



The Entocytherid Ostracods  
of North Carolina

HORTON H. HOBBS, JR.  
and  
DANIEL J. PETERS

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## ABSTRACT

Hobbs, Horton H., Jr., and Daniel J. Peters. The Entocytherid Ostracods of North Carolina. *Smithsonian Contributions to Zoology*, number 247, 73 pages, 33 figures, 3 tables, 12 maps, 1977.—The entocytherid ostracods are obligate external symbionts of crayfishes, and in North Carolina comprise 31 species distributed among 13 genera. Except for five species that seem to be restricted to burrowing crayfishes, all infest more than one host species. Following a brief historical account of the studies of the species reported to occur in North Carolina are discussions of the topography and drainage systems of the State, entocytherid infestations and associates, hosts and the ostracods infesting them, zoogeographic and ecological distributions, life history, and taxonomic characteristics employed in recognizing the North Carolina entocytherid fauna. Keys to the genera and species introduce the annotated list containing synonymies, diagnoses of the genera and species, type-localities, ranges, hosts, and entocytherid associates. Illustrations and distribution maps are also provided for each species. A new genus, *Aphelocythere*, is proposed to receive a previously undescribed species, *A. acuta*. Five additional new species are included from the State: *Dactylocythere isabelae*, *D. peedeensis*, *Donnaldsoncythere leptodrilus*, *Entocythere costata*, and *Harpagocythere baileyi*. Nine of the 31 species occur in the Coastal Plain Province of the State, 19 in the Piedmont, and 17 in the Mountain Province. Fourteen species are restricted to the Atlantic slope, four to streams draining into the Gulf of Mexico, and 13 occur on both sides of the Appalachian Divide.

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# The Entocytherid Ostracods of North Carolina

*Horton H. Hobbs, Jr.,  
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## Introduction

The ostracods treated herein infest crayfishes on which they occur as obligate external symbionts. Although occasionally invading the branchial chambers of the hosts, they occur in greatest numbers on setiferous areas or in crevices on the exoskeleton. Insofar as is known, they do no harm to the crayfish, and, if their presence on the host is beneficial to it, such has not been demonstrated.

The entocytherid fauna of North Carolina comprises 31 species distributed among 13 genera. All of them are assigned to the nominate subfamily Entocytherinae, the members of which are restricted to Middle and North America and Cuba, and, except for one Mexican species (see below), all infest crayfishes of the families Astacidae and Cambaridae. Of the 27 native crayfishes occurring in the State, only four are not known to harbor entocytherids. With little doubt, a lack of adequate samples is responsible for our failing to report infestations on them.

In this study, we have attempted to compile all available information on the entocytherids occurring in the State, and, while collections are available from all parts of the latter, we have comparatively few records from the southeastern segment of the Tidewater region. Moreover, in all

probability, additional species will be found at lower elevations along the western slopes of the mountains.

As is evident in the treatment of the various species, except for their ranges, hosts, and a few ecological data, virtually nothing is known of the biology of any entocytherid occurring in the State.

A recent monographic review of the family, including summaries of what is known of the biology of the entocytherids, has been provided by Hart and Hart (1974). Inasmuch as this work includes complete synonymies for all except those species newly described here, we have limited our citations to the original description, synonyms, and references pertaining to North Carolina.

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#### Historical Account

The earliest record of the occurrence of an entocytherid ostracod in North Carolina is that of Allen (1933:119-120) who reported finding *Entocythere cambaria* Marshall (1903:117) on *Cambarus acuminatus* Faxon (1884:113) [= *C. (Puncticambarus)* sp. C] collected near Durham, and on *Cambarus blandingii* (Harlan, 1830:464) [= *Procambarus (O.) blandingii*] near Charlotte. Inasmuch as this ostracod has not subsequently been found in the State, and several species occur in the areas mentioned, it is not possible to determine what species Allen encountered in her studies.

Twenty-two years elapsed before Hobbs (1955) described two new species, *Entocythere daphnioides* [= *Dactylocythere daphnioides*] and *E. runki* [= *Dactylocythere runki*] from the New and Watauga basins, recording both, together with *E. humesi* Hoff (1943:282) [= *Donnaldsoncythere donnaldsonensis*], from Ashe, Avery, and Watauga counties, and *E. runki* also from the Little Tennessee Basin in Swain County.

Two additional species were reported to occur within the State by Hobbs and Walton (1961:381) who noted that their *Entocythere falcata* [= *Dactylocythere falcata*] was widespread in the Hiwassee Basin and *Entocythere hiwasseeensis* [= *Donnaldsoncythere donnaldsonensis*] was apparently limited to streams in "the upper reaches of the Nottely and Hiwassee rivers."

Crawford (1961:244), in describing *Entocythere chelomata* [= *Dactylocythere chelomata*], indicated that it had been found in Sugar Fork (Cullasaga River) northwest of Highlands, in Macon County, and in the Valley River at Andrews, Cherokee County. The current nomenclature of the family dates to Hart's revision (1962) in which seven of the 12 genera known from the State were recognized.

Three years later, Crawford (1965:149, 153) described *Ankylocythere ancyla* and *Entocythere dentata* from Greensboro, Guilford County, and noted that the former ranged northward to Albemarle County, Virginia, and southward to Richland County, South Carolina.

Hobbs (1967:6) recorded the presence of *Dactylocythere jeanae* in Greene County, and Ferguson (1968:501), summarizing the recently described freshwater ostracods in North America, referred to the two species described by Crawford in 1965. In the same year, Hobbs and Walton (1968:242, 250) reported the discovery of two previously undescribed species from the State: *Dactylocythere prinsi*, which occurs in the Savannah Basin in Jackson County, and *Litocythere lucileae* in the Catawba drainage system in Avery County. They also indicated that *Harpagocythere tertius* (in part = *H. baileyi*, see below) had been found in Jackson County (p. 247) along with unidentified specimens belonging to the genera *Uncinocythere* and *Dactylocythere*.

Hart and Hart (1971:111) described *Dactylocythere megadactylus* from Randolph County where it was associated with *Ankylocythere ancyla*, *An. telmoecia*, *Dactylocythere suteri*, and *Entocythere internotalus*. They also reported its occurrence in Rowan County with *An. ancyla* and *Dt. suteri*, and in Yadkin County with *An. ancyla* and *Donnaldsoncythere* sp.

