The Insects of Virginia No. 12

THE DYTISCIDAE OF VIRGINIA (COLEOPTERA: ADEPHAGA) (Subfamilies: Laccophilinae, Colymbetinae, Dytiscinae, Hydaticinae and Cybistrinae)*

by

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A CALL FOR HELP TO OUR READERS REQUESTING INSECT MATERIAL ON LOAN OR AS A DONATION

Our next issues in this series, now in preparation, will include the following insect groups from Virginia:

1. A revision and updating of our No. 3 (44) bulletin on the genus *Culicoides* (Diptera: Ceratopogonidae), by E. Craig Turner, Jr.;
2. The Longhorned Beetles (Coleoptera: Cerambycidae), by Robert H. Perry;
3. The Damselflies (Odonata: Zygoptera), by J. Reese Voshell, Jr. and James H. Kennedy;
4. The Dragonflies (Odonata: Anisoptera), by Frank Carle and E. Craig Turner, Jr.;
5. The Lygaeid Bugs (Hemiptera: Lygaeoidea), by Richard L. Hoffman;
6. The Armored Scale Insects (Homoptera: Diaspididae), by Michael Kosztarab;
7. The Flower Flies (Diptera: Syrphidae), by F. Christian Thompson;
8. The Ticks of Virginia, with notes on their biology and ecology (Acari: Metastigmata), by Daniel E. Sonenshine;
9. The Trichoptera of Virginia, by Oliver S. Flint.

Each of the authors listed above could fully utilize more material from Virginia for their studies. There are definite gaps in the geographical distribution of most insect species, usually because of lack of collecting in certain areas of the state. The Board of Review and the authors encourage our readers to intensify their collecting efforts for these groups and lend or donate available insects (in their personal possession, or in the public collection under their supervision) to the Department of Entomology at Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, (Dr. Michael Kosztarab, Curator). If donated, the commercial value of the collections will be appraised and acknowledged by letter to the donors for use in claiming possible tax deductions. In each bulletin we also acknowledge the loans and/or donations for that project. The donated or loaned material will be forwarded to authors of future bulletins for processing and for inclusion of new distribution records in manuscripts they are preparing. Only with such joint effort in the inventorying of our insect fauna can we achieve our goal of a better understanding of the living environment in Virginia.

PUBLICATIONS in this series are intended to serve as scientific contributions for a better understanding of the **living environment** in Virginia.

Recognizing the basic economic importance of faunistic studies, our goal is to survey methodically the local insect fauna through preparation of inventories designed to show the geographic and seasonal occurrence of insects in the Commonwealth, and to provide keys, descriptions, and illustrations to facilitate their recognition.

Insofar as possible, these studies will include data on biology and life cycles to aid in the formulation of control recommendations and information on ecological interactions—including host relationships, parasites, and predators—and the potential of various species as possible biological control agents. Knowledge gained from such studies will be used to evaluate the impact of future changes in our environment.

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CONTENTS

ABSTRACT

Forty-seven species and subspecies of non-hydroporine Dytiscidae are discussed. Of this number, 40 species and subspecies are recorded from Virginia, and 7 are listed as probably occurring in the state. Keys to all taxonomic groups are given. Original citations, diagnoses, ranges, Virginia records, and habitat preferences are supplied for each species and subspecies discussed, and a key to the genera of Dytiscidae in the Eastern United States is presented.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the cooperation given by Dr. P. J. Spangler, National Museum of Natural History; Drs. M. Kosztarab and E. C. Turner, Virginia Polytechnic Institute and State University; Dr. J. Lawrence, Museum of Comparative Zoology, Harvard University; Mr. J. F. Greene, North Carolina Department of Agriculture; and Dr. D. Young, North Carolina State University, in loaning specimens and providing access to reference collections.

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INTRODUCTION

Insects are readily observed in a variety of aquatic habitats and play an important role in the aquatic community. Aquatic insects are dominant members of the littoral fauna and, in many situations, the aquatic Coleoptera, or beetles, constitute the majority of insect species encountered. Most aquatic beetles play a predatory role in the food chain, and some species are economically important in pond fish culture (Wilson, 1923). As a tool for the researcher in applied aquatic biology, some aquatic beetle families may be used to characterize certain aquatic situations (Leech and Chandler, 1956). In addition, some species may prove to be important biological indicators of water quality.

With few exceptions, very little is known of the aquatic beetle fauna on a regional basis. In Virginia, the Hydrophilidae (Matta, 1974) and the Haliplidae (Matta, 1976) have been studied. This paper is the third in a series dealing with the aquatic Coleoptera of Virginia and treats five of the six subfamilies of Dytiscidae. The largest subfamily, the Hydroporinae, which comprises well over one-half of the dytiscid species in Virginia, is currently being studied by J. F. Matta. Results of this study will be published at a later date.

References in the literature to species of Dytiscidae occurring in Virginia are limited. Horn (1868) lists a single dytiscid in a survey of several counties in southwestern Virginia. In studies by Sherman (1913) and Fall (1927b), two additional Virginia species are noted.

More recently Matta (1973) discussed 13 species of dytiscids in a review of the aquatic beetles of the Dismal Swamp. Matta and Michael (1976) have described a new subspecies of *Acilius* from Virginia and North Carolina.

Additional information on Virginia species is provided in the following revisionary works: Fall (1922), two species of *Agabus;* Young (1963), one species of *Copelatus*; McWilliams (1969), two species of *Thermonectus;* Zimmerman (1970), five species of *Laccophilus*; and Hilsenhoff (1975), two species of *Acilius*. Also, Young (1954) reports *Cybister fimbriolatus crotchi* Wilke from Virginia.

MATERIALS AND METHODS

Collecting

The authors prefer to use a long-handled aquatic net to collect aquatic beetles. For best results the net should be passed back and forth along the bottom and margins of the collecting spot. Particular attention should be paid to any aquatic vegetation in the area. Sweeps should be made vigorously, and before moving to a new spot, it is often advantageous to make several repeated sweeps after each examination of the net's contents. The net's contents are more easily examined if dumped into a white enameled pan. Collected beetles are placed in isopropyl alcohol until pinned.

If collected persistently enough, nearly all aquatic situations will yield some beetles. The most productive areas, however, are shallow situations, such as ponds and pools that have some marginal, emergent, or submergent vegetation or leaf litter. Habitats with a dense algal growth often do not produce a varied fauna, although they may be very productive in terms of numbers of specimens. Other habitats which generally possess a limited fauna and may be peculiar to only certain species include: ditches, roadside pools, the backwaters and margins of streams, open marshes, typha ponds and borrow pits.

Mounting and Measuring

Specimens are mounted using standard techniques. Genitalia extracted from male specimens are placed in a microvial with a drop of glycerine and pinned beneath the specimens.

Measurements were made with a standard 10 mm reticle mounted in a 10X ocular of an AO Stereostar Zoom dissecting microscope. While viewing the specimens through the same microscope, with a 10 mm grid in a 15X ocular, illustrations were drawn on grid paper and then transferred to bristol paper.

Format of this Work

The primary source of information on the species occurring in Virginia was from specimens taken in field collections. In addition, the following reference collections were screened for Virginia records: the National Museum of Natural History (USNM); Virginia Polytechnic Institute and State University (VPI&SU); the Museum of Comparative Zoology at Harvard University (MCZ); and the North Carolina Department of Agriculture Museum (NCDA). Literature references also provided Virginia records. Spe-

cies occurring in states bordering Virginia and those recorded from both north and south of neighboring states are also discussed.

The diagnosis given herein is not intended as a species description; it is meant to be used to point out characters that will aid in distinguishing the species under discussion from those species with which it might be confused. Distributional information on Virginia species is generally given by county. Additional information is provided regarding those species where few records are available. Records not followed by a museum designation are represented in the Old Dominion University collection (ODU).

Lengths are given as a range that should include most Virginia specimens. Habitat information was taken from the authors' notes, and where available, from the literature.

THE FAMILY DYTISCIDAE

The family Dytiscidae, the predacious diving beetles, is the largest family of aquatic Coleoptera. The family comprises 6 subfamilies and is estimated to be represented by more than 400 species in North America. The dytiscids are streamlined beetles, slightly convex, and range in size from 1 to 40 mm. Color is variable, ranging from piceous, greenish in a few species, to tones of brown and reddish brown. Some species may have variegate or vermiculate patterns.

The head is prognathous, the maxillary palpi are 4-segmented and the labial palpi are 3-segmented. The filiform antennae are simple and have 9 flagellar segments. The prosternum is usually keeled and articulates in a notch of the metasternum. The prosternal process, which varies from being flat and broadly rounded to carinate and sharply acuminate, may be either all in the same plain or sharply bent at the base. The hind coxae are fused to the metathorax and divide the first visible abdominal sternum, as in the other Adephaga.

The adaptations to the aquatic habitat serve to distinguish the Dytiscidae from other adephagid Coleoptera. The Dytiscidae arose from terrestrial ancestors (Leech and Chandler, 1956), but are well adapted to aquatic environment and are strong swimmers. The hind legs are oarlike, fringed with hydrophilic hairs, and stroke in unison when the beetles swim. The dytiscids are primarily dependent on atmospheric oxygen, but may obtain oxygen from air bubbles in the

subelytral air space and on submerged vegetation (Leech and Chandler, 1956). Specimens may often be observed in the field, popping to the water surface to renew their air supply, then diving quickly. When at rest, they cling by the middle pair of legs to vegetation, the bottom, or debris, and may stay submerged for a considerable length of time. The authors have observed *Cybister fimbriolatus*, held in an aquarium, to remain submerged on numerous occasions for as long as 5 minutes.

There are four stages in the life cycle of Dytiscidae, and the bionomics of only a few species have been studied. In general, the eggs are laid either in moist soil or on aquatic plant tissue. In a few species the females have specialized ovipositors used to penetrate plant tissue for deposition of the eggs. The larvae are strictly aquatic, and one species possesses gills (*Coptotomus interrogatus* Fabricius). Larvae in early instars rely on dermal respiration. Cannibalism is common, and the larvae of some species are fierce predators and are known to attack even small fish fry (Wilson, 1923). The pupal stage for the majority of species is unknown. This results from a lack of collecting in the habitat where the pupal stage is passed. The adults, for the most part, are aquatic and awkward on land, although a number of species are active flyers and are often encountered around lights. Sexual dimorphism is displayed, and males may be recognized by the glandular pubescence on the tarsal joints of the pro- and mesothoracic legs. In some species the protarsi are expanded to form an oval or round adhesion disc used to hold the female when mating. The females in some species have sulci or grooves on the elytra.

Additional information on the morphology of Dytiscidae is contained in Arnett (1960) and Leech and Chandler (1956). Figure 1 is included as a ready reference to most external characters of the Dytiscidae.

Figure 1. Dorsal (left) and ventral (right) view of *Rhantus binotatus* (Harris) to illustrate the principal characters of the Dytiscidae: ant, antenna; clp, clypeus; cx, coxa; e, eye; ely, elytra; epl, epipleuron; epm, epimeron of mesothorax; eps_1, episternum of prothorax; eps_2, episternum of mesothorax; fem, femur; g, gula; lab, labrum; lp, labial palp; mes, mesosternum; met, metasternum; met l, metacoxal lobe; met p, metacoxal plate; mp, maxillary palp; p, prosternal process; pro, pronotum; prs, prosternum; s, scutellum; st 1-6, sterna; sw, metasternal side wing; tro, trochanter.

