 6.

Gyrinus confinis Group: *G. confinis* and *G. bifarius*. The elytra of these species are finely sculptured and distinctly bronzed. The eleventh elytral stria is remote from the margin, slightly closer than in the *G. aenolus* and *G. ventralis* groups. Females average nearly 6.0 mm in length, while males average slightly under 5.5 mm. The only sure means of separating these species is by examining the male genitalia.

Gyrinus confinis LeConte, 1868:368,370. Figs. 34, 58.

LENGTH: Male 5.0 - 5.6 mm; female 5.6 - 6.3 mm. WIDTH: Male 2.8 - 3.0 mm; female 2.9 - 3.4 mm. COLOR: Elytra black, rather dull with a greenish bronze lustre; ventral surface uniformly reddish-brown. ANATOMY: Elytra heavily sculptured with scattered nonstrial punctures in the female, moderately sculptured and covered with numerous

nonstrial punctures in the male; eleventh stria removed from the margin, strial punctures moderately impressed and slightly larger laterally than at the suture. MALE GENITALIA: Basal half flattened becoming concave apically, tip round (Fig. 58).

DISTRIBUTION: Massachusetts, New York, Ontario, Manitoba, and Montana (Fall, 1922). Common in Minnesota, Manitoba, Ontario, Wisconsin, Michigan, and the eastern half of North Dakota (Fig. 34). Specimens examined: 462.

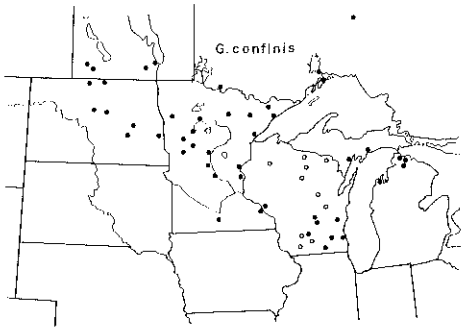


Figure 34. Distribution of *Gyrinus confinis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus bifarius Fall, 1922:286. Fig. 35, 57.

LENGTH: Male 5.2 - 5.8 mm; female 5.9 - 6.3 mm. WIDTH: Male 2.6 - 2.9 mm; female 3.2 - 3.5 mm. COLOR: Elytra shiny black in male and slightly dulled, especially posteriorly, in female lateral margins bronzed; ventral surface uniformly reddish-brown. ANATOMY: Elytra densely covered with fine nonstrial punctures; female, especially posteriorly, heavily sculptured; male moderately sculptured; eleventh stria removed from margin, lateral strial punctures a little larger than sutural punctures. MALE GENITALIA: Figure 57.

DISTRIBUTION: This species is widely distributed, ranging from Maine to California (Fall, 1922). Specimens have been examined from Minnesota, Wisconsin, Ontario, and Manitoba (Fig. 35). Specimens examined: 73.

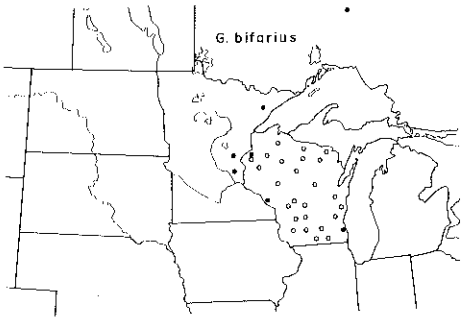


Figure 35. Distribution of *Gyrinus bifarius*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus lecontei Group: *G. lecontei, G. aquiris,* and *G. gehringi.* These species are characterized by highly polished elytra, abdominal sternites medially darkened, except in *G. gehringi,* and the eleventh stria close to the margin. *Gyrinus gehringi* can be distinguished by its larger size and its abdominal sternites not being medially darkened. *Gyrinus aquiris* and *G. lecontei* can be separated with certainty only by examination of the male genitalia.

Gyrinus lecontei Fall, 1922:291. Figs. 36, 62, 63.

LENGTH: Male 5.1 - 5.6 mm; female 5.5 - 6.0 mm. WIDTH: Male 2.8 - 3.2 mm; female 3.0 - 3.6 mm. COLOR: Elytra black, highly polished; ventral surface reddish-brown, the epipleura and hypomera sometimes lighter in color, abdominal sternites darker medially. ANATOMY: Rather broadly rounded, especially the female; elytra finely sculptured, nonstrial punctures moderately dense in female, scattered in male; eleventh stria close to the margin; lateral strial punctures larger than those near the suture. MALE GENITALIA: Figures 62 and 63.

DISTRIBUTION: Great Lakes Region, extending from Maine to Wisconsin (Fall, 1922). Examined specimens extend the range across all but the southwestern corner of Minnesota and into eastern Iowa and the eastern edge of South Dakota (Fig. 36). Specimens examined: 426.