In their monograph of the family Entocytheridae, Hart and Hart (1974) included 16 species from North Carolina as follows: *Ankylocythere ancyla* from Bladen, Chatham, Columbus, Orange, Randolph, Wilson, and Yadkin counties (1974:22); *An. hobbsi* from Alamance County (p. 28); *An. telmoecia* from Randolph County (p. 32); *Dactylocythere daphnioides* from Alleghany, Ashe, Avery, Transylvania, and Watauga counties (p. 56); *Dt. chelomata* from Cherokee and Macon counties (p. 53); *Dt. jeanae* from Greene County (p. 60); *Dt. megadacty-*



*lus* from Randolph, Rowan, and Yadkin counties (p. 64); *Dt. prinsi* from Jackson County (p. 66); *Dt. runki* from Alleghany, Ashe, Avery, Swain, and Watauga counties (p. 68); *Dt. suteri* from Chatham, Durham, Edgecombe, Orange, and Randolph counties (p. 73); *Donnaldsoncythere hiwasseensis* [= *Dn. donnaldsonensis*] from southwestern North Carolina (p. 79); *Entocythere dentata* from Guilford and Orange counties (p. 86); *E. internotalus* from Beaufort, Bladen, and Randolph counties (pp. 90–91); *Litocythere lucileae* from Avery County (p. 102); *Okriocythere cheia* (p. 104) from Edgecombe [i.e., Greene] County (p. 104), and *Uncinocythere zancla* from Alleghany, Durham, and Orange counties (p. 141). Two of these records are based upon erroneous determinations: as far as we know, neither *Ankylocythere hobbsi* nor *Uncinocythere zancla* occurs in North Carolina. We have examined the specimens that Hart and Hart (1974) reported and have identified them as *Ankylocythere ancyla* and *Uncinocythere simondsi*, respectively. Although no localities were mentioned by them in their treatments of the following individual species, they included North Carolina in plotting the ranges of *An. tiphophila* on plate 45, *Cymocythere clavata* on plate 47, *Dt. falcata* on plate 49, *Dt. striophylax* (two localities) on plate 48, and *Ornithocythere waltonae* on plate 53.

Thus by 1974, two-thirds of the presently known entocytherid fauna of the State had been reported.

### Topography and Drainage Basins

We are following Stuckey (1965) in recognizing three physiographic provinces in the State: Coastal Plain, Piedmont Plateau, and the Appalachian Mountains, the first consisting of two regions, the Tidewater and Inner Coastal Plain (Map 1). As pointed out by him, the Coastal Plain encompasses almost half of the State, extending from the ocean inland some 100 to 150 miles (160 to 240 km), attaining an altitude usually of no more than 400 feet (120 m).

According to Stuckey, the Tidewater Region averages no more than 20 feet [6 m] in elevation. In this low-lying area, there are many marshes and swamps, and, particularly in that part of the State south of the Neuse River, there are many lakes and ponds. Most of the streams are sluggish, fre-

quently coffee colored, and they usually support luxuriant growths of vegetation.

The Inner Coastal Plain ranges in elevation from "less than 50 feet [15 m]" to as much as 740 feet (230 m) along the fall line in Montgomery County, rising, on the average "a little more than one foot [0.3 m] per mile" (Stuckey and Steel, 1953:1). In general, in the north it is rolling and well drained, but south of Raleigh, the eastern half is much like the Tidewater, marked by swamps and lakes. The topography of the western part is rolling, particularly in the sand hill area in the southern part of the State. The streams, with a moderate to sluggish current, flow most often over sand or clay beds with abundant organic deposits, frequently supporting dense growths of both emergent and submergent plants. Many of the streams are coffee colored.

The Piedmont Province, including about two-fifths of the State, rises "at the rate of 3 or 4 feet per mile [0.9 to 1.2 m per 1.6 km]" (Stuckey and Steel, 1953:1) to elevations between 1500 and 2000 feet (450 and 600 m) along the edge of the Blue Ridge escarpment. A rolling topography is characteristic of the Piedmont, and "where the streams cross the ridges, their valleys are narrow and often steep sided" (Stuckey, 1965:19). Most of the streams flow with a swift to moderate current over rocky, sandy, or clay beds largely devoid of vascular plants.

The Appalachian Mountains, covering some 6000 square miles (15,500 sq. km), rise for the most part to elevations between 3000 and 4000 feet (910 and 1200 m) with a maximum of 6684 feet (2025 m). "The contour of the mountains is gentle, generally presenting smooth rounded outlines. Most of the rivers are well graded and cascades and waterfalls are only locally abundant in the region" (Stuckey, 1965:20). The streams in the Appalachian Mountains, originating in springs or seepage areas, vary from small brooks that cascade over rocky and sandy beds, to the larger, swiftly flowing creeks and rivers flowing over bedrock or beds littered with rocks. The water level in the streams frequently rises sharply after heavy rains, but having steep gradients, the streams quickly return to their usual level. Seldom are vascular plants present in the stream beds.

The Appalachian Divide (the Blue Ridge in North Carolina) traverses the western part of the State, and those streams originating on its western

slope drain about one-eighth of the State (Stuckey and Steel, 1953:3) and empty into the Gulf of Mexico. Those streams on the eastern side debouch into the Atlantic Ocean. All except one of the westward flowing streams are tributaries of the Tennessee River which flows southwestward into Alabama before turning westward and then to the north to join the Ohio River. The New River courses northeastward into Virginia before being diverted northwestward through the Allegheny Mountains. Flowing across the State of West Virginia, it also joins the Ohio River, but several hundred miles upstream from the mouth of the Tennessee River.

Among the streams on the Atlantic slope (Map 2) the Catawba (including the Broad), Pee Dee, and Roanoke originate in the mountains. The former is limited to the Mountain and Piedmont provinces in North Carolina, but the latter two drain parts of all four physiographic regions. Coursing between the Pee Dee and the Roanoke rivers are the Cape Fear, Neuse, and Pamlico, all originating in the Piedmont and flowing across the Inner Coastal Plain and Tidewater. Except for the Chowan River, the remaining streams are largely confined to the Tidewater, although some of the headwaters of the New (East) and White Oak lie in the lower part of the Inner Coastal Plain.

The ostracods occurring in these regions are indicated in Table 1.

#### Entocytherid Infestations and Associates

In North Carolina, as elsewhere, frequently more than one entocytherid infests the same host crayfish, and in this study the ostracods were, for the most part, obtained from collections of crayfishes in which all of the specimens collected in one locality were preserved in the same container. Thus, if two or three species of crayfishes were obtained at one station, we were unable to determine which of the ostracods retrieved from the container infested which host species. The only instances in which we can be certain that an entocytherid was associated with a particular host species are those in which collections contain only one species of crayfish. In Table 2, the associations indicated are based in part upon records of ostracods occurring in the same locality, perhaps infesting more than one

species of crayfish (open circles) rather than occurring on the same host species (solid circles).