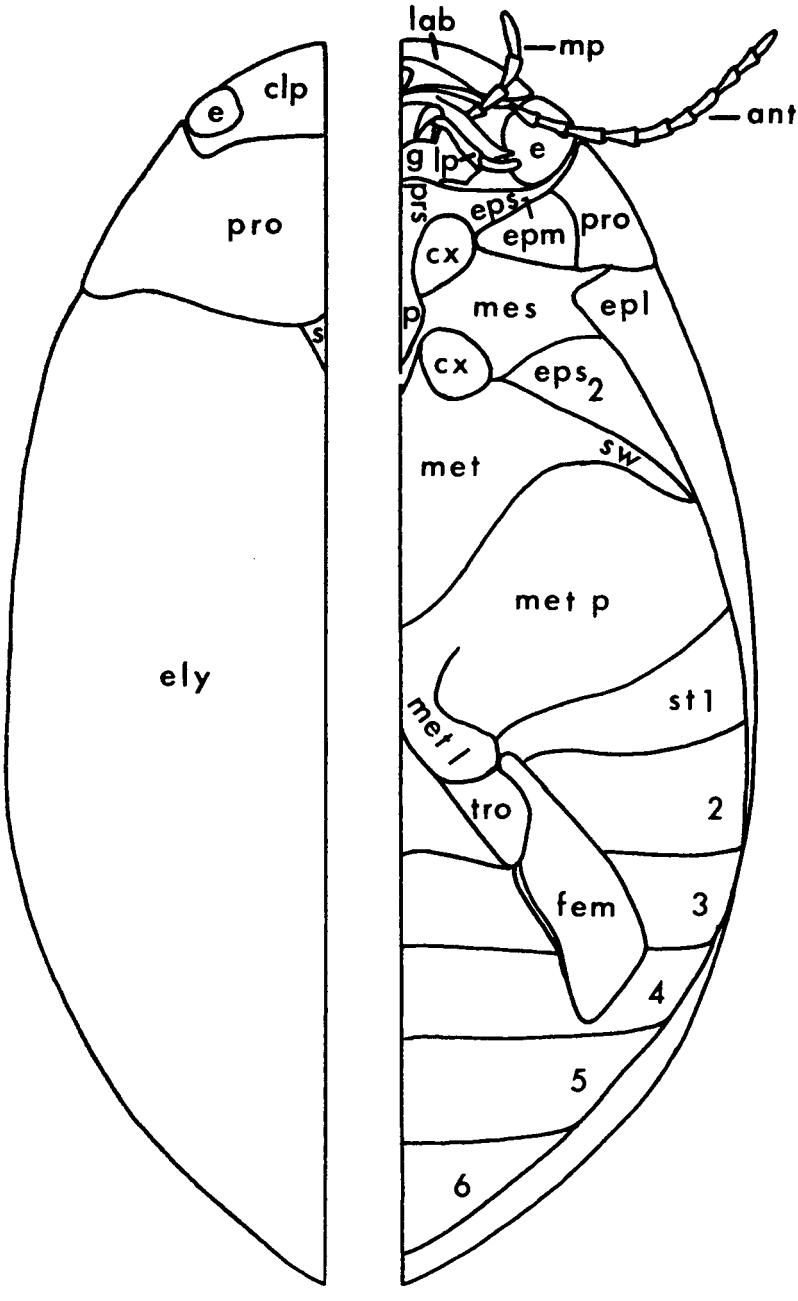
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Figure 1

The number of non-Hydroporine species occurring in Virginia compares favorably with species recorded in other geographic regions. The Florida species and subspecies number 31 (Young, 1954). Malcolm (1971) records 35 species for Maine, and Brimley (1938) records 18 species from North Carolina. In Indiana, Blatchley (1910) records 51 species, Gordon and Post (1965) record 33 species for North Dakota, and Leech and Chandler (1956) record 69 species and subspecies for California. There are 40 non-Hydroporine species and subspecies recorded from Virginia, with 7 species probably present but as yet unrecorded.

KEY TO THE GENERA OF DYTISCIDAE OF THE EASTERN UNITED STATES, EAST OF THE MISSISSIPPI RIVER *

1. Fore- and middle tarsi 5-segmented, with the 3rd segment bilobed, and the 4th segment reduced and hidden in the lobes of the 3rd (except *Bidessonotus*); scutellum completely concealed (except in *Celina*); prosternal process strongly bent, not on plane with the base of the prosternum (fig. 2B) ---- 2

   Fore- and middle tarsi distinctly 5-segmented; scutellum usually exposed (concealed in *Laccophilus, Laccodytes*) prosternal process not bent, in the same plane as the base of the prosternum (fig. 2A) ---------- 19

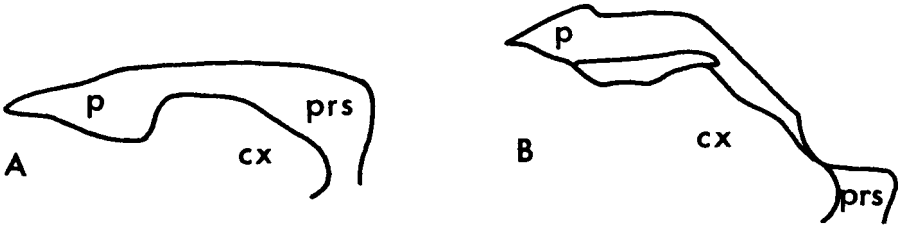

Figure 2. Lateral view of the prosternum (prs) and the prosternal process (p), coxa (cx) of *Dytiscus fasciventris* (A) and *Hydroporus* sp. (B).

* Modified from Leech and Chandler, (1956).

2. Scutellum exposed; body distinctly parallel sided -- *Celina*
Scutellum concealed; body form variable ---------- 3

3. Metepisterna not reaching middle coxal cavities (fig. 3A); prosternal process short, broad, ending in front of contiguous middle coxa; southern Florida ---------- *Derovatellus*
Metepisterna not completely cut off from middle coxal cavities (fig. 3B); prosternal process reaching the metasternum ---------- 4

4. Anterior and middle tarsi distinctly 5-segmented; pronotum with lateral plicae extending to the base and continued by similar impressions on the base of the elytra; middle tibia of male strongly bent ---------- *Bidessonotus*
Anterior and middle tarsi pseudotetramerous; if pronotum and elytra with plicae, then middle tibia of male without modification ---------- 5

5. Broad apex of hind coxal process divided into three parts, forming lateral lobes and a broad depressed middle region (fig. 3C); elytra pointed and last abdominal segment ends in acute spinelike apex; body form hemispherical ---------- *Hydrovatus*
Not as above ---------- 6

6. Hind coxal processes flat, without lateral lobes; base of hind trochanter entirely free (fig. 3D) ---------- 7
Hind coxal processes somewhat raised, not on a plane with the 1st abdominal sternum; sides of the hind coxal process more or less produced into lateral lobes which cover the bases of the hind trochanter (fig. 3E) ---------- 13

7. Hind tibia straight, almost uniform in width from base to apex; hind tarsal claws unequal; epipleura with a diagonal carina near the base ---------- 8
Hind tibia slightly arcuate, narrow at base, gradually widening to apex; hind tarsal claws equal; epipleura without a diagonal carina (except in *Brachyvatus*) ---------- 9

8. Middle coxae separated by about the width of a middle coxa; prosternal process short and broad, apex obtuse ---------- *Pachydrus*
Middle coxae separated by about half the width of a middle coxa; prosternal process rhomboid, apex acute ---------- *Desmopachria*

9(7). Head with a transverse cervical stria or suture behind the eyes ---------- 10
Head without a cervical stria ---------- *Uvarus*

10. Elytra without basal, sutural or accessory striae; clypeus thickened anteriorly with two small tubercles at middle; epipleura with a transverse carina at base ---------- *Brachyvatus*
Not exactly fitting the above description ---------- 11

11. Clypeal margin thickened anteriorly, upturned, tuberculate; each elytron with a sharp narrow carina starting at the base opposite the pronotal plicae ---------- *Anodocheilus*
Clypeal margin not thickened, upturned, or tuberculate; elytra without carinae ---------- 12

12. Elytra without sutural striae, accessory discal stria or impressed punctures; anal sternum narrow, impressed on either side ---------- *Liodessus*
Elytra without sutural striae but with distinct accessory striae; anal sternum broad, not impressed at sides ---------- *Neobidessus*

13(6). Bases of hind femora attaining the lobes of the posterior coxal processes (fig. 3F) ---------- *Laccornis*
Bases of hind femora separated from the hind coxal lobes by the basal part of the trochanter (fig. 3E) -- 14

Figure 3. A. *Laccophilus* sp. showing the metepisternum separated from the middle coxal cavity by the mesosternum. B. *Hydroporus* sp. with metepisternum reaching the middle coxal cavity. C. The broad apex of hind coxal process divided into three parts: two lateral lobes (lat l) and a broad depressed middle region of *Hydrovatus* sp. D. The hind coxal process of *Anodocheilus* sp. without lateral lobes and base of trochanter free. E. Hind coxal process of *Hydroporus* sp. with lateral lobes, the base of the trochanter covered and the femur separated from the coxal lobe by the trochanter. F. The hind femur of *Laccornis* sp. attaining the hind coxal lobes.

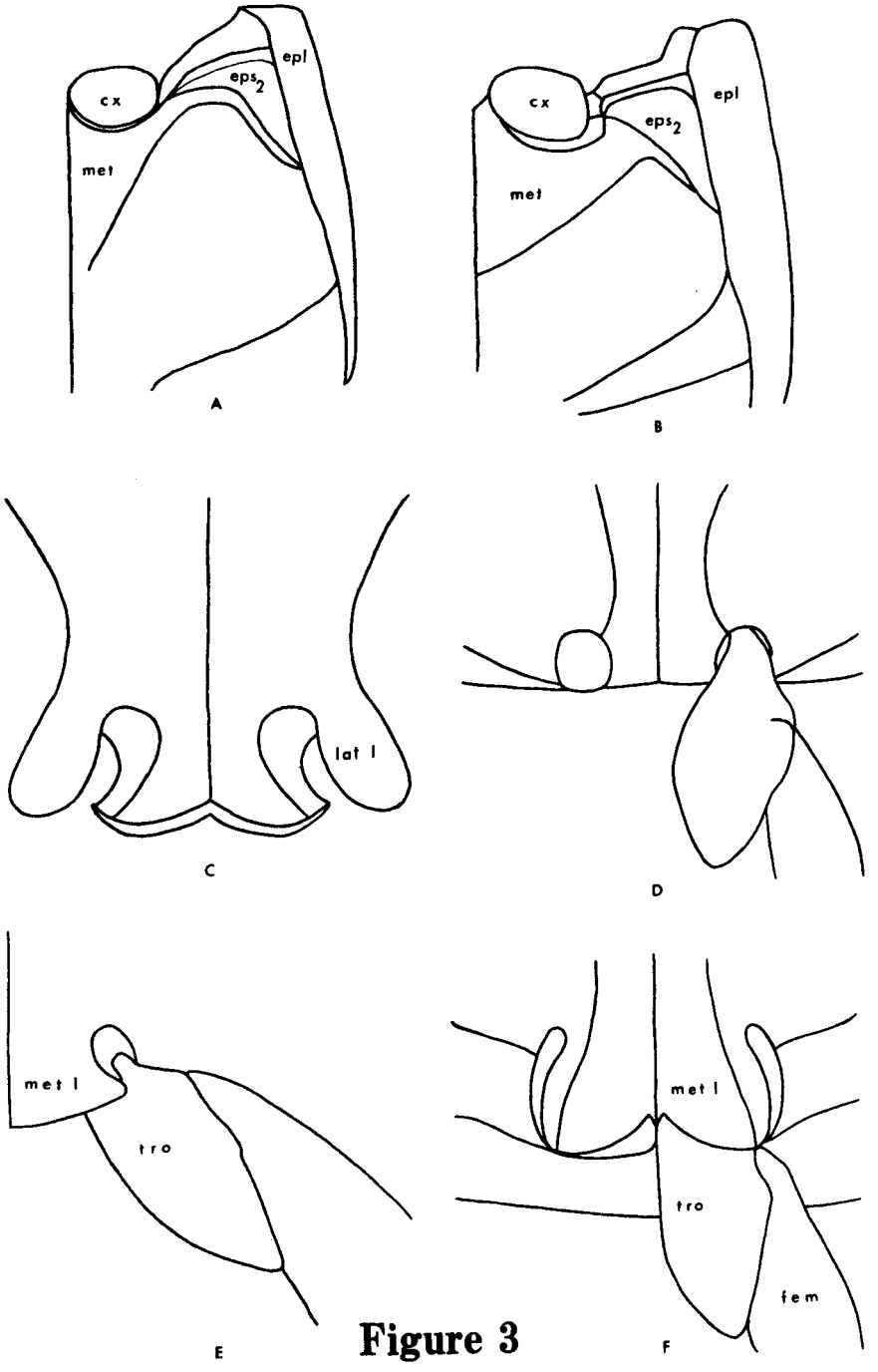
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Figure 3

14. A diagonal carina crossing the epipleuron near the base; fore- and middle tarsi 4-segmented ___ *Hygrotus*
No carina present on epipleuron; tarsi 5-segmented, the 4th usually very small, hidden between lobes of the third ---------- 15

15. Hind margin of the hind coxal processes triangularly incised at middle (fig. 4A) ---------- 16
Hind margin of the hind coxal processes truncate or produced at middle, but not triangularly incised (fig. 4B) ---------- 17

16. Pronotum with a longitudinally impressed plica on each side, usually with a shallow transverse impression near the base or impression on each side near the base; hind femora with a median line of setigerous punctures, otherwise sparsely punctate or smooth ---------- *Oreodytes*
Pronotum without sublateral impressed plica, usually without basal impression; hind femora usually densely punctate over entire surface ___ *Deronectes*

17(15). Hind margin of hind coxal processes either truncate or angularly prominent at middle, not sinuate ___ ---------- *Hydroporus*
Hind margin of hind coxal processes sinuate -------- 18

18. Hind angle of pronotum rectangular or obtuse_ *Hydroporus*
Hind angle of pronotum acute ---------- *Deronectes*

19(1). Scutellum concealed or rarely with a small tip visible; hind tarsi each with a single straight claw ____ 20
Scutellum entirely visible; hind tarsi with 2 claws (if only 1 claw present, size greater than 15 mm) __ 21

Figure 4. A. *Deronectes* sp. showing the triangularly incised middle of the hind coxal process. B. *Hydroporus* sp. with a produced hind margin of the hind coxal process. C. The head of *Rhantus* sp. with emarginate eyes. D. The head of *Cybister* sp. with non-emarginate eyes. E. *Ilybius* sp. showing the linear group of cilia on the hind femur. F. The ciliate posterior margins of the hind tarsal segments in *Thermonectus* sp. G. The bare posterior margins of the hind tarsal segments in *Dytiscus* sp. H. The straight outer margin of the metasternal side wing in *Hydaticus* sp. I. The curved outer margin of the metasternal side wing in *Graphoderus* sp.