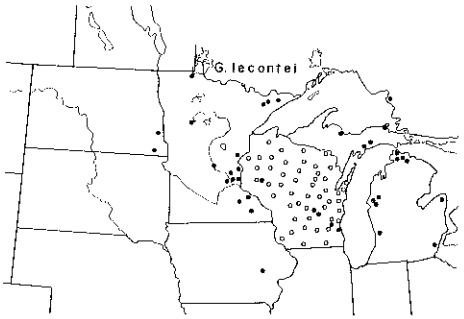


Figure 36. Distribution of *Gyrinus lecontei*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus aquiris LeConte, 1868:368,371. Figs. 37, 61.

LENGTH: Male 5.0 - 5.3 mm; female 5.2 - 5.9 mm. WIDTH: Male 2.8 - 2.9 mm; female 2.9 - 3.1 mm. COLOR: Elytra black, highly polished; ventral surface reddish-brown, abdominal sternites darkened medially. ANATOMY: Rather narrow; elytra not sculptured, nonstrial punctures scattered in the male and more numerous in the female; eleventh stria very close to the margin, punctures of lateral striae large. MALE GENITALIA: Apically convex, tip slightly rounded (Fig. 61).

DISTRIBUTION: Massachusetts, New York, and Montreal, Canada (Fall, 1922). In the north-central states specimens have been examined from Michigan through Minnesota except for the extreme southern and southwestern portion of Minnesota (Fig. 37). Specimens examined: 118.

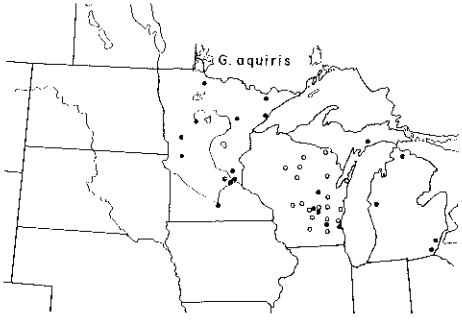


Figure 37. Distribution of *Gyrinus aquiris*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus gehringi Chamberlain, 1929b:247 Figs. 38, 59, 60.

LENGTH: Male 5.8 - 6.1 mm; female 6.1 - 6.6 mm. WIDTH: Male 3.1 - 3.5 mm; female 3.5 - 3.8 mm. COLOR: Elytra black, highly polished; ventral surface reddish-brown, abdominal sternites not darkened medially, epipleura and hypomera sometimes lighter in color. ANATOMY: Large and broadly rounded; elytra with very fine sculpturing and minute nonstrial punctures, more noticeably in the female; eleventh stria very close to the margin, lateral strial punctures larger than those near suture. MALE GENITALIA: Figures 59 and 60.

DISTRIBUTION: Moose Pond, Pittsburgh, New Hampshire (type specimens); and 9 new specimens, 8 from Lake Superior Provincial Park, Sand River, Ontario (Can. Nat. Mus.), 1 from 3 miles north of Blaney Park, Schoolcraft Co., Michigan (U.S. Nat. Mus.) (Fig. 38). Specimens examined: 11.

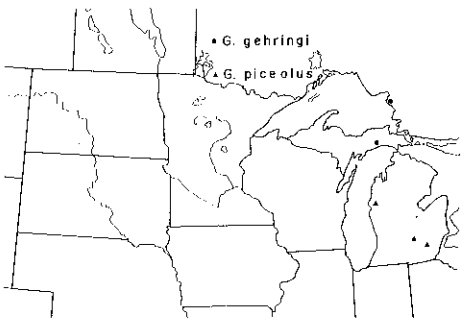


Figure 38. Distribution of *Gyrinus gehringi* and *Gyrinus piceolus*.

Gyrinus maculiventris Group: *maculiventris*, *G. affinis*, and *G. piceolus*. This group is characterized by a metallic black ventral surface with the epipleura and hypomera distinctly reddish-brown. *G. maculiventris* can be distinguished by having maculated abdominal sternites. *G. affinis* is very large while *G. piceolus* is distinctly smaller.

Gyrinus maculiventris LeConte, 1868:368,371. Figs. 39, 64, 65.

LENGTH: Male 5.3 - 5.8 mm; female 6.0 - 6.5 mm. WIDTH: Male 2.8 - 3.1 mm; female 3.1 - 3.4 mm. COLOR: Elytra black, highly polished; ventral surface black, epipleura and hypomera distinctly reddish-brown; lateral margins of abdominal sternites conspicuously reddish-brown. ANATOMY: Narrow, elytra covered with very fine sculp-

turing; eleventh stria close to margin; elytral punctures a little coarser in lateral striae. MALE GENITALIA: Figures 64 and 65.

DISTRIBUTION: Recorded by Fall (1922) from New Jersey, Michigan, Illinois, and Alberta, Canada. In the north-central states it is found everywhere east of the Missouri River but more uncommon west and south of Minnesota (Fig. 39). Specimens examined: 1389.

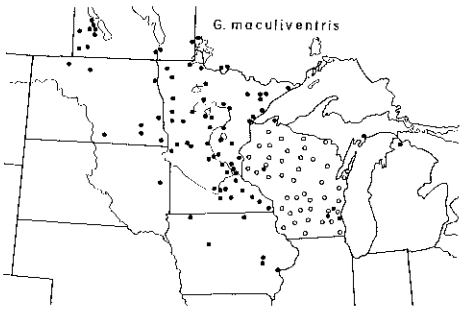


Figure 39. Distribution of *Gyrinus maculiventris*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus affinis Aube, 1838:669. Figs. 40,66.