In only a limited number of localities was a single species of ostracod found to infest a host species. This association occurred most frequently between *Ankylocythere tiphophila* and *Procambarus (O.) acutus acutus*, but inasmuch as this ostracod was found in company with *Ankylocythere ancyla* in other collections and with 12 additional entocytherids on other crayfishes, one may conjecture that environmental factors (those not directly related to the exoskeleton of the host) are probably responsible for the lone presence of *An. tiphophila* on this crayfish in certain localities.

According to our data, the ostracods sharing their hosts with the greatest number of entocytherid associates are *Donnaldsoncythere donnaldsonensis* and *Ankylocythere ancyla* (Table 3). The former has been found in company with 10 (possibly 18) other ostracod species; the corresponding number of associates for *An. ancyla* are 10 and 17.

No associates are recorded for *Lordocythere petersi* because our record of its presence in North Carolina is based on a sketch made by one of us (Hobbs) bearing no other data except "Hiwassee drainage system, North Carolina." The ostracods having the fewest number of associates are *Dactylocythere isabelae*, with one, and *Dactylocythere chelomata*, *Entocythere costata*, and *Ornithocythere waltonae*, each with two.

In part, the number of entocytherid associates is a reflection of both the ecological distribution and the size of the range of the ostracod. For example, the range of *An. ancyla* not only extends across all of the physiographic provinces in North Carolina (where it occurs in habitats ranging from mountain brooks to temporary pools in roadside ditches and crayfish burrows) but also encompasses most of the State. By contrast, in North Carolina *Ornithocythere waltonae* is restricted to the northern sector of the Tidewater region where it has been found in association with only *Dactylocythere jeanae* and *Okriocythere cheia*, infesting the burrowing crayfish *Cambarus (L.) diogenes diogenes*. Similarly, the mountain inhabiting *Ascetocythere cosmata* shares its only known host, the burrowing *Cambarus (J.) dubius*, with *Entocythere dentata*, *Uncinocythere simondsi*, and possibly *Litocythere lucileae*. Similarly, the mountain-stream dwelling *Dactylocythere chelomata* has been associated with



TABLE 2.—North Carolina entocytherid ostracods and their hosts (solid circles = known host-commensal relationships, open circles = occurrence in same locality; see "Entocytherid Infestations and Associates" for more detailed explanation)

ENTOCYATHERIDS	HOSTS																						
	<i>C. (C.) bartonii</i>	<i>C. (C.) sp. A</i>	<i>C. (D.) catagius</i>	<i>C. (D.) latimanus</i>	<i>C. (D.) reduncus</i>	<i>C. (D.) sp. B</i>	<i>C. (H.) chasmodactylus</i>	<i>C. (H.) longirostris</i>	<i>C. (H.) longulus</i>	<i>C. (J.) asperimanus</i>	<i>C. (J.) dubius</i>	<i>C. (J.) nodosus</i>	<i>C. (L.) d. diogenes</i>	<i>C. (P.) reburrus</i>	<i>C. (P.) robustus</i>	<i>C. (P.) sp. C</i>	<i>C. (P.) sp. D</i>	<i>F. (C.) uhleri</i>	<i>P. (O.) a. acutus</i>	<i>P. (O.) blandingii</i>	<i>P. (O.) medialis</i>	<i>P. (O.) pearsei</i>	<i>P. (O.) plumimanus</i>
<i>An. ancyla</i>	●	○	●	●	●			○					●			●		●	●	●		●	●
<i>An. telmoecea</i>				○	○												●	●					
<i>An. tiphophila</i>		○			○								●			○		●	●	●	○	○	○
<i>Ap. acuta</i>	○								●														
<i>As. cosmeta</i>									●	●													
<i>C. clavata</i>	○								●														
<i>Dt. chelomata</i>	●							○															
<i>Dt. daphnioides</i>	●						●	○	○	○				○	●	○							
<i>Dt. falcata</i>	●							○				○			○	○							
<i>Dt. isabelae</i>						●																	
<i>Dt. jeanae</i>												●						○	●				
<i>Dt. leptophylax</i>	●								○		●						○						
<i>Dt. megadactylus</i>	○	○	●	○				○	○					○		●		○					
<i>Dt. peedeensis</i>															●			○					
<i>Dt. prinsi</i>	○								○														
<i>Dt. runki</i>	●	○					●	○	○						●	●							
<i>Dt. striophylax</i>	●								○							●			●				
<i>Dt. suteri</i>	●	○	●	○				○	○			●			●	●		○					
<i>Dn. donnaldsonensis</i>	●	●		○		○	○	○	●	○			○	●	●				●				
<i>Dn. leptodrilus</i>	●			○				○							●			○					
<i>E. costata</i>																		●	●		○	○	
<i>E. dentata</i>			●	●	●					●					●								
<i>E. harrisi</i>	○	○	○										●			●			○				
<i>E. internotalus</i>			○										○			●		●	●		●	●	
<i>E. reddelli</i>	●															○							
<i>H. baileyi</i>	○								●														
<i>Li. lucileae</i>	○								●					○		○							
<i>Lo. petersi</i>											●												
<i>Ok. cheia</i>												●						?	?				
<i>Or. waltonae</i>												●						?	?				
<i>U. simondsi</i>	○	○					○		●	●	●			○	○	○							



only two possible hosts, *C. (C.) bartonii* and *C. (H.) longirostris*, sharing them with *Dactylocythere daphnioides* and *Donnaldsoncythere donnaldsonensis*.

Among our records, the greatest number of entocytherid species known to occur on a single host species in one locality is six. A collection of *Cambarus (P.)* sp. C made in a tributary of the Yadkin River (Pee Dee River Basin) 5 miles (8.1 km) northeast of Elkin on State Route 268, Surry County, served as hosts to *Dactylocythere daphnioides*, *Dt. megadactylus*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Entocythere harrisi*, and *Uncinocythere simondsi*.

As demonstrated by Walton and Hobbs (1971), in instances in which two or more ostracods infest a single host, different species of entocytherids tend to be concentrated in different areas of the exoskeleton of the crayfish. A study to determine the distribution of the ostracods on the hosts has not been made on any of the species occurring in North Carolina.