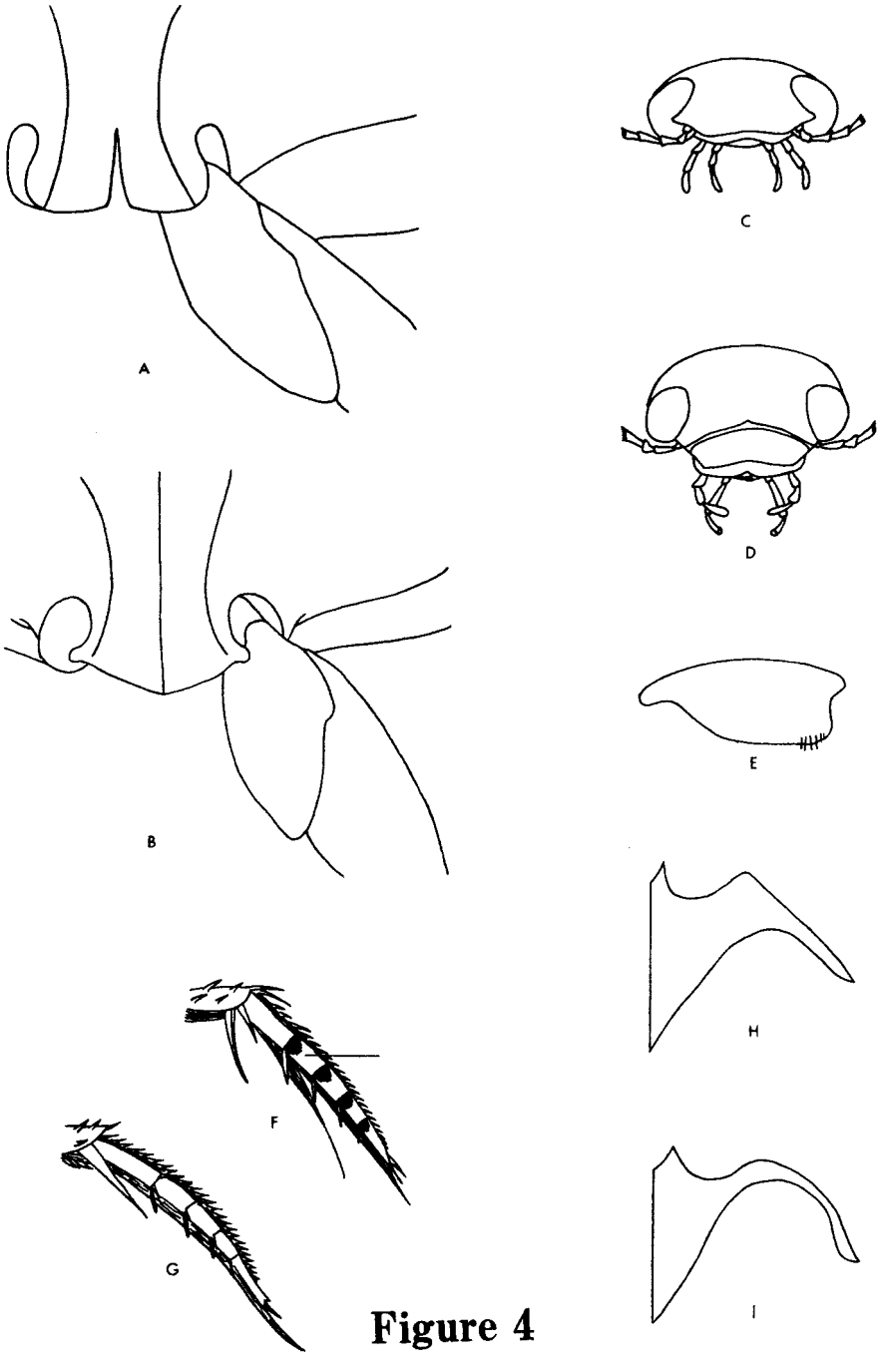

Figure 4

20. Length greater than 2.3 mm; spines of hind tibia notched at tip ---------- *Laccophilus*, p. 14
Length less than 2.3 mm; spines of hind tibia acute at tip ---------- *Laccodytes*

21(19). Eye emarginate at side above the base of the antenna (fig. 4C); male anterior tarsi not forming a round or oval adhesion disc although it may be widened and with suction cups beneath ---------- 22
Eye not emarginate (fig. 4D); first 3 segments of anterior tarsi of male greatly expanded to form an oval or round adhesion disc ---------- 31

22. Hind femora with a linear group of cilia near the posterior apical angle (may be reduced to a small tuft) (fig. 4E) ---------- 23
Hind femora not as above ---------- 24

23. Hind tarsal claws equal or nearly so ----- *Agabus*, p. 19
Hind tarsal claws unequal, the outer one ⅔ or less the length of the inner one ---------- *Ilybius*, p. 36

24(22). Prosternum with a median longitudinal furrow; first 4 hind tarsal segments distinctly produced at the upper (inner) posterior corners ------- *Matus*, p. 38
Prosternum without a median longitudinal furrow; hind tarsal segments not lobed on the upper posterior corners ---------- 25

25. Hind tarsal claws equal in length ---------- 26
Hind tarsal claws unequal, outer one from ⅓ to ⅔ the length of the inner one ---------- 28

26. Each elytron with a submarginal stria and at least 5 discal striae; hind coxal lines divergent anteriorly, almost touching the median line posteriorly ---------- *Copelatus*, p. 32
Elytra without discal striae, hind coxal lines not as above ---------- 27

27. Apical segment of palpi notched at apex; pronotum narrowly margined; elytra at least with 2 short yellow streaks at base ---------- *Coptotomus*, p. 34
Apical segment of palpi not emarginate at apex; pronotum not margined not with a fine line along the edges; elytra unmarked ---------- *Agabetes*, p. 18

28(25). Anterior point of metasternum, between mesocoxae clearly triangularly split to receive the apex of the prosternal process; pronotum usually margined laterally ---------- 29

Anterior point of metasternum depressed or broadly notched but never triangularly split; pronotum not margined ---------- 30

29. Prosternal process flat; pronotum widely margined laterally ---------- *Hoperius*, p. 35

Prosternal process convex or cariniform; pronotum narrowly margined laterally ---------- *Rhantus*, p. 39

30(28). Elytral sculpture consisting of numerous parallel transverse grooves ---------- *Colymbetes*, p. 31

Elytra coarsely reticulate, without transverse grooves ---------- *Neoscutopterus*

31(21). Shorter spur at apex of hind tibia dilated, much broader than other spur; first 3 segments of front tarsi of male forming an oval plate ---------- 32

Shorter spur at most little broader than the other spur; first 3 segments of male tarsi forming a round plate ---------- 33

32. Apex of hind tarsi of males with two claws, females with a long outer claw and rudimentary inner claw; southern Florida ---------- *Megadytes*

Apex of hind tarsi of male always with one claw, female usually with only one claw; generally distributed ---------- *Cybister*, p. 42

33(31). Posterior margins of first 4 hind tarsal segments with a fringe of flat cilia. (fig. 4F) ---------- 34

Posterior margins of first 4 hind tarsal segments bare (fig. 4G) ---------- *Dytiscus*, p. 40

34. Prosternal process with apex acute; pronotum margined; side margins of elytra on posterior half with serrate spines ---------- *Eretes*

Prosternal process with apex round; pronotum not margined ---------- 35

35. Outer margin of metasternal wing straight (fig. 4H); apical spur of hind tibia acute -- *Hydaticus*, p. 48

Outer margin of metasternal wing arched (fig. 4I); apical spur of hind tibia blunt and emarginate at tip ---------- 36

36. Body beneath almost smooth, with scarcely observable punctuation; first 3 segments of male anterior tarsi with a few large and many small suction cups ---------- 37

Body beneath coarsely punctate; suction disk of male protarsus with a large basal and 2 smaller suction cups ---------- *Acilius*, p. 44

37. Elytra black with yellow maculae or transverse bands, or yellow with black spot, or irrorate; hind margin of middle femora with a series of stiff setae which are as long or longer than the femora are wide ---------- *Thermonectus*, p. 49

Elytra basically yellowish, uniformly speckled or vermiculate with black; hind margin of middle femora with a series of stiff setae which are only about ½ as long as femora are wide-*Graphoderus*, p. 47

Genus *LACCOPHILUS* Leach

This genus has been revised by Zimmerman (1970) who lists 7 species from eastern North America. The genus may be recognized by the intermediate size (3 to 7 mm), hidden scutellum, 5-segmented front and middle tarsi and the produced lobe on the hind margin of the metatarsal segments. The metatibial spines are bifid and the prosternal process is unispinose. The males of some species have a series of short ridges (metacoxal file) on the metacoxal plate. They are easily recognized in the field by the way they spring about in hand and net.

KEY TO THE SPECIES OF *LACCOPHILUS* OF VIRGINIA *

1. Elytra with irrorations (color applied like grains of sand); males with metacoxal file ---------- 2

Elytra without irrorations; males without metacoxal file ---- 4

* Modified from Zimmerman (1970).

2. Elytra with irregular black fascia across posterior half ---------- *fasciatus rufus*
   Elytra without fascia ---------- 3

3. Elytra with three or four well defined maculae along lateral margins; length over 5 mm ----- *maculosus maculosus*
   Elytral maculae less well defined, with only the middle macula most apparent; size smaller, under 4.5 mm -- *proximus*

4. Elytral pattern with an incomplete sub-basal yellow band and two preapical yellow spots, or variegated ---------- 5
   Elytra not patterned ---------- *gentilis gentilis*

5. Elytral pattern with an incomplete sub-basal yellow band and 2 preapical yellow spots; palpi and antennae not darkened ---------- *schwarzi*
   Elytral pattern variegated; palpi and antennae darkened at tips ---------- *undatus*

LACCOPHILUS FASCIATUS RUFUS Melsheimer

Laccophilus rufus Melsheimer, 1844, Proc. Acad. Nat. Sci., Phila. 2:28.

Diagnosis: Length 4.7 to 4.9 mm. Easily separated from the other Virginia species by the presence of a black fascia on the posterior half of the elytra.

Range: This eastern subspecies occurs from Vermont to northern Florida, westward to southern Michigan and south along the 97th meridian from South Dakota to east Texas.

Virginia Records: Dismal Swamp, counties of Augusta, Bath, Culpeper, Fairfax, Halifax, Hanover, Henrico, Lee, Mecklenburg, Montgomery, Nansemond, New Kent, Nottoway, Page, Pittsylvania, Prince William, Rockbridge, Southampton, Spotsylvania, Stafford, Sussex, Warren, Wise and the cities of Norfolk, City of Chesapeake, and City of Virginia Beach. Specimens were collected from March to December.

Habitat Preference: This subspecies along with *Laccophilus m. maculosus* is one of the most commonly encountered dytiscids in Virginia. It may be collected in any number of habitats with and

without vegetation, such as permanent pools, stream margins and backwaters. It is most commonly collected in temporary pools with muddy or silty bottoms formed by roadside ditches and intermittent streams.

LACCOPHILUS GENTILIS GENTILIS **LeConte**

Laccophilus gentilis LeConte, 1863, Smiths. Misc. Coll. 167:23.

Diagnosis: Length 3.2 to 3.7 mm. This is the smallest North American species of *Laccophilus*. The small size and uniform color of the elytra will distinguish it from the other species of *Laccophilus* in Virginia.

Range: This subspecies occurs from Louisiana to Florida and north to southeastern Virginia. Although it is found throughout most of the Florida peninsula other records are scarce. There are two records from southern Georgia and one each from Louisiana, North Carolina, and Virginia.

Virginia Records: City of Chesapeake (15 June 1972, J. F. Matta)

Habitat Preference: One specimen was collected in a grass clump in the margin of the Northwest River, another in a similar situation in Currituck County, North Carolina. Young (1954) found this subspecies most abundant in Florida in sloughs or swamps along lake edges. He also indicates that the preferred habitats are backwaters and edges of small streams.

LACCOPHILUS MACULOSUS MACULOSUS **Say**

Laccophilus maculosus Say, 1823, Trans. Amer. Philos. Soc. 2:100.

Diagnosis: Length 5 to 5.8 mm. The distinct maculae on the elytra should easily distinguish this from other Virginia species. The males possess metacoxal files, the females sawlike ovipositors.

Range: From Alabama to Nova Scotia with its westward range probably restricted to a line running from northeastern Georgia to southwestern Nebraska.

Virginia Records: Dismal Swamp, counties of Albemarle, Alleghany, Augusta, Bath, Campbell, Culpeper, Dickenson, Fairfax, Fauquier, Frederick, Giles, Hanover, Highland, Lee, Madison, Montgomery, New Kent, Page, Pittsylvania, Prince William, Richmond, Rockbridge, Smyth, Warren, Wise, and the City of Chesapeake, cities of Norfolk, Portsmouth, and City of Virginia Beach. Collections range from May to December.