LENGTH: Male 6.0 - 6.3 mm; female 6.7 - 7.0 mm. WIDTH: Male 3.4 - 3 .8 mm; female 3.9 - 4.1 mm. COLOR: Elytra black, moderately shiny; ventral surface black, mesosternum, epipleura, hypomera and the seventh abdominal sternite reddish-brown. ANATOMY: Large and rather rounded; elytra densely sculptured with fine short oblique scratches; eleventh stria close to margin, elytral punctures slightly larger laterally. MALE GENITALIA: Figure 66.

DISTRIBUTION: From Maine to British Columbia and down into California Fall (1922). Common in northern Minnesota, Wisconsin, Michigan, and into Manitoba and Ontario. One specimen was examined from the Black Hills of South Dakota (Fig. 40). Specimens examined: 508.

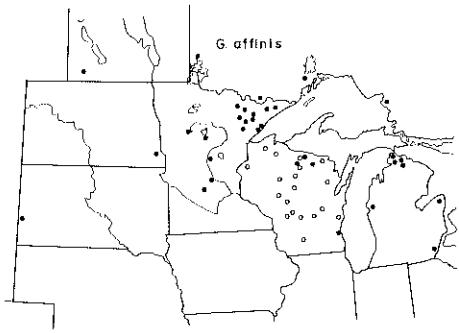


Figure 40. Distribution of *Gyrinus affinis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus piceolus Blatchley, 1910:240. Figs. 38, 67.

LENGTH: Male 4.7 - 5.0 mm. WIDTH: Male 2.5 - 2.7 mm. No females examined. Blatchley (1910) in the original species description gives the length as 5.5 mm. The type specimen was not examined, but from the specimens examined this would almost certainly have been a female. COLOR: Elytra black, highly polished; ventral surface black, epipleura, hypomera and anal sternite reddish-brown. ANATOMY: Rather narrow; elytra completely without sculpturing or minute punctures; strial punctures larger and more impressed at sides than near suture. MALE GENITALIA: Figure 67.

DISTRIBUTION: Not found in Minnesota. Three specimens from Michigan have been examined (Fig. 38), and Blatchley (1910) lists it as being found in Indiana. Specimens examined: 3.

Gyrinus impressicollis Group: *G. impressicollis*. The largest species of *Gyrinus* in our fauna, averaging over 7.0 mm. Males have massive genitalia and the females have densely reticulate elytral sculpturing.

Gyrinus impressicollis Kirby, 1837:79. Figs. 41, 85, 86.

LENGTH: Male 7.1 - 7.8 mm; female 6.5 - 7.4 mm. WIDTH: Male 3.9 - 4.5 mm; female 3.8 - 4.3 mm. COLOR: Elytra black, dull in female, moderately shiny in male, ventral surface black, epipleura and anal sternite sometimes obsurely reddish-brown. ANATOMY: Large and broadly rounded; lateral margins very wide; elytra in female with dense reticulate sculpturing, nonstrial punctures obscured and scat-

tered; elytra in male finely sculptured, nonstrial punctures large and numerous; anal sternite at least twice the length of the third abdominal sternite (the first complete sternite behind the coxae); basal segment of male front tarsi nearly as long as the following two segments combined. MALE GENITALIA: Figures 85 and 86.

DISTRIBUTION: Probably found throughout the extreme northern edge of the eastern United States and on into Canada (Fig. 41). This species is probably often overlooked or missed. Our records and comments by Larson (1973) indicate this species is limited to open water areas of lakes and large rivers, often far from shore. Specimens examined: 108.

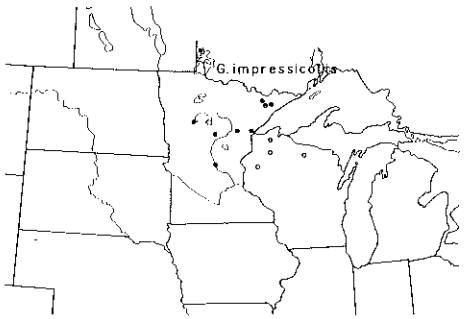


Figure 41. Distribution of *Gyrinus impressicollis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus pectoralis Group: *G. pectoralis*. This species, because of its uniquely trilobed mesosternum cannot be confused with any other species.

Gyrinus pectoralis LeConte, 1868:370,372. Figs. 42, 68, 84.

LENGTH: Male 4.7 - 5.0 mm; female 5.5 - 5.8 mm. WIDTH: Male 2.6 - 2.9 mm; female 2.8 - 3.2 mm. COLOR: Elytra shiny black, polished; ventral surface black. ANATOMY: Elytra densely covered with nonstrial punctures; strial punctures moderately impressed, slightly larger laterally; the anterior margin of the mesosternum impressed on each side, giving it a trilobed outline (Fig. 84). MALE GENITALIA: Figure 68.