As has been pointed out previously (Hobbs, Holt, and Walton, 1967:7, and Hobbs III, 1968:40), there is little evidence of host specificity among the crayfish-ostracod associations. Among the entocytherids of North Carolina, only *Ascetocythere cosmeta* (on *C. (J.) dubius*), *Dactylocythere isabelae* (on *C. (D.)* sp. B), *Lordocythere petersi* (on *C. (J.) nodosus*), *Ornithocythere waltonae* (on *C. (L.) d. diogenes*), and possibly *Okriocythere cheia* (on *C. (L.) d. diogenes*) are restricted to single host species. Inasmuch as all of these hosts are largely confined to burrows and no other primary burrowing crayfishes (sensu Hobbs, 1942:20) occur within the ranges of these ostracods, it is possible, if not probable, that the associations are determined by the habitat rather than a specific host-commensal relationship.

### Hosts and Entocytherid Infestations<sup>1</sup>

TABLE 2

Of the 27 native crayfishes known to occur in North Carolina, all except four have been found to be infested with entocytherids in at least one locality. We have no ostracod-bearing specimens of *Cambarus (J.) carolinus* (Erichson, 1846:96), *Orco-*

*nectes virginiensis* Hobbs (1951:122), *Procambarus (O.) ancylus* Hobbs (1958:164), or *P. (O.) lepidodactylus* Hobbs (1947:25) from the state. The following crayfishes, all belonging to the Cambaridae, have been found to be infested with entocytherids (for bibliographic data and other information pertaining to the crayfish hosts, see Hobbs, 1969 and 1974, and Bouchard and Hobbs, 1976):

1. *Cambarus (Cambarus) bartonii* (Fabricius, 1798:407)
2. *Cambarus (Cambarus) sp. A*
3. *Cambarus (Depressicambarus) catagius* Hobbs and Perkins, 1967:141
4. *Cambarus (Depressicambarus) latimanus* (LeConte, 1856:402)
5. *Cambarus (Depressicambarus) reduncus* Hobbs, 1956a:61
6. *Cambarus (Depressicambarus) sp. B*
7. *Cambarus (Hiaticambarus) chasmodactylus* James, 1966:14
8. *Cambarus (Hiaticambarus) longirostris* Faxon, 1885:64<sup>2</sup>
9. *Cambarus (Hiaticambarus) longulus* Girard, 1852:90
10. *Cambarus (Jugicambarus) asperimanus* Faxon, 1914:391
11. *Cambarus (Jugicambarus) dubius* Faxon, 1884:114
12. *Cambarus (Jugicambarus) nodosus* Bouchard and Hobbs, 1976:8
13. *Cambarus (Lacunicambarus) diogenes diogenes* Girard, 1852:91
14. *Cambarus (Puncticambarus) reburrus* Prins, 1968:458
15. *Cambarus (Puncticambarus) robustus* Girard, 1852:90
16. *Cambarus (Puncticambarus) sp. C*
17. *Cambarus (Puncticambarus) sp. D*
18. *Fallicambarus (Creaserinus) uhleri* (Faxon, 1884:116)
19. *Procambarus (Ortmannicus) acutus acutus* (Girard, 1852:91)
20. *Procambarus (Ortmannicus) blandingii* (Harlan, 1830:464)
21. *Procambarus (Ortmannicus) medialis* Hobbs, 1975:10
22. *Procambarus (Ortmannicus) pearsei* (Creaser, 1934:1)
23. *Procambarus (Ortmannicus) plumimanus* Hobbs and Walton, 1958:8

The members of the genus *Cambarus* referred to as "sp. A, B, C" belong to species complexes which have not been analyzed adequately to permit specific identifications. That designated as *C. (Puncticambarus) sp. C* (one of the most common species occurring in the State) has been referred to repeatedly as *Cambarus (P.) acuminatus*, but as pointed out by Hobbs, "Although . . . [the range of this crayfish] is indicated to encompass an area extending from the Saluda River in South Carolina northward to Maryland, it is almost certain that two, and possibly three, distinct species are pres-

<sup>1</sup>The preceding section on "Entocytherid Infestations and Associates" should be consulted before reading the following paragraphs.

<sup>2</sup>Subsequent to the completion of this manuscript, Raymond W. Bouchard (1976:592) indicated that *Cambarus (Hiaticambarus) longirostris* Faxon is a junior synonym of *Cambarus (Hiaticambarus) girardianus* Faxon (1884:117).

ently assigned to *Cambarus acuminatus*" (1969:135). *Cambarus* (*Cambarus*) sp. A is a close ally or a variant of *C. (C.) bartonii*, and *Cambarus (Depressicambarus)* sp. B bears a similar relationship to *C. (D.) reduncus*. The description of *Cambarus (Puncticambarus)* sp. D has been completed by one of us (Hobbs) and will appear in a forthcoming review of the crayfishes of Georgia.

As may be noted above, the genus *Cambarus* is represented by 17 species distributed among six subgenera. Members of this genus occur throughout the State but are most abundant in the Mountain and Piedmont provinces and are rare in the Tidewater region. Only one (*Entocythere costata*) of the 31 entocytherids is not known to use a member of the genus *Cambarus* as a host.

A single member of the genus *Fallicambarus* occurs in the Tidewater, Inner Coastal Plain and Piedmont regions. Associated with it are only eight (possibly ten) entocytherids, six (possibly eight) of which also occur on *P. (O.) acutus acutus*. In North Carolina, no ostracod utilizes only *F. (C.) uhleri* as a host.

Five species of the genus *Procambarus*, all members of the subgenus *Ortmannicus*, have been reported from the State, and they are most abundant in the Tidewater and Inner Coastal Plain regions, occasionally invading the lower Piedmont. Except for *P. (O.) acutus acutus*, that serves as host to 11 (possibly 13) entocytherids, none of the others is infested with more than four ostracods, and *P. (O.) medialis* is suspected to harbor only one.

The crayfishes serving as hosts to the greatest number of entocytherid species are *C. (P.)* sp. C. and *C. (C.) bartonii*, the former with nine definitely associated symbionts and an additional seven suspected ones, and the latter with nine and 10, respectively.

To summarize, none of the entocytherids is limited to members of the genera *Fallicambarus* or *Procambarus*. In contrast, 17 of the 31 species occurring in North Carolina appear to be restricted to one or more members of the genus *Cambarus*.