Habitat Preference: Young (1954) states that this subspecies prefers shallow, partially shaded situations that tend to have some water present all year. This subspecies is widely dispersed in Virginia and is found in many situations with *L. f. rufus*. Both are pioneer species and have even been collected in a backyard swimming pool.

LACCOPHILUS PROXIMUS Say

Laccophilus proximus Say, 1823, Trans. Amer. Philos. Soc. 2:101.

Diagnosis: Length 3.8 to 4.6 mm. This species should be easily distinguished from *L. m. maculosus* because of its smaller size and less distinct maculae. The males have a strongly developed metacoxal file.

Range: A widely distributed species; its range extends from southeastern Canada southward to Florida, westward to Wyoming, and southward into coastal Mexico, Yucatan, and the Antilles.

Virginia Records: Dismal Swamp, counties of Bath, Dickenson, Fairfax, Hanover, Montgomery, Prince William, Scott, Stafford, and Wise and the cities of Norfolk, Suffolk and City of Virginia Beach. Specimens were collected from April to October.

Habitat Preference: A principal pioneer species of newly formed ponds or puddles and, according to Young (1954), the most common *Laccophilus* of these situations in Florida. Though not as common as *L. f. rufus* and *L. m. maculosus* in Virginia, this species was collected in a variety of habitats. These included a typha pond, a spring fed pond, temporary pools, roadside puddles and, most commonly, sand pits.

LACCOPHILUS SCHWARZI Fall

Laccophilus schwarzi Fall, 1917, J. New York Ent. Soc. 25:165.

Diagnosis: Length 3.9 to 4.2 mm. Its larger size and elytral markings separate *L. schwarzi* from *L. g. gentilis*. It is separated from all other eastern species of *Laccophilus*, except *undatus*, by the lack of irrorations and a metacoxal file.

Range: This is perhaps the rarest species of *Laccophilus* in the United States. It has only been collected in the vicinity of Washington, D. C., Amherst and Stafford counties in Virginia, in Alabama, and in Bladensburg, Maryland.

Virginia Records: Amherst County, near Monroe (28 August 1959 F. N. Young) (USNM); Ash Grove, near Washington, D. C. (22 September 1910, J. D. Sherman) (AMNH). Stafford County (11 and 12 August 1972 and 1 August 1973, J. F. Matta) (ODU).

Habitat Preference: Its habitat is very restricted, and adult specimens have only been collected in August and September. According to Zimmerman (1970), to collect this species one must look in nearly dried-up brooks, in eddies where fallen trees or stumps have made dams and where leaves have accumulated along with scum and rubbish on the water's surface. In a similar stream situation, several specimens of *L. schwarzi* were collected from a small stream near Fredericksburg, Virginia. The collections were made at the stream margin, just downstream from a fallen tree, in the root mass under an overhung bank.

LACCOPHILUS UNDATUS **Aube**

Laccophilus undatus Aubé, 1838, Species general des coleopteres. 6: 435.

Diagnosis: Length 3.2 to 4.3 mm. The variegated elytral pattern and the darkened tips of the antennae and maxiliary palpi separate this species from all other eastern *Laccophilus*.

Range: Vermont to Virginia and west to Indiana.

Virginia Records: Zimmerman (1970) gives a single Virginia record, Fairfax county, Black Pond, 1 September 1921, Shoemaker (USNM).

Habitat Preference: This species is found in shaded pools in deciduous woodlands (Zimmerman, 1970).

Genus *AGABETES* Crotch

This genus is represented by a single species in North America. The dorsum is densely sculptured, with many short irregular grooves, and the pronotum is unmargined.

AGABETES ACUDUCTUS **(Harris)**

Colymbetes acuductus Harris, 1928, New England Farmer. 7:164.

Diagnosis: Length 6 to 7.5 mm. The color above is almost entirely piceo-testaceous, except for the head which is light reddish-brown. The apical abdominal sternum has two parallel grooves along its entire length.

Range: Southern Canada, west to Michigan and Indiana and Arkansas and south to Florida.

Virginia Records: Dismal Swamp (numerous specimens have been collected from 5 sites in the months of June, July and August), Fairfax County (Sherman, 1913) and the City of Virginia Beach (22 June 1973, A. G. Michael and 10 October 1970, J. F. Matta).

Habitat Preference: This is a woodland pool species; Sherman (1913) noted records from forest ponds of New York and Virginia. This species may often be collected with a rarer woodland pool dytiscid *Hoperius planatus*.

Genus *AGABUS* Leach

The genus *Agabus* includes more species than any other genus of North American Dytiscidae, except the genus *Hydroporus*. The genus *Agabus* is primarily a northern one distributed across the entire continent and includes about 56 species. Eleven species are recorded in Virginia, with four additional species probably occurring in the state.

Most of our species are black and moderately convex and range in size from 7 to 11.5 mm. The genus is easily separated from our other dysticids, except *Ilybius*, by the presence of a group of cilia on the metafemora. *Agabus* differs from *Ilybius* in that it is less convex and the hind tarsal claws are equal in length.

The close similarity among various groups of species of *Agabus* make identification difficult without some working experience with the genus. Fall's (1922) review of the North American species, which is not illustrated, has a very adequate key, but a number of diagnostic characters may be unclear if the investigator does not have a few correctly determined specimens as standards of reference. Illustrations of male protarsal claws and aedeagi, figures 5 & 6, are included to aid in identification.

KEY TO THE SPECIES OF *AGABUS* OF THE SOUTHEASTERN UNITED STATES

1. Prosternal process broad, smooth and flatly convex to moderately convex ---------- 2
   Prosternal process narrower, varying from moderately convex to angularly convex ---------- 8

Range: Southern Canada, west to Michigan and Indiana and Arkansas and south to Florida.

Virginia Records: Dismal Swamp (numerous specimens have been collected from 5 sites in the months of June, July and August), Fairfax County (Sherman, 1913) and the City of Virginia Beach (22 June 1973, A. G. Michael and 10 October 1970, J. F. Matta).

Habitat Preference: This is a woodland pool species; Sherman (1913) noted records from forest ponds of New York and Virginia. This species may often be collected with a rarer woodland pool dytiscid *Hoperius planatus*.

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KEY TO THE SPECIES OF *AGABUS* OF THE SOUTHEASTERN UNITED STATES

1. Prosternal process broad, smooth and flatly convex to moderately convex ---------- 2
   Prosternal process narrower, varying from moderately convex to angularly convex ---------- 8

2. Hind tibia with a series of punctures along the inner margin ---------- 3
Hind tibia without a series of punctures along the inner margin ---------- 5

3. Elytra with a postmedian sublateral yellow spot or a postmedian and subapical sublateral yellow spot ---- 4
Elytra without spots ---------- *seriatus seriatus*

4. Length 11.5 mm; elytra with a postmedian sublateral yellow spot; anterior protarsal claw of male arcuately thickened postmedially ---------- *confusus*
Length 7.3 to 8 mm; elytra with a postmedian and subapical sublateral yellow spot; male claw not as above ---------- *obtusatus*

5(2). Elytra with sublateral yellow vitta behind middle; minute punctures of elytra occurring on the reticulating lines ---------- 6
Elytra with postmedian and subapical yellow spots; minute punctures of elytra occurring within the areolae ---------- *planatus*

6. Anterior protarsal claw of male with ante-basal tooth ---------- *semivittatus*
Anterior protarsal claw of male not toothed, but with a basal lobe ---------- 7

7. Anterior protarsal claw of male with a large angulate basal lobe ---------- *johannis*
Anterior protarsal claw of male with a strong rectangular basal lobe ---------- *stagninus*

8(1). Elytra yellow with black vittae ---------- 9
Elytra not yellow with black vittae ---------- 10

9. Venter all reddish-brown ---------- *taeniolatus*
Venter in part pale, metasternum and coxal plates black ---------- *disintegratus*

10. Inner apical hind tibial spur longer than basal joint of tarsus ---------- 11
Inner apical hind tibial spur not longer than basal joint of tarsus ---------- 12

11. Middle femora of male fimbriate with long hairs on posterior margin; long spur of hind tibia cylindrical, tapering to a fine point; posterior margin of metafemora noticeably produced to a point beneath the cilia ---------- *aeruginosus*
Middle femora without hairs as above; long spur of hind tibia stout, flattened and abruptly pointed; posterior margin of metafemora not produced beneath cilia ---------- *punctatus*

12(10). Lower face of hind tibia without a series of punctures along the inner margin ---------- 13
Lower face of hind tibia with a series of punctures along the inner margin ---------- 14

13. Protarsal claw of male expanded, leaflike --- *erythopterus*
Protarsal claw of male not expanded ---------- *ambiguus*

14(12). Pro- and mesotarsi of male with extremely large circular palettes beneath; prosternal process long, tip acuminate ---------- *anthracinus*
Pro- and mesotarsi of male lacking distinct palettes beneath; prosternal process not as above ------ *gagates*

AGABUS AERUGINOSUS **Aube**

Agabus aeruginosus Aubé, 1838, Species general des coleopteres. 6: 298.

Diagnosis: Length 7 to 7.9 mm. *A. aeruginosus* is very similar to *Agabus punctatus*, and both species have the inner hind tibial spur longer than the basal tarsal joint. In *A. aeruginosus* this spur is cylindrical and gradually tapers to a fine point. The aedeagus (fig. 5a) also differs from that of *A. punctatus*.

Range: This species is found from Massachusetts to Florida and westward in Illinois, Iowa, and Indiana.

Virginia Records: Nine specimens were taken from a single site in the Dismal Swamp (2 March 1974, A. G. Michael).

Habitat Preference: We collected this species from a marsh within the Dismal Swamp. The portion of the marsh which yielded the specimens was partially shaded, with emergent grass and pine needle litter. In Florida, Young (1954) collected it in flat woods, while in Indiana it occurred in upland ponds with *A. punctatus*.

AGABUS AMBIGUUS **Say**

Agabus ambiguus Say, 1823, Trans. Amer. Philos. Soc. 2:96.

Diagnosis: Length 8 to 8.3 mm. *A. ambiguus* and *A. erythopterus* are the only two Virginia *Agabus* with a piceous pronotum and brown elytra. The male claws of smaller size and unmodified (fig. 5c) in *A. ambiguus* readily separates it from *A. erythopterus.*

Range: This species occurs westward in Canada to Manitoba and South Dakota and, in the east, southward to Virginia.

Virginia Records: Recorded from the counties of Augusta, Bath, Frederick, Giles, Highland. Montgomery, and Wise. Specimens were collected from May to August.

Habitat Preference: The species apparently prefers the grassy margins of streams and ponds in upland situations, and it is often collected with *A. erythopterus.*

AGABUS ANTHRACINUS **Mannerheim**

Agabus anthracinus Mannerheim, 1852, Bull. Soc. Imp. Nat. Moscou. 25:304.

Diagnosis: Length 6.8 to 8 mm. The convex, sharply acuminate prosternal process and the long metasternal groove, in conjunction with the other key characters will differentiate this species from all other Virginia *Agabus.*

Range: *A. anthracinus* is a common northern species and occurs across the continent from Newfoundland to Alaska. In the east it descends, via the Appalachian range, into West Virginia.

Virginia Records We have not seen any Virginia specimens, however the presence of this species nearby in Tucker County, West Virginia (Dolly Sods, 4 May 1974, A. G. Michael) indicates its probable occurrence in Virginia.

Habitat Preference: We collected *A. anthracinus* from the grassy margins of beaver ponds.