DISTRIBUTION: This common northern species is found in Alberta, Manitoba, Montana, and Washington state (Fall, 1922). In the north-

central states it appears to extend from central Wisconsin across Minnesota and through the north-eastern corner of North Dakota (Fig. 42). Specimens examined: 1440.

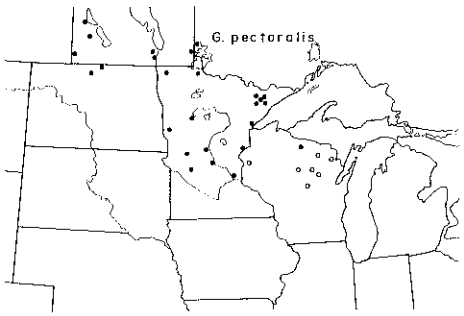


Figure 42. Distribution of *Gyrinus pectoralis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus parcus Group: *G. parcus, G. pugionis,* and *G. borealis*. This group is characterized by the lateral strial punctures being considerably coarser than those near the suture, and the lateral striae being distinctly impressed and canaliculate. *Gyrinus parcus* is an unusual species with its eleventh stria so marginal it is barely visible when viewed from the plane of the reflexed margin. In *G. pugionis* the lateral margins of the abdominal sternites are obscurely reddish-brown, while in *G. borealis* they are completely black.

Gyrinus parcus Say, 1834:448. Figs. 43, 69.

LENGTH: Male 4.6 - 5.0 mm; female 4.8 - 5.1 mm. WIDTH: Male 2.5 - 2.7 mm; female 2.8 - 2.9 mm. COLOR: Elytra shiny, polished black in male, dull black in female; ventral surface black, epipleura, hypomera, mesosternum and anal sternite sometimes obscurely reddish. ANATOMY: Strongly convex; elytra of male finely sculptured and with scattered nonstrial punctures; elytra of female densely sculptured, especially laterally and posteriorly; strial punctures coarse, especially at sides; lateral striae visibly impressed, canaliculate; eleventh stria marginal throughout its length. MALE GENITALIA: Figure 69.

DISTRIBUTION: Found in western Pennsylvania, Kansas, Texas and California, as well as Mexico, Guatemala and Peru (Fall, 1922). It is a rare species this far north, having been recorded no farther north than central Minnesota (Fig. 43). Specimens examined: 35.

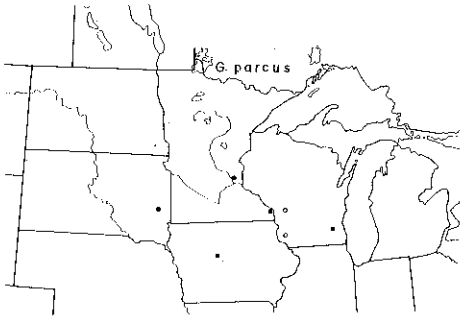


Figure 43. Distribution of *Gyrinus parcus*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus pugionis Fall, 1922:296. Figs. 44, 70.

LENGTH: Male 5.8 - 6.2 mm; female 6.3 - 6.9 mm. WIDTH: Male 3.1 - 3.4 mm; female 3.6 - 3.8 mm. COLOR: Elytra moderately shiny black; ventral surface black, epipleura, and lateral margins of abdominal sternites obscurely reddish-brown. ANATOMY: Rather large; elytra moderately sculptured in male and densely sculptured in the female; lateral strial punctures coarser than those near suture, lateral striae heavily impressed, canaliculate. MALE GENITALIA: Figure 70.

DISTRIBUTION: Fall (1922) reports this species from Maine through New York. In the north-central states it is recorded from northern Michigan through central Wisconsin to northern Minnesota (Fig. 44). Specimens examined: 242.

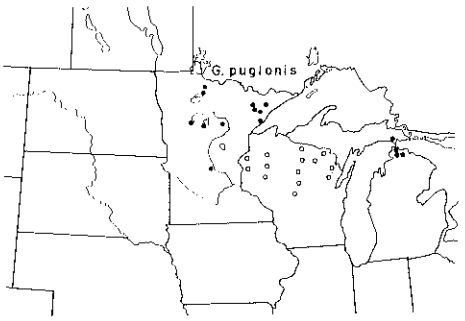


Figure 44. Distribution of *Gyrinus pugionis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus borealis Aube, 1838:692. Figs. 71, 72.

LENGTH: Male 5.7 mm; female 5.9 mm. WIDTH: Male 3.1 mm; female 3.3 mm. COLOR: Elytra moderately shiny black; ventral surface black, anal sternite and epipleura obscurely reddish. ANATOMY: Elytra finely sculptured in male, sculpturing coarser and denser in female, nonstrial punctures scarce; lateral striae strongly impressed, canaliculate; lateral strial punctures much larger than those near suture. MALE GENITALIA: Figures 71 and 72.

DISTRIBUTION: This species has not been found in Minnesota, but LeConte (1868) lists it from New York to Lake Superior. It is also recorded from Indiana (Blatchley, 1910) and Massachusetts, New Jersey, and Virginia (Fall, 1922). Specimens examined: 2.