#### Zoogeographic Considerations

Insofar as we are aware, the entocytherids of North Carolina are obligate commensals of crayfishes and are largely dependent upon their hosts for transporting them, especially from one drainage

basin to another. Thus, in the following discussion, a passive migration on the part of the ostracods is assumed. In crossing the Appalachian Divide, most, if not all, of the ostracods have been dependent upon migrations of hosts living in or around headwater streams, chiefly *Cambarus (C.) bartonii* and *C. (J.) asperimanus*. This inference is made in light of the fact that all except two of the entocytherids known to occur on both sides of the Divide have been found in collections containing the former; the remaining two infest the burrowing *C. (J.) dubius* which has been observed repeatedly to wander over land on humid evenings. (The association of *E. dentata* with the latter crayfish is assumed because it is the only host of this ostracod that has been found on both sides of the Divide.)

As may be observed in Table 1, among the entocytherids occurring within the State, *Ankylocythere ancyla* is the only one that has been found in all the physiographic areas recognized here, and only 15 are restricted to a single province. Of the latter, 10 occur only in the Mountain region: *Aphelocythere acuta*, *Ascetocythere cosmata*, *Cymocythere clavata*, *Dactylocythere chelomata*, *Dt. falcata*, *Dt. leptophylax*, *Dt. prinsi*, *Harpagocythere baileyi*, *Litocythere lucileae*, and *Lordocythere petersi*. Limited to the Piedmont Province are *Dt. isabelae*, *Dt. megadactylus*, *Dt. peedeensis*, and *Donnaldsoncythere leptodrilus*. None of the species is confined to the Inner Coastal Plain, and only one, *Ornithocythere waltonae*, is restricted to the Tidewater Region. Of the remaining species, five (*Ankylocythere telmoecea*, *An. tiphophila*, *Entocythere harrisi*, *E. internotalus*, and *Okriocythere cheia*) occur from the Piedmont through the Tidewater; seven (*Dactylocythere daphnioides*, *Dt. runki*, *Dt. striophylax*, *Donnaldsoncythere donnaldsonensis*, *Entocythere dentata*, *E. reddelli*, and *Uncinocythere simondsi*) range in the Mountain and Piedmont provinces; one (*Dactylocythere suteri*) is found in the Piedmont and Inner Coastal Plain; and two (*Dactylocythere jeanae* and *Entocythere costata*) inhabit the Inner Coastal Plain and Tidewater regions.

Only six of the North Carolina entocytherids are not known to occur beyond the State boundary: *Aphelocythere acuta*, *Dactylocythere isabelae*, *Dt. peedeensis*, *Dt. prinsi*, *Donnaldsoncythere leptodrilus*, and *Harpagocythere baileyi*. Almost certainly, when the faunas of the Savannah River basin in Georgia and South Carolina become better

known, *Ap. acuta*, *Dt. prinsi*, and *H. baileyi* will be found in one or both states. On the basis of our limited knowledge of the ranges of the other three, it seems likely that they are indeed endemic in North Carolina. *Dactylocythere isabelae* is known from a single locality in the Catawba Basin where it infests a burrowing crayfish, *Cambarus (Depressicambarus)* sp. B (a close relative of *C. (D.) reduncus*), a crayfish that has been found only in the vicinity of Conover, Catawba County. Probably slightly less restricted in its number of hosts, *Dt. peedeensis* is known to infest *Cambarus (Puncticambarus)* sp. C and perhaps *Procambarus (Ortmannicus) a. acutus* in the Piedmont sector of the Pee Dee Basin. Although utilizing perhaps as many as five hosts, *Donnaldsoncythere leptodrilus* also has a limited range in the Piedmont segments of the Catawba, Pee Dee, and Cape Fear drainage systems.

An examination of the distribution of the entocytherids in the two major watersheds in the State (Table 1) indicates that 13 species occur only in streams flowing into the Atlantic Ocean, four in those emptying into the Gulf of Mexico, and 14 have been found on both sides of the Appalachian Divide.

Although we are aware of the dangers fraught with suggesting directions of migrations across divides between drainage basins, we nevertheless suggest the following, hoping that with future analyses of comparable ranges in other aquatic organisms, generalizations of the migrations across the Appalachian Divide in North Carolina may be forthcoming. Of the 14 species that occur on both sides of the Divide, only one, *Ankylocythere ancyla*, can be assumed with any degree of certainty to have crossed it into the New River. Hobbs, Holt, and Walton (1967:35) reported the presence of this ostracod in headwater tributaries of the Roanoke River in Virginia, but they failed to find it in adjacent tributaries of the New. It is therefore probable that this species breached the Divide between Pee Dee and New river basins in the northwestern part of North Carolina. Perhaps *Entocythere dentata* paralleled *An. ancyla* in crossing the Divide from the Catawba into the New River watershed.

*Dactylocythere suteri*, *Cymocythere clavata*, and possibly *Dt. striophylax*, seem to have gained access to the Gulf Basin through the French Broad headwaters. Also, inasmuch as *H. georgiae* (Hobbs III,

1965), the only other species belonging to the genus *Harpagocythere*, occurs in the Atlantic Basin, the presence of *H. baileyi* in the French Broad and Savannah drainage systems suggests a migration from the latter watershed into the former.

Believed to have crossed the divide in the opposite direction (west to east) is *Dactylocythere daphnioides* which has gained access to the Catawba and Pee Dee drainages. There is no evidence as to which of several routes it might have taken. Indeed it is possible that it may have invaded the two eastern basins separately, or equally likely, it gained access to one and secondarily penetrated the other. Having no records of the occurrence of *Dt. runki* in the Pee Dee drainage system, it seems to have reached the Catawba Basin directly from the French Broad, Nolichucky, or Watauga systems. In view of the ranges of certain cyprinid fishes cited below, both perhaps utilized a path from the Nolichucky into the Catawba watershed.

*Ucinocythere simondsi*, which is widespread west of the Appalachian Divide, has not been reported from South Carolina or Virginia, and, east of the Divide in North Carolina, has not been found except in the Catawba, Pee Dee, Neuse, and Roanoke drainages. Although on the basis of the materials available to us from North Carolina this ostracod is known from more localities east of the Divide than west of it, we believe that this is the result of inadequate sampling of the lower tributaries of the westward flowing streams and that its presence along the Atlantic slope of the State represents an invasion from the west.

Because the only other known localities for *Entocythere reddelli* lie within the Gulf Basin, we suppose that its presence in the Catawba drainage of North Carolina represents a migration from the west.