Figure 5. The male anterior protarsal claws and aedeagi of A-B *Agabus aeruginosus,* C-D. *A. ambiguus,* E-F. *A. anthracinus,* G-H. *A. confusus,* I-J. *A. disintegratus,* K-L. *A. erythopterus,* M-N. *A. gagates,* O-P. *A. johannis.*

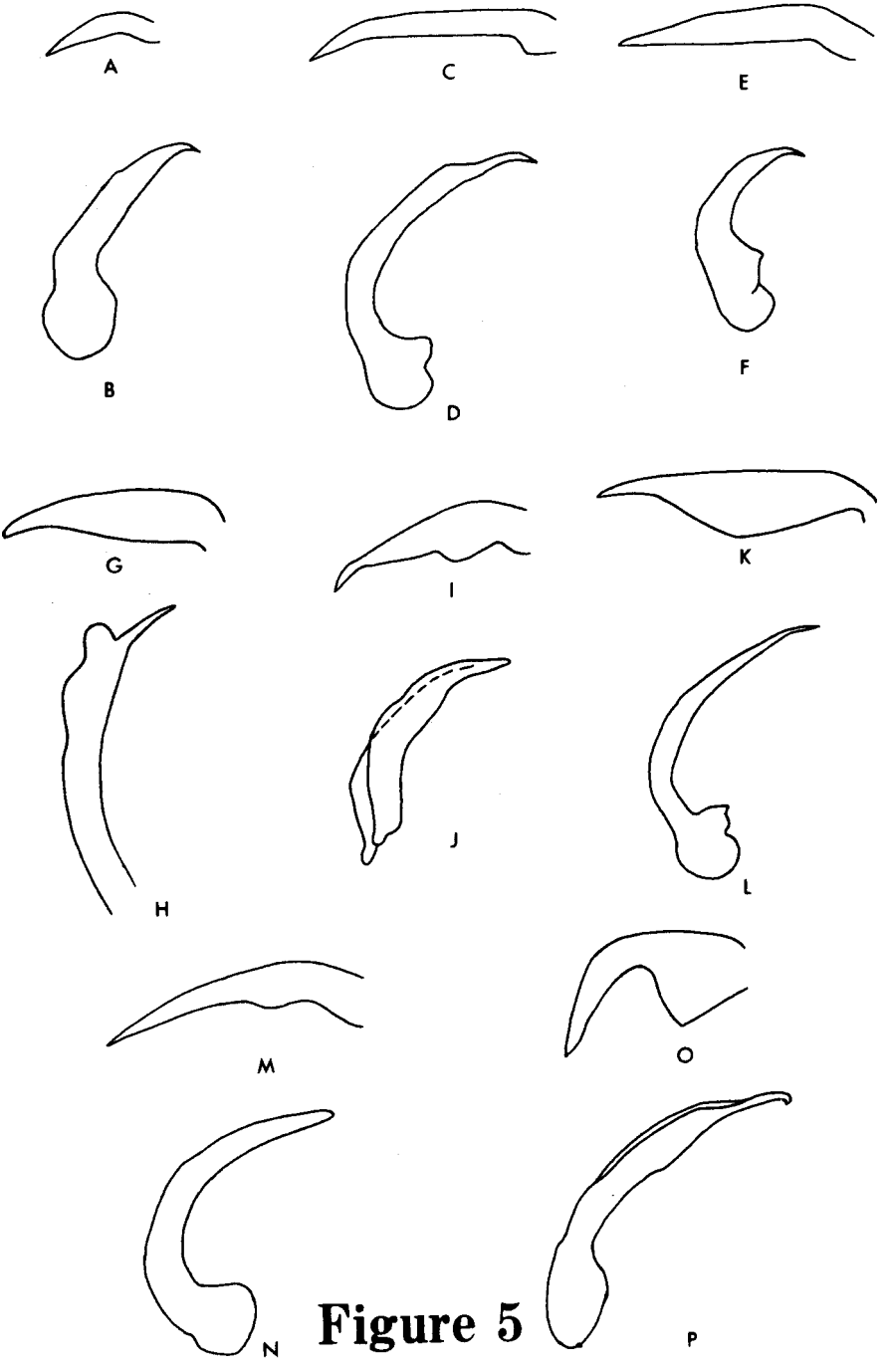

Figure 5

AGABUS CONFUSUS **(Blatchley)**

Rhantus confusus Blatchley, 1910, Coleoptera of Indiana. p. 229.

Diagnosis: Length 11.5 mm. This is the largest species of *Agabus* known and may be separated on the basis of its generic characters and size. The unique aedeagus (fig. 5H) makes its identification easy.

Range: *Agabus confusus* has been recorded from Wisconsin, Indiana, Kentucky, Arkansas, Illinois, and Missouri. It is not recorded from Virginia but may occur in the extreme southwest section of the state.

Habitat Preference: Hilsenhoff (1974) reports the habitat of both the larva and the adult as the grassy margins of fast moving streams. Adults have been collected in small intermittent streams in wooded areas of limestone and sandstone regions of Indiana and Kentucky (Kline, 1953) and in clean, cold streams and springs in Missouri (Spangler in Hilsenhoff, 1974).

AGABUS DISINTEGRATUS **Crotch**

Agabus disintegratus Crotch, 1873, Trans. Amer. Ent. Soc. 4:416.

Diagnosis: Length 7 to 7.8 mm. *A. disintegratus* is one of the three North American species which have yellow elytra with black stripes. The piceous metacoxal plate quickly separates it from the other striped eastern species, *A. taeniolatus*. The distinctly different male protarsal claw and aedeagus (figs. 5I and J) will aid in identifying teneral specimens.

Range: This wide ranging species is found from Massachusetts and Ontario to Washington, south into California in the west and south to South Carolina in the east.

Virginia Records: The counties of Giles, Montgomery, New Kent, and Stafford and the cities of Norfolk and City of Virginia Beach. Collections range from April to December.

Habitat Preference: This species apparently prefers open pools and ponds of a permanent nature with at least some marginal vegetation.

AGABUS ERYTHOPTERUS Say

Agabus erythopterus Say, 1823, Trans. Amer. Philos. Soc. 2:95.

Diagnosis: Length 8.5 to 9.5 mm. The brown elytral color, the large size and the unique leaflike male protarsal claws (fig. 5K) characterize this species.

Range: *A. erythopterus* ranges from Nova Scotia south to Virginia and westward to Lake Superior.

Virginia Records: Collected from the counties of Albemarle (UMMZ), Bath, Essex, Giles, Gloucester, Highland, Madison, Nelson and Page. Specimens were collected from May to September.

Habitat Preference: The primary habitat is probably stream margins, but frequently it is encountered in beaver-dam ponds.

AGABUS GAGATES Aube

Agabus gagates Aubé, 1838, Species general des coleopteres. 6:306.

Diagnosis: Length 8 to 9.2 mm. *A. gagates* is the most commonly encountered species of *Agabus* in Virginia and most typifies the genus in shape and form. The prosternal process is moderately convex, the lower face of the hind tibia has a row of punctures along the inner margin and the pro- and mesotarsi are without distinct palettes. The male protarsal claw and aedeagus (figs. 5M and N) will also aid in the identification of this species.

Range: New England to North Carolina.

Virginia Records: Widely distributed throughout the state; recorded from the Dismal Swamp and the counties of Bath, Craig, Essex, Fairfax, Giles, Highland, King George, Shenandoah, Stafford, and Wise and the City of Chesapeake. Collections range from May to October.

Habitat Preference: This species is most commonly found in woodland pools. It also inhabits beaver ponds, flooded pastures and stream margins.

AGABUS JOHANNIS Fall

Agabus johannis Fall, 1922, A Review of North American *Agabus*. p. 10.

Diagnosis: Length 8.5 to 9 mm. The large, angulate basal lobe of the male protarsal claw (fig. 5O) immediately identifies this species. The male aedeagus (fig. 5P) which resembles an elongated bird's head with a slightly hooked tip, is also distinctive of *A. johannis*.

Range: This species was previously known only from Florida and southern Georgia, however, two specimens, a male and female, in the USNM collection are labeled "Newton Grove, N. C. Apr. 15, '44, roadside ditch."

Virginia Records: No Virginia specimens have been collected to date. However, if the North Carolina specimens are correctly labeled, more intensive collecting of preferred habitats may reveal the presence of *A. johannis* in Virginia.

Habitat Preference: In Florida, Young (1954) most often encountered this species in running water and in distinctly lotic uplands situations. The North Carolina material was collected in a roadside ditch.

AGABUS OBTUSATUS Say

Agabus obtusatus Say, 1823, Trans. Amer. Philos. Soc. 2:99.

Diagnosis: Length 7.3 to 8 mm. *A. obtusatus* is very similar to *A. planatus*, the only other North American species with both apical and postmedian sublateral yellow elytral spots. The two species may be separated by the width of the pronotal margin, male protarsal claw and aedeagus (figs. 6A and B).

Range: This species may be found from Canada through the New England states south to North Carolina (Brimley, 1938) and west to Iowa and Lake Superior.

Figure 6. The male anterior protarsal claws and aedeagi of A-B. *Agabus obtusatus*, C-D. *A. planatus* E-F. *A. punctatus*, G-H. *A. semivittatus*, I-J. *A. s. seriatus*, K-L. *A. stagninus*, M-N. *A. taeniolatus*.

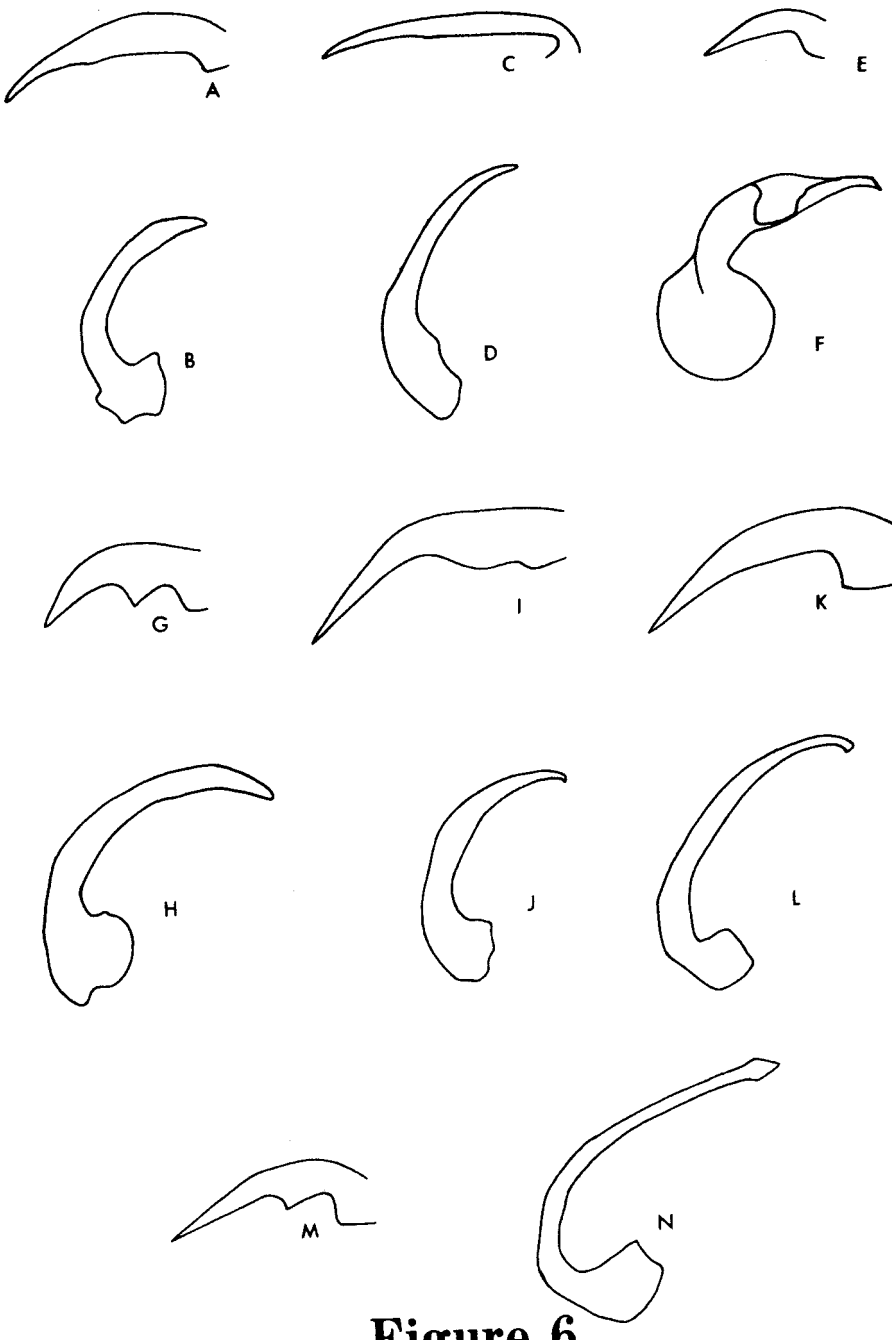

Figure 6

Virginia Records: The counties of Bath, Cambell, Fairfax, Floyd, Highland, Prince William and Wise. Specimens were collected from May to September.

Habitat Preference: *A. obtusatus* is an upland species. It has been collected from the grassy area at the margin of a beaver pond, a slow moving stream, the muddy backwash of a creek and from a drain pool beside a road. The authors also collected it in leaf litter in a deeply shaded portion of an old reservoir, a habitat which was similar to a woodland pool.

AGABUS PLANATUS Sharp

Agabus planatus Sharp, 1882, Sci. Trans. Roy. Dublin Soc. 2:503.

Diagnosis: Length 7.5 to 8.5 mm. *A. planatus* is larger than *A. obtusatus* and the pronotum is noticeably more broadly margined. The male claw and aedeagus (figs. 6C and D) are markedly different in both species and further serve to separate them.

Range: This species was known to Fall (1922) only from Staten Island, New York and Marion, Massachusetts, and he believed it to be of extremely local distribution. It is presently recorded from Massachusetts to Maryland and appears to be confined to the coastal plain.

Virginia Records: Specimens from Virginia have yet to be collected. The single male specimen (Baltimore Co., Md., 25 June 1940) in the USNM collection indicates its possible occurrence in Virginia.

Habitat Preference: Fall (1922) collected his material from nearly dried brook beds. A single specimen was collected from Taunton, Massachusetts by A. G. Michael in an exposed area of a small stream bed.

AGABUS PUNCTATUS Melsheimer

Agabus punctatus Melsheimer, 1844, Proc. Acad. Nat. Sci., Phila. 2:27.