Gyrinus lugens Group: *G. lugens, G. picipes,* and *G. analis*. In this group the males have shiny elytra with very little sculpturing; and the females, except for *G. picipes,* have somewhat duller elytra with prominent sculpturing. *G. analis* is an unusual species with a conspicuously reddish anal sternite. Male *G. lugens* are easily identified by their genitalia. Because of their dense elytra sculpturing and large size, female *G. lugens* are easily confused with those of the *G. wallisi* group. Both sexes of *G. picipes* lack sculpturing and have only scattered nonstrial punctures.

Gyrinus lugens LeConte, 1868:369. Figs. 45, 74, 75.

LENGTH: Male 5.2 - 5.9 mm; female 5.9 - 6.4 mm. WIDTH: Male 2.8 - 3.2 mm; female 3.1 - 3.5 mm. COLOR: Elytra black, with a bronze lustre, moderately shiny in male, dull in female; ventral surface uniformly black, anal sternite sometimes obscurely reddish-brown. ANATOMY: Form rather broad, especially in female; elytra of female with a dense reticulate sculpturing, male finely sculptured; nonstrial punctures sparse in male, slightly more noticeable in female; strial punctures not noticeably larger at sides. MALE GENITALIA: Figures 74 and 75.

DISTRIBUTION: New England to Manitoba but no farther south than New Jersey and Pennsylvania (Fall, 1922). Except for one locality in extreme eastern South Dakota, it seems to be limited to eastern Minnesota, Wisconsin, and northern Michigan (Fig. 45). Specimens examined: 422.

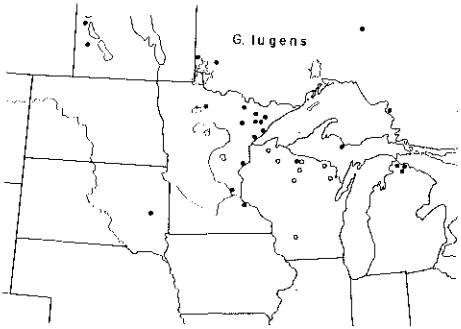


Figure 45. Distribution of *Gyrinus lugens*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus picipes Aube, 1838:604. Figs. 76, 77.

LENGTH: Male 5.2 mm; female 5.8 mm. WIDTH: Male 2.8 mm; female 3.2 mm. COLOR: Elytra black, highly polished; ventral surface black, anal sternite and epipleura somewhat reddish-brown. ANATOMY: Elytra rarely with a fine sculpturing, usually without sculpturing; nonstrial punctures sparse in female, more numerous in male; lateral strial punctures coarser than those at suture; eleventh stria close to margin. MALE GENITALIA: Figures 76 and 77.

DISTRIBUTION: Fall (1922) records this species from Alaska, British Columbia, Washington, California, and Manitoba. Specimens have been examined from Manitoba mile posts 214 and 256, Hudson Bay Railroad, but not Minnesota (Wallis, 1920's). Specimens examined: 2.

Gyrinus analis Say, 1823:108. Figs. 46, 73.

LENGTH: Male 4.2 - 5.0 mm; female 5.0 - 5.5 mm. WIDTH: Male 2.4 - 2.7 mm; female 2.7 - 2.9 mm. COLOR: Elytra black, slightly bronzed, very shiny in male, moderately shiny in female; ventral surface black, anal sternite distinctly reddish-brown, epipleura sometimes obscurely reddish. ANATOMY: Elytra of female densely sculptured, male very finely sculptured; nonstrial punctures numerous, somewhat more noticeable near suture in female than in male; size of lateral strial punctures equal to those near suture. MALE GENITALIA: Median lobe with a weak medial ridge and narrowly rounded at tip (Fig. 73).

DISTRIBUTION: Nova Scotia to Kansas south to the Gulf Coast (Fall, 1922). Found throughout the north-central states but becoming rare in the north (Fig. 46). Specimens examined: 1056.

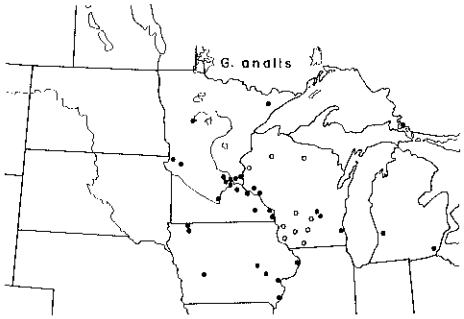


Figure 46. Distribution of *Gyrinus analis*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus wallisi Group: *G. wallisi, G. frosti,* and *G. opacus*. These species are rather densely sculptured in both sexes, except for the male of *G. wallisi*. *G. frosti* can be recognized by its broad form, gibbous profile, and reddish anal sternite. *G. wallisi* females have dense reticulate sculpturing with obscured nonstrial punctures, and the males have sparse sculpturing with numerous large nonstrial punctures. Lateral striae are heavily impressed posteriorly and the tarsal claws are black. In *G. opacus* the female has a fine dense sculpturing throughout, while the male is more heavily sculptured posteriorly. Nonstrial punctures are numerous and rather fine, and the tarsal claws are yellowish.

Gyrinus wallisi Fall, 1922:302. Figs. 47, 79.