Thus, in traversing the Appalachian Divide, there is evidence that five species have crossed it in westward migrations, four moved eastward, and the following four lend no obvious clues as to which direction was taken by them.

*Donnaldsoncythere donnaldsonensis* is one of the most widespread species of the family, occurring throughout much, if not all, of the Appalachians from Georgia to Maine, eastward into the Piedmont and even in the Tidewater of Virginia (see Peters, 1975:30—referred by him to *Dn. hiwasseensis*). West of the mountains, its range extends through



much of Tennessee and Kentucky into southern Indiana. In view of such a range, its route to North Carolina will perhaps always remain unknown.

The monotypic *Aphelocythere acuta*, one of the few species now known only from North Carolina, occurs in both the French Broad and Savannah drainage systems, and we have no evidence to indicate which of the two was first occupied by it.

The presence of *Ascetocythere cosmeta* and *Litocythere lucileae*, infesting crayfishes living at high altitudes in burrows and headwater streams on both sides of the Divide, reveals no evidence as to the direction taken in their traversing it. That they were carried by their hosts in both directions, and repeatedly, seems highly probable.

Dr. Edward F. Menhinick, of the University of North Carolina at Charlotte, who is preparing a synopsis of the fishes of North Carolina, has kindly provided us with a copy of his manuscript containing spot maps of the distribution of all of the species known to him. While we are aware of the possibility that the occurrence of at least some species on both sides of the Appalachian Divide has resulted from introductions by man, some could well have traversed it through piracy of headwater streams.

As might be anticipated, a number of fishes occur on both sides of the Divide, and we call attention to a few of the cyprinids which exhibit patterns of distribution similar to those of the entocytherids.

On the basis of Dr. Menhinick's maps, it appears to us that perhaps *Nocomis leptoccephalus* (Girard) and *Notropis chiliticus* (Cope) crossed the Divide from the Pee Dee to the New River as has been suggested for *Ankylocythere ancyla*. (It is perhaps equally likely that the fishes traversed the mountains between the Roanoke and the New.)

Several minnows, apparently widespread in the Gulf Basin of the State, appear to have gained a foothold in the Catawba (including the Broad) watershed from the Nolichucky headwaters. These include *Nocomis micropogon* (Cope), *Notropis spectrunculus* (Cope), *N. coccigenis* (Cope), *N. galacturus* (Cope), *N. telescopus* (Cope), and *Rhinichthys cataractae* (Valenciennes). A similar route was suggested for the ostracods, *Dactylocythere daphnioides* and *Dt. runki*. The former also may have gained access to the Pee Dee from the New River as perhaps did *Rhinichthys atratulus* (Hermann).

Sharing the French Broad and Savannah basins

are two members of the genus *Notropis*: *N. galacturus* and *N. spectrunculus*. Restricted to the same river systems are *Aphelocythere acuta*, *Dactylocythere striophylax*, *Dt. suteri*, and *Harpagocythere baileyi*. The ranges of the fishes suggest a migration from the French Broad to the Savannah basin, a direction opposite to that postulated for the entocytherids. Regardless of the route taken by these animals, the possibility of a former connection between parts of the two basins exists.

The similarity in the ranges of *Hypentilium nigricans* (Lesueur) and *Uncinocythere simondsi* in North Carolina is rather striking, for in addition to their presence along the western slope of the Mountain Province, they are also inhabitants of a number of streams in the upper Catawba, Pee Dee, and Roanoke basins; furthermore, a hiatus exists between the known localities in these three and those in the upper Neuse watershed.

#### Ecological Considerations

Our knowledge of the entocytherid fauna of the State has one outstanding weakness in that, as a result of inadequate sampling, we have virtually no records of their occurrence in the larger streams or lakes. Consequently, in the following brief descriptions of the major habitats occupied by them, we have excluded the larger bodies of water.

Following is a classification of the habitats that we believe will be useful in locating specimens of the entocytherids occurring in North Carolina. In comparing the faunas of the various habitats recognized here, it will become apparent that many of the ostracods occurring in them demonstrate a broad ecological tolerance. Nevertheless, some of them do seem to be restricted to certain habitats; these apparently more discriminating species are indicated by an asterisk.

#### LENTIC HABITATS

**PONDS AND ROADSIDE DITCHES.**—These habitats, occurring primarily in the Coastal Plain and lower Piedmont provinces, offer a wide range of variation that is not recognized by either the entocytherids or their hosts. The water in many of them is temporary, disappearing in dry seasons when the crayfish must burrow to or near the subsiding watertable. Only members of the genera *Ankylo-*

there and *Entocythere* occur in such habitats; the species are *An. ancyla*, *An. telmoecea*, *An. tiphophila*, *E. costata*, *E. harrisi*, and *E. internotalus*.

**CRAYFISH BURROWS.**—In studying the crayfishes of Florida, Hobbs (1942) recognized three types of burrowing crayfishes that were classified as "primary, secondary, and tertiary burrowers," and species of all three types serve as hosts to the North Carolina entocytherids. The same adjectives applied to the "burrows" are useful for classifying habitats of the ostracods.

**Primary Burrows:** Such burrows, occurring in areas where the water table is near the surface, are constructed by crayfishes that spend most or essentially all of their life below ground. Some of these burrows are complex, consisting of many horizontal, branching galleries, several of which lead to openings to the surface. Others, while less complex, always possess at least two openings. The North Carolina crayfishes that construct such burrows at higher altitudes include *Cambarus (D.)* sp. B, *C. (J.) carolinus*, *C. (J.) dubius*, and *C. (J.) nodosus*. Infesting at least one of them (see Table 2) are: *As. cosmeta\**, *Dt. falcata* (possibly), *Dt. isabelae\**, *Dt. leptophylax*, and *Lo. petersi\**. At lower altitudes are the crayfishes *Cambarus (D.) catagius* and *C. (L.) d. diogenes*. Infesting one or the other of them (see Table 2) are *An. ancyla*, *An. tiphophila*, *Dt. jeanae\**, *E. dentata*, *E. harrisi*, *Ok. cheia\**, and *Or. waltonae\**.

**Secondary Burrows:** These simple subvertical burrows, seldom with more than one or two openings to the surface, are constructed by species that spend much of their life in subsurface tunnels, but when the burrows become flooded, the crayfish venture into open water, often even during the daylight hours. Among the North Carolina crayfishes that construct such burrows are *Cambarus (D.) reduncus*, *Procambarus (O.) medialis*, *P. (O.) pearsei*, and *P. (O.) plumimanus*. Infesting these burrowing crayfishes are *An. ancyla*, *E. dentata*, and *E. internotalus*; others possibly include *An. telmoecea*, *An. tiphophila*, *Dt. megadactylus*, *Dt. suteri*, *Dn. donaldsonensis*, *Dn. leptodrilus*, and *E. costata*.