Diagnosis: Length 7.0 to 7.2 mm. This is one of our two species where the inner apical spur of the hind tibia is longer than the basal tarsal segment. The spur differs from *A. aeruginosus* in that it is abruptly pointed, flattened ventrally and is noticeably striate. The distinctive aedeagus (fig. 6F), which strongly resembles a bird's head, immediately distinguishes this species.

Range: Massachusetts to Florida.

Virginia Records: The counties of Craig (3 April 1974, R. M. Clayton) (VPI&SU), Mecklenburg (16 June 1955) (VPI&SU). New Kent (13 October 1972, J. F. Matta), Stafford (USNM) and the City of Virginia Beach (20 November 1970, J. F. Matta).

Habitat Preference: This species has been collected from shallow, semi-permanent ponds.

AGABUS SEMIVITTATUS **LeConte**

Agabus semivittatus LeConte, 1851, Ann. Lyc. Nat. Hist., N. Y. 5: 204.

Diagnosis: Length 7.5 to 8.8 mm. *A. semivittatus* is one of our vittate species and has the minute elytral punctures occurring within the areolae of the reticulation. The antebasal tooth of the male anterior protarsal claw and the aedeagus (figs. 6G and H) will aid in identification.

Range: This species is widely dispersed in the interior region of the United States, occurring from Ontario to Ohio and Nebraska and south to Texas. Fall (1922) indicated that *A. semivittatus* does not attain either coastline. In Virginia it is found only in the Appalachian area.

Virginia Records: Counties of Augusta (21 July 1973, A. G. Michael), Frederick (9 June 1973, J. F. Matta), and Rockbridge (13 June 1973, J. F. Matta).

Habitat Preference: *A. semivittatus* was collected only in the grassy margins of small streams and sloughs, which are probably its preferred habitat.

AGABUS SERIATUS SERIATUS **(Say)**

Colymbetes seriatus Say, 1823, Trans. Amer. Philos. Soc. 2:97.

Diagnosis: Length 8 to 9.3 mm. The broad, moderately convex prosternal process, the presence of punctures along the inner margin of the hind tibia and the lack of elytral spots or vittae separate this subspecies from other Virginia *Agabus*. The male protarsal claw and aedeagus (figs. 6I and J) will also aid in the recognition of *A. s. seriatus*.

Range: Leech (1942) recognizes two subspecies of *A. seriatus*. The eastern subspecies *A. s. seriatus* ranges from Manitoba eastward to New England and southward to Virginia. The western subspecies *A. s. intersectus* occurs from Manitoba west to British Columbia and southward into California and New Mexico.

Virginia Records: A single teneral specimen in the USNM collection is labeled "U. of Va. Campus, X-10-1948, R. Selander". Fall (1922) also records this species from Washington, D. C.

Habitat Preference: This species was collected in Massachusetts and New York from a roadside pool and from the grassy margins of small streams.

AGABUS STAGNINUS **Say**

Agabus stagninus Say, 1823, Trans. Amer. Philos. Soc. 2:100.

Diagnosis: Length 9.2 to 10 mm. The strong rectangular basal lobe of the male protarsal claw (fig. 6K) in addition to the elytral sublateral yellow vitta readily distinguish this species.

Range: This species is restricted to the eastern coastal plain between New Jersey and North Carolina.

Virginia Records: Dismal Swamp (16 July 1970, J. F. Matta), City of Chesapeake (9 March 1971, W. C.) and City of Virginia Beach, several specimens collected in March, April, June, September and October.

Habitat Preference: The preferred habitat of *Agabus stagninus* is open marsh ponds of the coastal plain.

AGABUS TAENIOLATUS **(Harris)**

Colymbetes taeniolatus Harris, 1828, New England Farmer. 7:164.

Diagnosis: Length 7.5 to 8 mm. This species and *A. disintegratus* are the only eastern striped *Agabus*. It averages slightly larger than *A. disintegratus* and unlike it, the venter is uniformly reddish in color. The aedeagus and male claw (figs. 6M-N) offer further distinguishing characteristics.

Range: *A. taeniolatus* is strictly an eastern species, ranging from Massachusetts to Virginia.

Virginia Record: The only specimens recorded from Virginia have been collected in the city of Fredericksburg (30 March 1899, Wm. D. Richardson) (USNM) and Prince William Co. (0.4 miles east of the Junction of State Roads 619 and 234, 29 April 1975; R. M. Duffield).

Habitat Preference: In Massachusetts this species was collected from the grassy margins of large coastal ponds.

Genus *COLYMBETES* Clairville

This genus is a northern one with 10 species in North America. In California six species are recorded, while in the east there are three species with only one reaching as far south as Washington, D. C. This genus of large beetles, 15 to 19 mm in length, is characterized by the transverse parallel elytral grooves, a shallow pit in the metasternum to receive the prosternal process and an unmargined pronotum.

COLYMBETES SCULPTILIS Harris

Colymbetes sculptilis Harris, 1829, New England Farmer. 8:1.

Diagnosis: Length 16 mm. The numerous parallel transverse elytral grooves immediately identify this species.

Range: Primarily a northern species, it ranges from Canada westward to Nebraska and southward to Washington, D. C.

Virginia Record: *Colymbetes sculptilis* has not yet been recorded from Virginia, however, specimens in the USNM collection from the adjacent localities of Washington, D. C. and Maryland would indicate that the species is likely to be found in Virginia. The following citations were noted from the USNM specimens: Washington, D. C. electric light, 9 June 1903 and 30 June 1903, C. E. Burden; and Maryland, Baltimore, 500 Masters, 1 December 1941, in a pond.

Habitat Preference: The authors have collected *C. sculptilis* in New Hampshire from a large pond with well established aquatic vegetation and algae. It has also been taken from a farm pond with only marginal vegetation. This species is also attracted to light.

Genus *COPELATUS* Erichson

This is primarily a southern genus, with one species ranging as far north as Ontario and another to New Jersey. The elytral striae readily identify this genus in our fauna. The Copelatini are also characterized by the convergence of the hind coxal lines anteriorly so as to almost touch the median line.

KEY TO THE SPECIES OF *COPELATUS* OF VIRGINIA *

1. Each elytron with a submarginal stria and with 10 discal striae; length not over 5 mm ---------- 2
   Each elytron with 8 distinct discal striae; length 6 to 7 mm ---------- *chevrolati chevrolati*

2. Base of elytra usually crossed by a distinct pale fascia contrasting with the ground color of pronotum and rest of elytra; male aedeagus strongly modified, resembling in lateral view a bird's head ---- *caelatipennis princeps*
   Dorsum usually uniformly colored, only rarely with a very vague fascia across base of elytra; male aedeagus simply curved ---------- 3

3. Elytra conspicuously punctate on intervals between striae (when viewed under high magnification); aedeagus stout, not strongly curved ---------- *punctulatus*
   Elytra not conspicuously punctate on intervals between striae; aedeagus slender, strongly curved to the side ---------- *glyphicus*

COPELATUS CAELATIPENNIS PRINCEPS Young

Copelatus caelatipennis princeps Young, 1963, Quarterly J. Fla. Acad. Sci. 26:64.

Diagnosis: Length 3.9 to 5 mm. This subspecies could be confused with *Copelatus glyphicus* at first glance, however, the narrower body and pale fascia at the base of the elytra are distinctive. Both sexes have scratch-like impressions distributed over the pronotum, and the male aedeagus resembles a bird's head.

* Modified from Young (1963).

Range: The Atlantic and Gulf coastal plains from New Jersey south to the Bahama Islands and west perhaps to Texas.

Virginia Records: Dismal Swamp (30 July 1970, J. F. Matta), Lancaster County (14 October 1973, A. G. Michael), city of Norfolk (2 July 1970, J. F. Matta) and the City of Virginia Beach (15 July 1973, Matta).

Habitat Preference: Young (1963) assigned the subspecific name *princeps* to denote its pioneer role of inhabiting newly formed ditches, ponds and pools. It is also found in more permanent situations usually of clear, unpolluted water. In the Dismal Swamp it occurs in shallow, clear water pools with aquatic vegetation, (Matta, 1973).

COPELATUS CHEVROLATI CHEVROLATI **Aube**

Copelatus chevrolati Aubé, 1838, Species general des coleopteres. 6: 389.

Diagnosis: Length 6 to 7 mm. The larger size and the presence of only 8 discal striae on the elytra readily separate this subspecies from our other species of *Copelatus.*

Range: This species occurs in the Atlantic and Gulf coastal plain area and the Bahamas. Young (1963) states that it is the most common and most widely distributed of the Nearctic species. Virginia is perhaps its northern limit.

Virginia Records: City of Virginia Beach, (31 August 1972, 23 September 1972, 14 October 1972, J. F. Matta).

Habitat Preference: This species also belongs to a pioneer group but may be found in more permanent habitats. Our specimens were collected in a small detritus filled semi-permanent rain pool in the Back Bay National Wildlife Refuge.

COPELATUS GLYPHICUS **(Say)**

Colymbetes glyphicus Say, 1823, Trans. Amer. Philos. Soc. 2:99.

Diagnosis: Length 4.2 to 5 mm. This species is broader in form and slightly larger than *C. c. princeps.* Some specimens show a very vague incomplete basal prontal fascia which is more evident medially.

Range: Southern Canada to Minnesota, south from New England to northern Florida and west to Texas.

Virginia Records: Dismal Swamp, counties of Augusta, Caroline, Carroll, Culpeper, Frederick, Halifax, Hanover, Nelson, Shenandoah, Smyth, Stafford, Warren and Wise, and the City of Chesapeake and City of Virginia Beach. Collections range from 12 February to 31 December.

Habitat Preference: This is the most prevalent species of *Copelatus* in Virginia. Young (1963) states that this species is associated with flocculent debris in seepage areas. In the locales in which it was collected the habitats were of three types: woodland pools, generally with much leaf litter, and detritus, and open flooded meadows and heavy grass margins of streams and ponds.

COPELATUS PUNCTULATUS Aube

Copelatus punctulatus Aubé, 1838, Species general des coleopteres. 6:381.

Diagnosis: Length 4.3 to 5 mm. The shape of the male aedeagus and the distinct interstrial punctures, when viewed under high magnification, should easily distinguish this species from *C. glyphicus*.

Range: Alabama, Florida, Georgia, and New Jersey.

Virginia Records: The occurrence of *Copelatus punctulatus* in states north and south of Virginia indicates that it should occur in Virginia. Its apparent rarity here may be due to insufficient collecting in appropriate habitats.

Habitat Preference: This species is associated with seepage areas in deciduous woodlands, a habitat it shares with *C. glyphicus*.

Genus *COPTOTOMUS* Say

The genus may be recognized by the notched tip of the compressed labial and maxillary palpi, the carinate prosternum, and the equal hind tarsal claws that are pressed close together and appear as one. The coptotomids are strongly convex beetles, oblong-ovate in form and with variegated elytra. The species are restricted to the western United States, with a single species occurring in the east.

COPTOTOMUS INTERROGATUS INTERROGATUS **(Fabricius)**

Dytiscus interrogatus Fabricius, 1801, Syst. eleuth. 1:267.

Diagnosis: Length 6.2 to 7.7 mm. The typical northern subspecies occurs in Virginia and is larger than the southern subspecies, *C. interrogatus obscurus,* which is found in the Florida flatwoods habitat. The dark brown dorsum, with yellow markings laterally, and the two distinct short yellow streaks which parallel the elytral suture for a short distance, distinguish this species from our other Dytiscidae.

Range: Massachusetts to Florida and westward, at least to Indiana.

Virginia Records: Dismal Swamp, counties of Albemarle, Augusta, Essex, Frederick, Gloucester, Henrico, Lancaster, Middlesex, Nelson, Stafford, Warren, and Westmoreland, and the cities of Chesapeake and Norfolk. Specimens were collected from February to October.

Habitat Preference: In the Dismal Swamp it occurs both in large woodland pools and ditches having slow water flow. In other localities its principal habitat is in muddy, grassy areas adjacent to lakes, streams, and ponds.

Genus *HOPERIUS* Fall

This is a monotypic genus of some rarity in collections. It was described by Fall (1927a) and its bionomics have recently been studied by Spangler (1973).

HOPERIUS PLANATUS **Fall**

Hoperius planatus Fall, 1927a, J. New York Ent. Soc. 35:177.

Diagnosis: Length 12 to 16 mm. This is one of the largest species of Colymbetinae in the United States. The prosternal process is flat and the pronotum widely margined laterally. The elytral reticulation resembles alligator skin.

Range: Collected in isolated areas, ranging south from Maryland to South Carolina and west to Alabama and Arkansas.

Virginia Records: Two sites in the Dismal Swamp yielded seven specimens in June, July, and September. One specimen was col-

lected in the city of Norfolk (1 April 1970, D. Crandall). In the Stumpy Lake region of the City of Chesapeake, 11 specimens were collected in March, April, June, and November.

Habitat Preference: This is strictly a woodland pool species.

Genus *ILYBIUS* Erichson

Members of this genus and the genus *Agabus* are similar in appearance and, inasmuch as they are often collected together, they may be easily confused without close examination. Both genera have a group of cilia on the posterior apical angle of the hind femora, thus separating them from our other genera. The noticeably unequal hind tarsal claws characteristically separate *Ilybius* from *Agabus*. The species of *Ilybius* are further distinguished by the more convex form, the uniform black coloration and the whitish yellow lateral vittae and apical spots of the elytra. Wallis (1939b) published a key to males and females of North American species north of Mexico.