LENGTH: Male 5.4 - 5.8 mm; female 5.6 - 6.2 mm. WIDTH: Male 2.9 - 3.3 mm; female 3.2 - 3.4 mm. COLOR: Elytra dull black in female, moderately shiny in male; ventral surface black, anal sternite and anterior legs sometimes obscurely reddish-brown, tarsal claws dark brown to black. ANATOMY: Elytra with dense reticulate sculpturing in female, sculpturing almost lacking in male; nonstrial punctures slightly larger laterally than near suture. MALE GENITALIA: Figure 79.

DISTRIBUTION: Recorded from North Dakota, Manitoba, central and northeastern Minnesota and northwestern Wisconsin (Fig. 47). Specimens examined: 95.

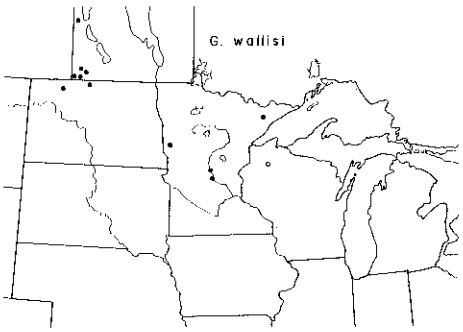


Figure 47. Distribution of *Gyrinus wallisi*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus frosti Fall, 1922:303. Figs. 48, 78.

LENGTH: Male 4.7 - 5.5 mm; female 5.5 - 5.9 mm. WIDTH: Male 2.8 - 3.1 mm; female 3.3 - 3.4 mm. COLOR: Elytra black, rather dull in female, slightly shinier in male; ventral surface black, anal sternite distinctly reddish-brown, epipleura sometimes obscurely reddish-brown. ANATOMY: Form broadly oval, moderately convex, gibbous in profile; elytra of female with dense but fine sculpturing, sculpturing slightly less evident in male, nonstrial punctures scattered; strial punctures fine and not heavily impressed, only slightly larger laterally. MALE GENITALIA: Figure 78.

DISTRIBUTION: Eastern states from Maine to Louisiana (Fall, 1922). *G. floridensis* Ochs. is probably a geographical race of *G. frosti* in Florida (Young, 1954). In the north-central states specimens have been examined from northern Michigan through northeastern and central Minnesota (Fig. 48). Specimens examined: 134.

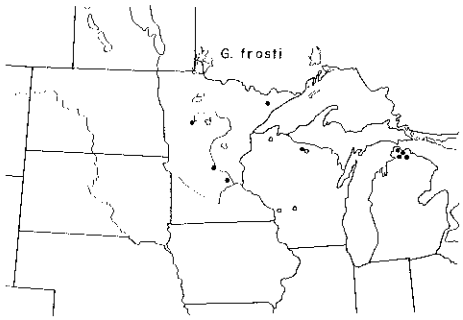


Figure 48. Distribution of *Gyrinus frosti*. Open circles represent data provided by Dr. William Hilsenhoff (1978).

Gyrinus opacus Sahlberg, 1817:45. Figs. 80, 81.

LENGTH: Male 5.0 - 5.5 mm; female 5.4 - 5.9 mm. WIDTH: Male 2.8 - 3.0 mm; female 2.9 - 3.2 mm. COLOR: Elytra black and moderately shiny, especially anteriorly and near suture; ventral surface black, epipleura obscurely reddish, front femora reddish-brown, tibia and tarsi with a black tinge, tarsal claws yellowish. ANATOMY: Elytra finely sculptured, more evident laterally and posteriorly; nonstrial punctures numerous, especially anteriorly and near the suture; strial punctures not heavily impressed and only slightly larger at sides. MALE GENITALIA: Figures 80 and 81.

DISTRIBUTION: This northern species is found from Norway to Lapland, through Scotland, Iceland and Greenland to Labrador, and across to Alaska (Fall, 1922). It is doubtful that its range extends as far south as Minnesota. Specimens examined: 122, all from Churchill, Manitoba, on Hudson Bay.