**Tertiary Burrows:** These, for the most part, are the comparatively simple, subvertical burrows of those crayfishes that occur in temporary bodies of water and which are forced to dig because of a subsiding watertable, or burrow only during the reproductive season. The burrows of *Fallicambarus*

(*C. uhleri* and *Procambarus (O.) a. acutus* are so classified. Occurring on these crayfishes are: *An. ancyla*, *An. telmoecea*, *An. tiphophila*, *Dt. jeanae* (rarely), *Dn. donaldsonensis*, *E. costata*, and *E. internotalus*.

None of the entocytherids associated with secondary or tertiary burrows is confined to such habitats.

#### LOTIC HABITATS

**SEEPAGE AREAS AND CASCADING BROOKS.**—Such habitats located at higher elevations of the State are principally occupied by only two crayfishes (excluding the primary burrowing species), *Cambarus (C.) bartonii* and *C. (J.) asperimanus*, which are infested with *Ap. acuta\**, *C. clavata*, *Dt. daphnioides*, *Dt. prinsii*, *Dt. runki*, *Dt. striophylax*, *Li. lucileae\**, and *U. simondsi*.

**LARGER MOUNTAIN STREAMS.**—Characteristic of mountainous areas of the State are swift, usually clear, streams flowing over bedrock or rock-littered beds. In them, the crayfish fauna include *Cambarus (C.) bartonii*, *C. (C.)* sp. A, *C. (H.) chasmodactylus*, *C. (H.) longirostris*, *C. (H.) longulus*, *C. (J.) asperimanus* (occasionally), *C. (P.) reburrus*, *C. (P.)* sp. C, and *C. (P.)* sp. D. Infesting them are *Dt. daphnioides*, *Dt. falcata*, *Dt. leptophylax*, *Dt. prinsii*, *Dt. runki*, *Dt. striophylax*, *Dn. donaldsonensis*, *E. dentata*, *E. reddelli*, *H. baileyi*, *Li. lucileae*, and *U. simondsi*.

**PIEDMONT STREAMS.**—These streams, possessing a swift to moderate current, flow over a sand or clay bottom (often littered with rocks) that is frequently scoured following heavy rains. Most lack submergent vascular plants. Frequenting these streams are *Cambarus (C.) bartonii*, *C. (D.) latimanus*, *C. (D.) reduncus*, *C. (P.)* sp. C, *Fallicambarus (C.) uhleri*, *P. (O.) a. acutus*, and *P. (O.) blandingii*. Most of these crayfishes construct burrows of varying complexity in the banks of streams. In such burrows connections with the water in the streams are maintained. Infesting them are *Dt. megadactylus*, *Dt. peedeensis*, *Dt. striophylax*, *Dt. suteri*, *Dn. donaldsonensis*, *Dn. leptodrilus*, *E. dentata*, *E. harrisi*, *E. internotalus*, *E. reddelli*, and *U. simondsi*.

**COASTAL PLAIN STREAMS.**—The streams of the Coastal Plain are highly variable, ranging from clear sand bottomed brooks to coffee colored creeks having rich organic deposits and frequently choked

with both emergent and submergent vegetation. Most are rather sluggish and many have conspicuous silt deposits. The crayfishes most frequently found in such streams are *Cambarus (D.) latimanus*, *Fallicambarus (C.) uhleri*, *Procambarus (O.) a. acutus*, and *P. (O.) blandingii*. Infrequently *C. (P.)* sp. C occurs in the uppermost part of the Province. Infesting these crayfishes are *Dt. suteri*, *E. costata*, *E. harrisi*, and *E. internotalus*.

**Life History**

Investigations of the life histories of entocytherids have been summarized recently by Hobbs (1971:4-6) and Hart and Hart (1974:1-3). Four studies (Marshall, 1903; Rioja, 1940; Stamper, 1957; and Young, 1971) include virtually all that is known of the postembryonic development of the members of the subfamily Entocytherinae. Our observations indicate that the presence of six instars (as determined by Rioja in studying the life history of his *Ankylocythere heterodonta*) is commonplace, if not typical, of the postembryonic development of all

members of the subfamily. Although several characters may be used to recognize the stadium of a specimen, the following key utilizes the most conspicuous features.

Young (1971) found that the eggs of *Ankylocythere sinuosa* (Rioja, 1942a:203), after being deposited on setae of the host, hatched within eight to 10 days at 20°C-22°C. He also pointed out that populations are smallest in winter, become larger in spring and early summer, and reach maximum concentrations in late summer. According to him, in Texas *An. sinuosa* produces eggs at all seasons of the year.

Whereas only adult males are members of amplexing pairs, usually biunguis (fifth instar) females are their partners; however, occasionally triunguis (adult) females have been observed to be paired with a male.

The life span of no entocytherid has been determined; however, Hobbs III (1973:208) isolated entocytherids from their hosts and maintained them in dishes. Of these, one triunguis female, *Sagittocythere barri* (Hart and Hobbs, 1961:174), lived for 186 days.

**Key to the Instars of Entocytherinae**

- 1. One pair of larval legs (lacking multidentate terminal claws) present ..... Instar I  
Two pairs of larval legs present or with one or more pairs of legs bearing terminal claws ... 2
- 2. Two pairs of larval legs present ..... Instar II  
Larval legs absent, one or more pairs of legs with multidentate terminal claws present ..... 3
- 3. One pair of subadult legs (consisting of 3 podomeres) present ..... Instar III  
Two or three pairs of subadult or adult (consisting of 4 podomeres) legs present ..... 4
- 4. Two pairs of subadult legs present ..... Instar IV  
Two or three pairs of adult legs present ..... 5
- 5. Two pairs of adult legs and one pair of subadult legs present; male with 2 pairs of posteroventrally directed lappets situated slightly posterior to posterior pair of legs; antenna of female with penultimate podomere undivided and bearing 2 apical claws (female referred to as "biunguis") ..... Instar V  
Three pairs of adult legs present; male with conspicuous copulatory apparatus; antenna of female with penultimate podomere divided and also bearing 3 apical claws (female referred to as "triunguis") ..... Adult

**Taxonomic Characteristics**

FIGURES 1, 2

The characters that we have used in recognizing the species and species groups of entocytherids in North Carolina include (1) the size and shape of the valves of the shell, (2) the terminal aspect of the distal podomere of the antenna, (3) the structure of the distal tooth of the mandible, (4) the compo-

sition of the genital complex of the female, and, most reliable of all, (5) the features of the copulatory complex of the male.