KEY TO THE SPECIES OF *ILYBIUS* OF VIRGINIA

1. Distance between hind coxal plates and middle coxae less than 1/5 the length of a coxal plate (fig. 7A) ------ *oblitus*
   Distance between hind coxal plates and middle coxae more than ¼ the length of a coxal plate (fig. 7B) ---- *biguttulus*

ILYBIUS BIGUTTULUS (Germar)

Dytiscus biguttulus Germar, 1824, Ins. sp. nov. p. 29.

Diagnosis: Length 9.5 to 10 mm. In addition to the character in the key which should be sufficient to separate this species from *Ilybius oblitus*, the only other Virginia species, the last ventral sternum in the male is acutely carinate.

Range: Fall (1927b) regarded the *Ilybius* to be essentially a northern genus, with *I. biguttulus* the only eastern species ranging as far south as Virginia. Its range, as it now stands, extends from South Carolina north to Canada and west to Illinois. It has also been collected in Tucker County, W. Va.

Virginia Records: Counties of Augusta, Bath, Essex, Frederick, Giles, Hanover, Highland, King George, Lancaster, Louisa, Nelson,

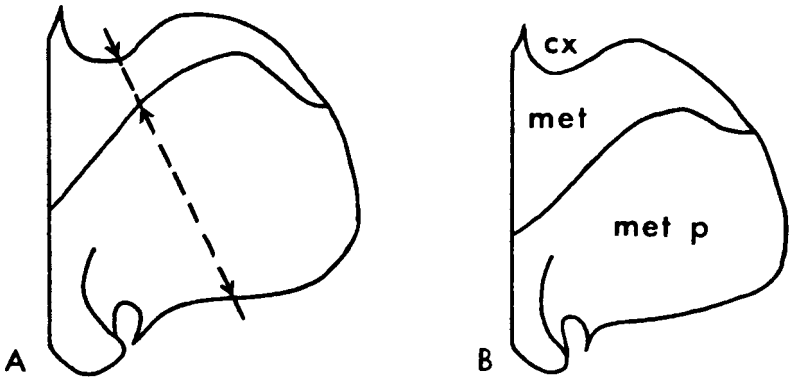

Figure 7. Comparison of the width of the metasternum to the width of the metacoxal plates, the measurements taken along the dotted line. A. *Ilybius oblitus;* B. *I. biguttulus.*

Pittsylvania, Richmond, Tazewell, Westmoreland, and Wise. Specimens were collected from May to October.

Habitat Preference: This species is often collected with *Agabus,* generally in shallow grassy margins of streams or in leaf litter at the margins of mill ponds and beaver ponds.

ILYBIUS OBLITUS Sharp

Ilybius oblitus Sharp, 1882, Sci. Trans. Roy. Dublin Soc. 2:560.

Diagnosis: Length 9.5 to 10 mm. *I. oblitus* closely resembles *I. biguttulus,* both in size and markings. The carina of the last abdominal sternum in the male is very short and visible only obliquely. The character in the key should suffice for the separation of this species from *I. biguttulus.*

Range: Previous collection records indicated that *I. biguttulus* was the only eastern species of this principally northern genus to occur as far south as Virginia. As now defined, the range of *I. oblitus* is from Massachusetts to South Carolina.

Virginia Records: Counties of Dickenson (27 July 1974, A. G. Michael), James City (10 May 1973, A. G. Michael) and Loudoun (31 May 1970, black light, W. A. Allen) (VPI&SU) and the City of Virginia Beach, where a roadside pool in the Back Bay National Wildlife Refuge has yielded a number of specimens to several collectors in the months of June, July and October.

Habitat Preference: Although collected in somewhat similar habitats as *I. biguttulus,* this species seems to prefer ponds or pools without detritus or leaf litter.

Genus *MATUS* Aube

Leech (1941) revised the genus, recording two species in North America. Young (1953b) described two new species to bring the total to four North American species, two of which occur in Virginia. The genus is characterized by the distinctive flat, sulcate prosternal process, elongately oval body form and brownish red color.

KEY TO THE SPECIES OF *MATUS* OF VIRGINIA

1. Body form elongate oval, attenuate behind; metacoxal plates polished, not microreticulate, sparsely punctate; male aedeagus resembles a bird's head with the beak straight ---------- *bicarinatus*

   Body form strongly ovate, less attenuate behind; metacoxal plates microreticulate, coarsely and closely punctate; male aedeagus with beak bent at tip ---- *ovatus ovatus*

MATUS BICARINATUS (Say)

Colymbetes bicarinatus Say, 1823, Trans. Am. Philos. Soc. 2:98.

Diagnosis: Length 8 to 8.8 mm. The sparsely punctate, nonreticulate metacoxal plates and the aedeagus, which resembles a bird's head with a straight beak, separate this species from *Matus o. ovatus.*

Range: Massachusetts to Texas.

Virginia Records: Counties of Essex (24 July 1973, A. G. Michael) and King George (13 October 1973, A. G. Michael).

Habitat Preference: In Essex County, this species was collected from a stream which had a coarse sandy bottom and saw grass along its margin. In King George County, it was collected in the margins of a man-made lake which had loamy soil, pine needle litter, and the emergent aquatic lizards tail (*Saururus cernuus*).

MATUS OVATUS OVATUS **Leech**

Matus ovatus Leech, 1941, Can. Ent. 73:79.

Diagnosis: Length 7.5 to 9.4 mm. The metacoxal plates are densely punctate and microreticulate and the aedeagus is distinctly bent at the tip.

Range: This subspecies occurs from Quebec south to Virginia and westward to Ontario and Illinois.

Virginia Records: City of Virginia Beach (5 March 1971, J. F. Matta). Alleghany Co., pond near Griffith, May-June 1952, R. L. Hoffman (in UMMZ).

Habitat Preference: This subspecies is found in open woodland pools.

Genus *RHANTUS* Dejean

Members of this genus are widely distributed in North America. Two of the 13 North American species occur in Virginia, with all the other species occurring to the north and west. The moderate size (10-14 mm) and flattened body form should separate *Rhantus* from most Dytiscidae. The triangularly split metasternum and the convex prosternal process should distinguish this genus from closely allied genera.

KEY TO THE SPECIES OF *RHANTUS* OF VIRGINIA

1. Pronotum with two dark spots; mesotarsal claws of male unequal ---------- *binotatus*
   Pronotum without spots; mesotarsal claws of male equal - *calidus*

RHANTUS BINOTATUS **(Harris)**

Colymbetes binotatus Harris, 1828, New England Farmer. 7:164.

Diagnosis: Length 10 to 12 mm. The smaller size, unequal mesotarsal claws in the male, and the bimaculate pronotum readily distinguish this species.

Range: Alaska, Washington, and Canada south to Virginia and West Virginia in the east and south to Kansas, New Mexico and Texas in the west.

Virginia Records: Counties of Bath (10 June 1973, J. F. Matta), Frederick (21 July 1973, A. G. Michael), and Smyth (6 August 1972, J. F. Matta).

Habitat Preference: *R. binotatus* is an upland species. In Bath County, and Tucker County, West Virginia, specimens were taken in beaverdam ponds. In Frederick County, Virginia, it was collected in a shallow, stream-fed pond with dense vegetation. In Smyth County, Virignia, it occurred in a tire rut in a meadow.

RHANTUS CALIDUS **(Fabricius)**

Dytiscus calidus Fabricius, 1792, Ent. Syst. 1:193.

Diagnosis: Length 11.5 to 14 mm. This is one of the larger Virginia Colymbetinae. Its convex prosternal process and narrower form should separate it from *Hoperius planatus*, which it closely resembles at first glance.

Range: New Jersey to Florida and through the West Indies to Mexico and Brazil.

Virginia Records: Dismal Swamp, counties of Fairfax (Zimmerman & Smith, 1975), Lancaster, Nelson (Zimmerman & Smith, 1975), Spotsylvania (Zimmerman & Smith, 1975), Stafford, and Wise and the cities of Fredericksburg (Zimerman & Smith, 1975), Norfolk, and City of Virginia Beach. Specimens were collected June to October.

Habitat Preference: *R. calidus* shows some preference for swamps and similar situations, though it occurs in a variety of habitats. Such areas would include woodland pools, open grassy marshes, ponds, and isolated muddy pools at stream margins.

Genus *DYTISCUS* Linnaeus

The largest aquatic beetles belong to this genus, and it includes 13 species which are generally distributed throughout the United States. The lack of golden cilia on the posterior margin of the hind tarsi is distinctive of the genus. Other characters which are useful in separating *Dytiscus* from *Cybister* — the only other Virginia dytiscid of comparable size — are the undilated inferior hind

tibial spur and the round adhesion disc of the male Dytiscus as opposed to the dilated spur and oval adhesion disc in *Cybister*. The females of one Virginia species have sulcate elytra.

KEY TO THE SPECIES OF *DYTISCUS* OF VIRGINIA *

1. Size large, length over 30 mm ---------- *verticalis*
   Size smaller, length under 30 mm ---------- 2

2. Dilated mesotarsal joints of male interrupted by a median longitudinal furrow; females not sulcate ---------- *hybridus*
   Mesotarsal joints not as above; females always sulcate ---------- *fasciventris*

DYTISCUS FASCIVENTRIS Say

Dytiscus fasciventris Say, 1824, Appendix 2:270.

Diagnosis: Length 25 to 28 mm. The females are always sulcate and the mesotarsal male adhesion discs are uninterrupted by a median furrow.

Range: Canada south to Virginia, west to Indiana and Michigan.

Virginia Records: Dismal Swamp (1 May 1957, R. H. R.), (30 September 1972, Hulse), (22 September 1973, O'Hop), counties of Gloucester (13 October 1973, A. G. Michael), King George (24 July 1973, A. G. Michael), and Lancaster (14 October 1973, A. G. Michael).

Habitat Preference: *Dytiscus fasciventris* is found in the coastal plain in Virginia. Aquatic situations with a build up of leaf litter along a muddy margin appear to be the preferred habitat. Specimens have been taken in a woodland pool, mill pond, the shallow margin of a lake, stream margin and a ditch.

DYTISCUS HYBRIDUS Aube

Dytiscus hybridus Aubé, 1838, Species general des coleopteres. 6: 116.

Diagnosis: Length 26 to 28 mm. The non-sulcate females and the longitudinal bare space of the male mesotarsi separate this species from *D. fasciventris*.

* Modified from Wallis (1950).

Range: Maine to North Carolina, west to Alberta, Canada, Kansas, and Indiana.

Virginia Records: Fairfax County, Ash Grove (1926. J. D. Sherman) (USNM) and the city of Fredericksburg (2 April 1890, 13 March 1892, 13 November 1892, Wm. D. Richardson) (USNM).

Habitat Preference: Ponds and woodland pools with leaf litter.

DYTISCUS VERTICALIS **Say**

Dytiscus verticalis Say, 1823, Trans. Amer. Phil. Soc. 2:92.

Diagnosis: Length 32 to 35 mm. This is the largest dytiscid found in Virginia and is among the largest found in North America.

Range: Maine to Virginia and west to Indiana and Michigan.

Virginia Records: Highland County, Locust Springs (3 May 1974, A. G. Michael, G. Corbett, D. Laist), and the city of Fredericksburg 27 April 1908, Wm. D. Richardson) (USNM).

Habitat Preference: The three specimens in the ODU collection were taken at the grassy margin of a beaver pond with a sandy bottom.

Genus *CYBISTER* Curtis

The species of *Cybister* are large beetles, 26 to 33 mm in length, characterized by the broadly dilated inferior hind tibial spur and the oval male adhesion disc (the modified basal tarsal segments on the proleg). Both of our subspecies are margined laterally by a yellow stripe running from the pronotum nearly to the end of the elytra.

KEY TO THE SUBSPECIES OF *CYBISTER* OF VIRGINIA *

1. Length 28 to 33 mm; male stridulating plate (in the depression just anterior to the hind coxae) usually with four distinct ridges; females with dense sexual sculpture of short ridges on pronotum and sometimes continuing to elytral suture; marginal yellow stripe of pronotum and elytra relatively broader, usually not very markedly separated from the margin posteriorly; occurring west of the fall line ____ *fimbriolatus fimbriolatus*

* Modified from Young (1954).

Length 26 to 32 mm; male usually with only three distinct ridges on stridulating plate; sexual sculpture of female less dense or lacking; marginal yellow stripe narrower and leaving the margin posteriorly; occurring in the coastal plain ---------- *fimbriolatus crotchi*

CYBISTER FIMBRIOLATUS CROTCHI **Wilke**

Cybister crotchi Wilke, 1920, Arch. Naturgesch. 85:246.

Diagnosis: Length 26 to 32 mm. See the **Remarks** under *C. f. fimbriolatus.*

Range: Young (1953a) defined the range of *C. f. crotchi* to be from the Bahamas and Florida westward to Louisiana and the coastal regions of Georgia, north to perhaps southern Pennsylvania.