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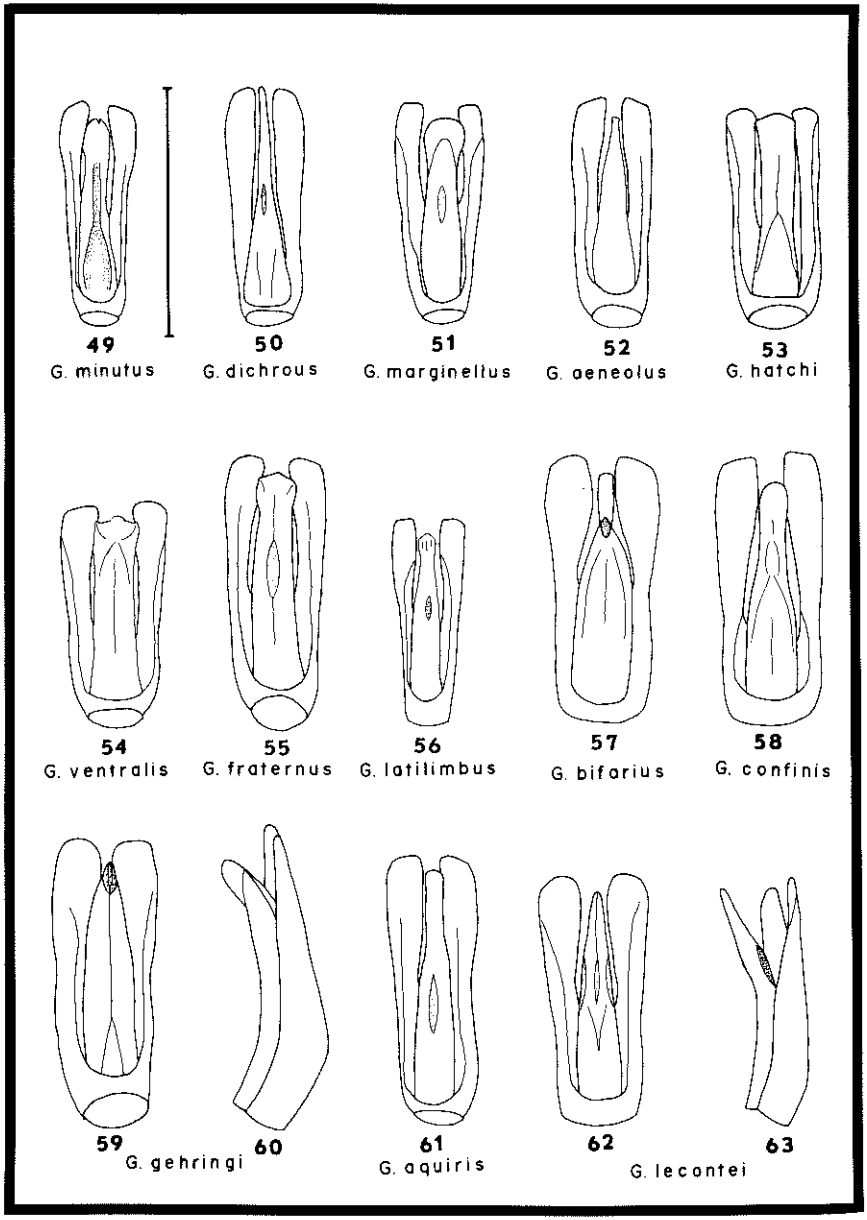
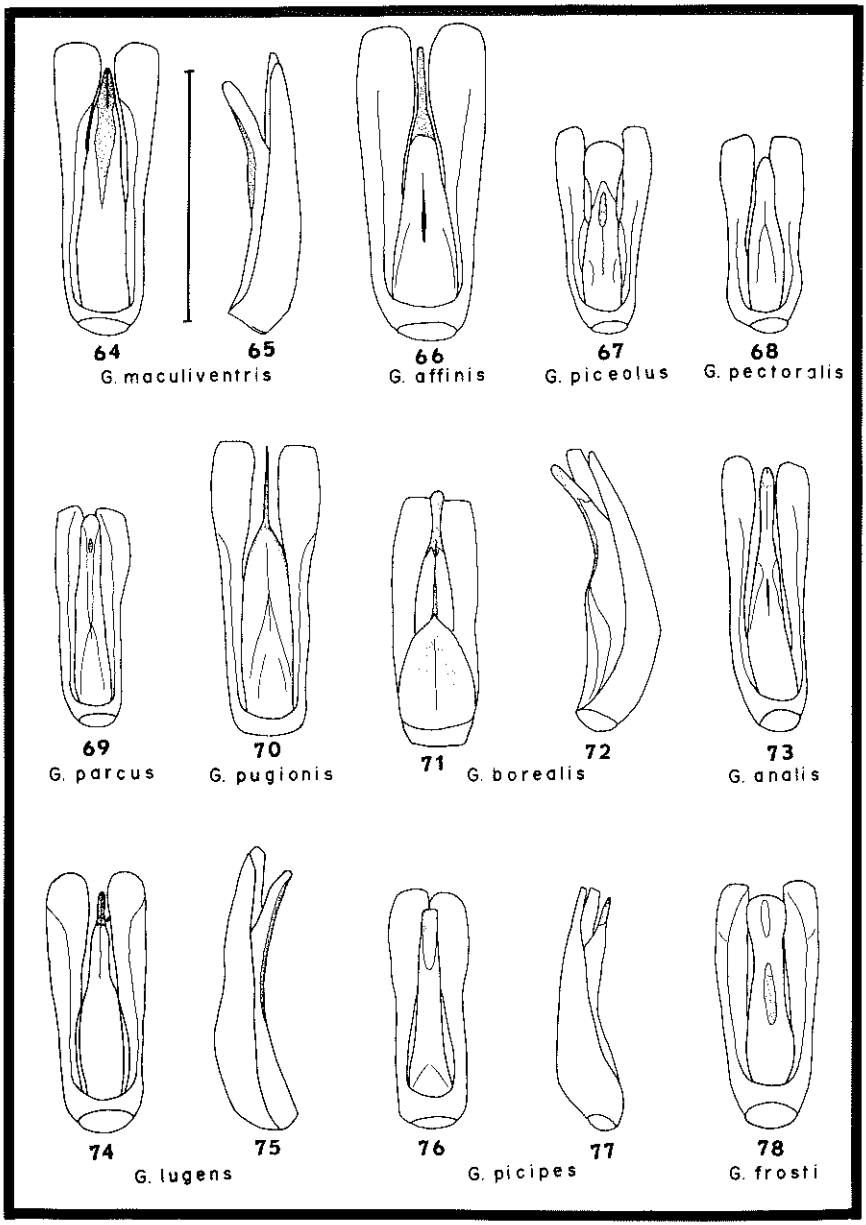
Table II. Species totals for distribution data provided by Dr. William Hilsenhoff, 1978.