Virginia Records: Counties of James City and Stafford and the cities of Hampton, Norfolk, Portsmouth, City of Virginia Beach and City of Chesapeake.

Habitat Preference: Young (1954) states that *Cybister* prefers the deeper water of ponds, ditches and similar situations. Our largest collection, however, came from a shallow pool in the Back Bay National Wildlife Refuge. Specimens from James City County were collected in minnow traps from a large pond in about 2½ feet of water. A single larva was also taken in an open grassy marsh often flooded by a nearby stream.

CYBISTER FIMBRIOLATUS FIMBRIOLATUS **(Say)**

Dytiscus fimbriolatus Say, 1823, Trans. Amer. Philos. Soc. 2:91.

Diagnosis: Length 28 to 33 mm. See the **Remarks** below.

Range: As defined by Young (1953a) the range is from New York and Virginia to Illinois, Kansas, parts of Texas, east to Georgia and perhaps northwestern Florida.

Virginia Records: Albemarle County, Charlottesville (10 September 1969, M. Bobb) (VPI&SU), Goochland County (17 May 49, M. Bobb) (VPI&SU), and Warren County, fish culture station (larvae) (21 July 1973, A. G. Michael and J. F. Matta).

Habitat Preference: This subspecies occurs in the same habitats as *C. f. crotchi.*

Remarks: There is some difficulty in separating these two subspecies in Virginia, because their ranges overlap considerably within the state. The lack of sufficient specimens from the central and western areas of the state adds to the problem. Young (1953a) states, "It is possible that *crotchi* developed in Florida under conditions of relative isolation, and has only recently come back into contact with the range of typical *fimbriolatus* with which it hybridizes, but I am inclined to think that the two forms intergrade over a wide area in the Coastal Plain region."

The specimens in the Old Dominion University collection do not consistently exhibit all the characters for either subspecies presented by Young and are most likely hybrids of the two subspecies. Male specimens conform to the key characters in size and stridulatory ridges for *crotchi*; however, the female sculpture tends towards *fimbriolatus*. All our specimens have a greenish color which Young (1953a) had not observed in any specimens of *crotchi*.

It is not possible, with the limited material available, to resolve the problems of subspecific ranking in Virginia. Therefore, we have separated subspecies occurring in Virginia on the basis of distribution, where *crotchi* is the coastal plain subspecies and *fimbriolatus* is that found west of the fall line.

Genus *ACILIUS* Leach

The genus *Acilius* may be readily recognized by the dense punctation of the dorsal and particularly the ventral surface. The body is broadened and flattened in the posterior third, and the elytra usually have a subapical yellow fascia. Hilsenhoff (1975) has revised the northeastern North American species and Matta and Michael (1976) have described a new subspecies from the southeastern United States. Although these efforts have clarified some of the taxonomic problems of the genus, several western and southern species remain unidentified, and a more thorough revision of all the North American species is needed.

KEY TO THE SPECIES AND SUBSPECIES OF *ACILIUS* OF VIRGINIA

1. Length less than 12.5 mm; males without tufts of hairs on inner ventral margins of 3 basal mesotarsal segments; females without sulci and with a distinct M-mark on the dorsum of head ---------- *mediatus*

Length over 12.5 mm; males with tufts of golden hairs on inner ventral margin of 3 basal mesotarsal segments; females either with sulcate elytra or without M-mark on head ---------- 2

2. Pro- and mesotarsal claws of male unmodified; females with smooth or sulcate elytra, longest sulci extending only to basal one-fourth of elytra; 2nd abdominal sternum without pale lateral spots; metafemora piceous, lighter apically ---------- 3

Anterior pro- and mesotarsal claws of male distinctly longer and thicker than posterior claws; females always sulcate, longest sulci extending to basal one-seventh of elytra; 2nd abdominal sternum with pale lateral spots; metafemora testaceous, with basal infuscation -- *semisulcatus*

3. Coxal plates and metasternum with a reddish cast; abdomen reddish brown; postmedian pale fascia usually distinct; females sulcate or not ---------- *fraternus fraternus*

Coxal plates and metasternum piceous; abdomen piceous; the distal margin of each abdominal segment with a red-brown tinge; post median pale fascia usually indistinct; females never sulcate ---------- *fraternus dismalus*

ACILIUS FRATERNUS FRATERNUS (Harris)

Dytiscus fraternus Harris, 1828, New England Farmer. 7:156.

Diagnosis: Length 14 to 16 mm. This subspecies and *Acilius semisulcatus* are often confused. Characteristics which will separate *A. fraternus* are the lack of modification in the pro- and mesotarsal claws and genitalia in the male. Females of *A. f. fraternus* exhibit both sulcate and non-sulcate forms. The non-sulcate females are separated from the females of *A. mediatus* by larger size and by lacking a distinct M-mark on the head. They are best separated from *Acilius fraternus dismalus* by the reddish caste of the coxal plates and metasternum.

Range: Southern Ontario, Wisconsin, Michigan, and Iowa south to Virginia and west of the fall line in North Carolina, South Carolina, and Georgia.

Virginia Records: Counties of Fairfax, Fauquier, and Stafford. In addition, intergrades between this and the following subspecies

have been collected in the counties of Gloucester, Henrico, King George, Lancaster, and New Kent.

Habitat Preference: *A. f. fraternus* is most often collected in shaded ponds and pools having some leaf litter. Specimens have been taken from a mill pond, a shallow lake margin, and a small stream-side pool.

ACILIUS FRATERNUS DISMALUS Matta & Michael

Acilius fraternus dismalus Matta & Michael, 1976, Entomological News, 87:12.

Diagnosis: The characteristics discussed for *Acilius f. fraternus* will suffice for separating this subspecies from other species of *Acilius*. It is best separated from the typical subspecies by the piceous coxal plates and metasternum (no reddish caste). In addition, the females are never sulcate.

Range: Southeastern Virginia to North Carolina. Material described by Young (1954) from Florida is probably this subspecies.

Virginia Records: This subspecies has been collected many times from the Dismal Swamp and from the City of Chesapeake, and once from the City of Virginia Beach. Collection dates range from 2 March to 31 December.

Habitat Preference: The habitat of *dismalus* is identical to the habitat of the nominate subspecies. It is most often collected in shaded ponds and pools having some leaf litter.

Remarks: This subspecies has developed a broad zone of intergradation with *A. f. fraternus*. This zone of integradation consists of the eastern Virginia coastal plain north of Hampton Roads and south of Fredericksburg — with minor salients to the northeast into Maryland and New Jersey — and the area adjacent to the fall line in southeastern Virginia and the Carolinas. Specimens taken from this area may not be assignable to subspecies.

ACILIUS MEDIATUS (Say)

Dytiscus mediatus Say, 1823, Trans. Amer. Philos. Soc. 2:93.

Diagnosis: Length 10 to 12 mm. The smaller size, lack of tufts of hairs on the 3 basal segments of the male mesotarsi and the nonsulcate females separate this species from the other *Acilius*.

Range: North Carolina to Ontario, Wisconsin, Michigan, and Missouri.

Virginia Records: The Dismal Swamp, the cities of Richmond and the City of Chesapeake and the counties of Campbell, Culpeper, Giles, Gloucester, Highland, Stafford, and Wise. Specimens were collected from 28 March to 31 December.

Habitat Preference: This species is most frequently found in woodland pools, but has also been collected from beaver ponds in the western part of the state.

ACILIUS SEMISULCATUS Aube

Acilius semisulcatus Aubé, 1838, Species general des coleopteres. 6: 132.

Diagnosis: Length 13 to 17 mm. The modified male claws and the sulcations of the female elytra with the sulci extending to the basal 7th of the elytra separate this species from *A. fraternus*.

Range: According to Hilsenhoff (1975) this northern species ranges from Alaska and Alberta to New Brunswick and south to South Dakota, Iowa, Ohio, and New Jersey.

Virginia Records: Although no specimens are recorded from Virginia, Spangler (1973) recorded this species from Maryland, which indicates its possible occurrence at least in the northern portion of Virginia.

Habitat Preference: Specimens taken in New Hampshire, along with *Colymbetes sculptilis*, were collected from a large open pond with well established vegetation and algae.

Genus *GRAPHODERUS* Aube

A single species of this genus occurs in Virginia. The pronotum and head are uniformly brownish yellow in color, while the elytra, though appearing dark, upon closer examination proves to be yellow with anastomosing black speckles. The metafemora possess setae that are only half as long as the width of the femora. Wallis (1939a) discusses the genus and presents a key to North American species.

GRAPHODERUS LIBERUS (Say)

Dytiscus liberus Say, 1825, J. Acad. Nat. Sci. Phil. 5:160.

Diagnosis: Length 10 to 12 mm. The arcuate outer margin of the metasternal side wings and the short setae of the middle femora separate this species from other Virginia Hydaticinae.

Range: Ontario and Quebec to British Columbia, south to Florida.

Virginia Records: Highland County (5 May 1974, A. G. Michael, G. Corbett, J. F. Matta), the cities of Norfolk (9 July 1974) and the City of Virginia Beach (31 October 1970 and 5 March 1971, J. F. Matta).

Habitat Preference: This species is characteristic of woodland pools, although it was collected also in an open beaver pond in Highland County and an open pool at the Back Bay National Wildlife Refuge.

Genus *HYDATICUS* Leach

Hydaticus contains beetles of moderate size, with five species generally distributed throughout the United States. The genus is typical of the Hydaticinae and superficially resembles other genera in the subfamily. However, the acute apical metatibial spurs and the straight outer margin of the metasternal side wings will readily separate the genus.

HYDATICUS BIMARGINATUS (Say)

Dytiscus bimarginatus Say, 1834, Trans. Amer. Philos. Soc. 4:442.

Diagnosis: Length 11.5 to 12 mm. The sharply defined submarginal yellow elytral stripes and the reddish brown pronotum — in contrast with the piceous elytral coloration — should, in addition to the characters presented in the key, separate this from our other Dytiscidae.

Range: Virginia to Florida and Louisiana.

Virginia Records: Dismal Swamp, counties of Essex and Prince William and the cities of Portsmouth, City of Chesapeake, and City of Virginia Beach. Specimens were collected from May to October.

Habitat Preference: Young (1954) states that, in Florida, it is more abundant in upland than in flatwood situations. It also occurs in brackish water in the Florida Keys. In Virginia it is found in woodland pools and thickly vegetated areas of non-acid ditches, predominantly in the coastal plain.

Genus *THERMONECTUS* Dejean

McWilliams (1969), in an unpublished dissertation, discusses 13 species and subspecies of *Thermonectus* in North America. The majority of species are distributed throughout the southwestern United States and Mexico. In the eastern United States, three species occur; one is restricted to southern Florida, while the remaining two are generally distributed. The smooth dorsal and ventral surfaces separate the genus from the closely allied *Acilius*. In addition, females never have sulcate elytra, but do have sculpturing on the bases of the elytra.

KEY TO THE SPECIES OF *THERMONECTUS* OF VIRGINIA

1. Size 9.5 to 14.1 mm; elytra yellow with many black speckles and a preapical pale yellow fascia; venter bright orange in live specimens, dark in dead specimens with pale yellow-orange spots on abdominal sterna 3-5 ---- *ornaticollis*

   Size 8.1 to 11.6 mm; elytra black or dark brown with an irregular subbasal yellow fascia; venter black or brown, abdominal sterna 3-5 without spots ---------- *basillaris*

THERMONECTUS BASILLARIS (Harris)

Dytiscus basillaris Harris, 1829, New England Farmer. 8:1.

Diagnosis: Length 8.1 to 11.6 mm. *T. basillaris* is generally smaller and is not as broad as *Thermonectus ornaticollis*. The elytra are dark brown to black in color often with some yellow along the lateral margins and with a subbasal yellow fascia.

Range: Occurs from the Bahama Islands, eastern United States and southern Canada throughout the Great Plains, south along eastern Mexico to Guatemala.

Virginia Records: Dismal Swamp, the counties of Culpeper, Fairfax, Giles, Hanover, New Kent, Rockbridge, Spotsylvania, Westmore-

land, and Wise and the cities of Norfolk, City of Chesapeake, and City of Virginia Beach. Specimens were collected from March to December.

Habitat Preference: This species most commonly occurs in temporary ponds with clear water and no vegetation, according to McWilliams (1969). In Virginia it is quite common in woodland pools of the Dismal Swamp and the Stumpy Lake area of Chesapeake.

THERMONECTUS ORNATICOLLIS **(Aube)**

Acilius ornaticollis Aubé, 1838, Species general des coleopteres. 6: 140.

Diagnosis: Length 9.5 to 14.1 mm. *T. ornaticollis* is broader and flatter than *T. basillaris*. The elytra are yellow with black speckles and have a subapical fascia, which is also found in *Acilius*. Live specimens are readily recognized by the bright orange venter.

Range: This widely dispersed species occurs in the West Indies, the eastern United States westward to Arizona and South to Mexico.

Virginia Records: Fredericksburg, 26 July 1900, W. Richardson (USNM).

Habitat Preference: McWilliams (1969) indicates that this species is most commonly taken in semi-permanent, clear water ponds with grassy margins.

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