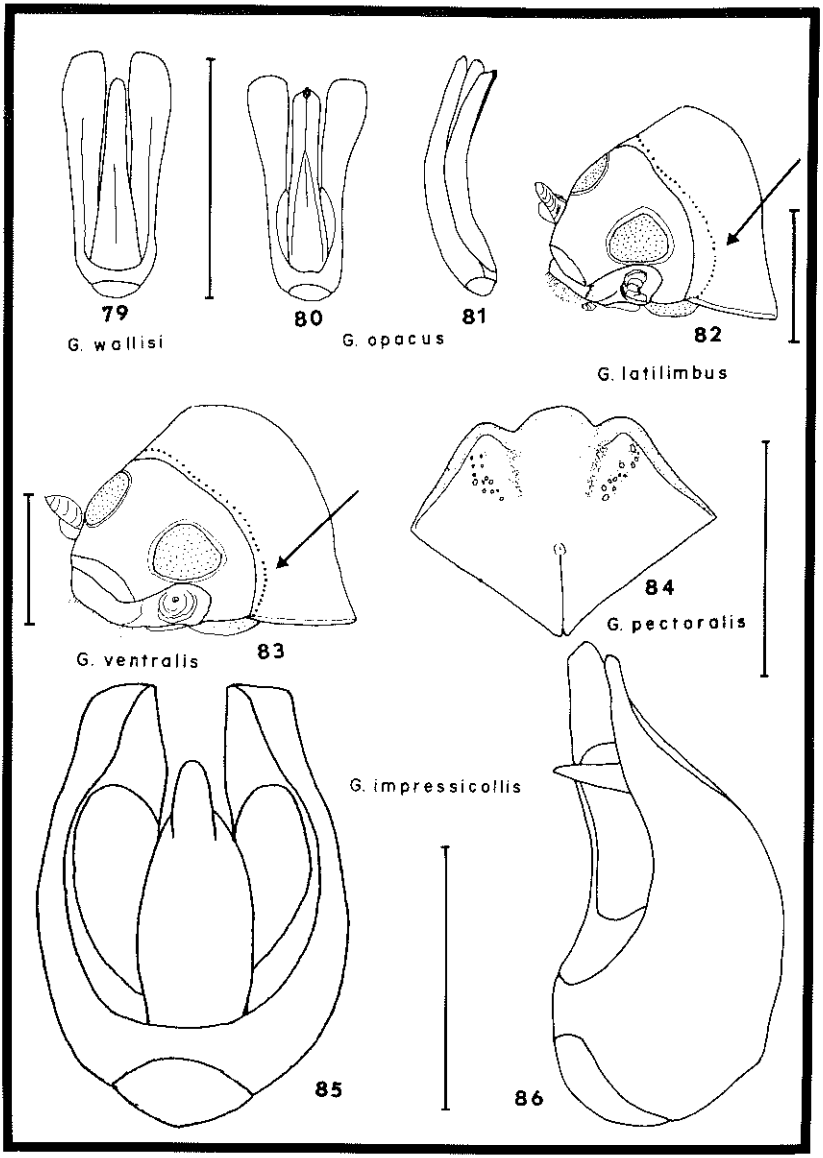
D. assimilis	726	
D. discolor	895	
D. hornii	177	
D. nigrior	267	
		Total *Dineutus* 2065
G. aeneolus	424	
G. affinis	794	
G. analis	271	
G. aquiris	604	
G. bifarius	453	
G. confinis	191	
G. dichrous	92	
G. frosti	72	
G. hatchi	1	
G. impressicollis	6	
G. latilimbus	526	
G. lecontei	547	
G. lugens	88	
G. maculiventris	1121	
G. marginellus	209	
G. minutus	77	
G. parcus	2	
G. pectoralis	15	
G. pugionis	89	
G. ventralis	297	
G. wallisi	1	
		Total *Gyrinus* 5880
		Total Speciments 7945



Figures 49-63. Dorsal and selected lateral views of male genitalia of *Gyrinus* spp. Scale line represents 1.0 mm.



Figures 64-78. Dorsal and selected lateral views of male genitalia of *Gyrinus* spp. Scale line represents 1.0 mm.



Figures 79-86. 79-81, 85, 86. Dorsal and selected lateral views of male genitalia of *Gyrinus* spp. 82, 83. Side views of head and pronotum of *Gyrinus* spp. 84. Mesosternum of *G. pectoralis*. Scale line represents 1.0 mm.