Usually the shells of the members of *Dactylocythere* and *Entocythere* are larger than those of the other entocytherids occurring in North Carolina. A specimen with an elongate shell, often with an almost straight anteroventral margin, can always be assigned to the genus *Entocythere*, and

one that possesses a posteroventral extension can, with almost equal certainty, be recognized as a member of the genus *Dactylocythere*.

A characteristic generally recognized to be of generic rank is the appendix at the base of the terminal claws of the antenna of the female, a structure found only in members of the genus *Entocythere*. The form of this appendix is, to some degree, unique in each species.

The distal tooth of the mandible of most entocytherids is pectinate; however, in members of the genus *Entocythere* it may be pectinate (*E. costata*), multicuspid (*E. dentata* and *E. internotalus*), or simple and acute (*E. harrisi* and *E. reddelli*).

The genital complex of the female is highly variable, but there is marked similarity in all of the members of each of the genera except those assigned to *Dactylocythere*. In a few of the genera (for example, *Ankylocythere*, *Uncinocythere*, *Aphelocythere*, and *Okriocythere*) the genitalia are so markedly similar that a generic assignment of the female cannot always be made. For convenience in pointing out some of the major differences in the

genital complex of the female, we refer to five basic types: tubelike, clawlike, campanulate, consisting of an amiculum and J-shaped rod, and variable complex. Among the genitalia that are tubular in form, some are associated with a hyalin mass (*Ascetocythere*); some are tubuliform and weakly sclerotized (*Ankylocythere*, *Aphelocythere*, *Litocythere*, and *Uncinocythere*); others are similar in form but heavily sclerotized (*Donnaldsoncythere* and *Okriocythere*). Characteristic of most female members of the genus *Dactylocythere* is an amiculum associated with a J-shaped rod. In the monotypic *Lordocythere*, the most conspicuous part of the female genitalia is the posteroventrally directed clawlike structure. A bell-shaped flange, campanula, surrounding a simple weakly sclerotized papilla is characteristic of all of the members of the genus *Ornithocythere*. In members of the genus *Entocythere*, the genital complex, while uniform in each of the species, is highly variable in respect to the presence or absence of components, but regardless of its nature is always supported by conspicuous sclerotized bars extending caudally from similar

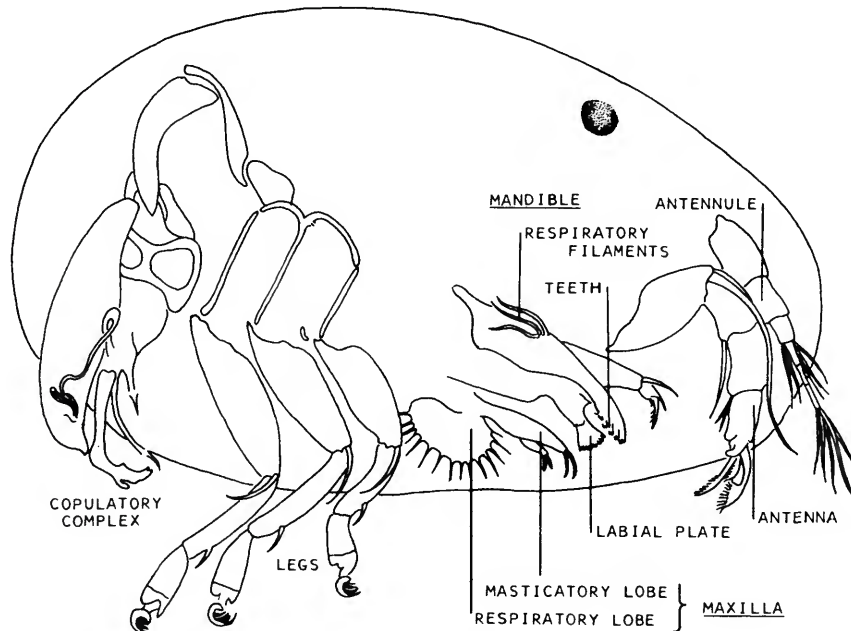


FIGURE 1.—Generalized entocytherid ostracod (from Hobbs, 1971:5).

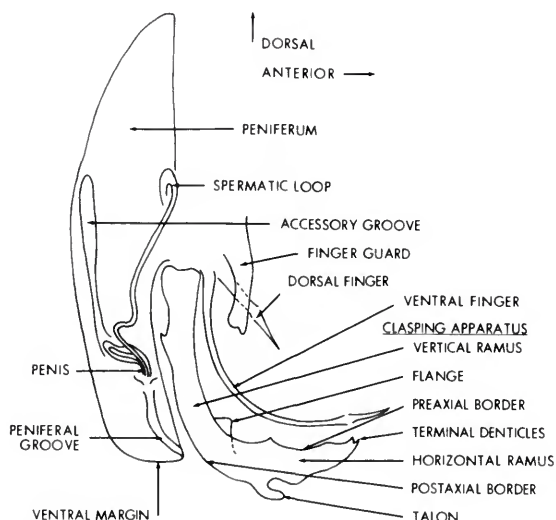


FIGURE 2.—Generalized clasper apparatus of male entocytherid ostracod (modified from Hobbs, 1971:5).

ones supporting the last pair of legs. These bars are probably homologues of the pastina (Hart and Hart, 1969:161) in the male.

“The most useful character for distinguishing species among all entocytherids is the copulatory complex of the adult males (Figure 2). This complex consists of a pair of appendages suspended from the posterodorsal portion of the body and is capable of being rotated 180°. Through convention, all descriptions are based on the appendages in their copulatory attitude, that is, with the ‘fingers’ and clasper apparatus directed anteriorly or anteroventrally rather than posteriorly” (Hobbs, 1971:4).

The recognition of entocytherid species in the North Carolina fauna must, on the basis of our present knowledge, be largely restricted to the adult male, and, to some extent, to the adult female. Juveniles and biunguis females can seldom, if ever, be identified even at the generic level.

### Key to Genera of Entocytheridae Occurring in North Carolina

(Based on adult males)

- 1. Penis directed posteriorly, emerging from posterior side of peniferum ..... *Lordocythere*
- 1'. Penis directed anteroventrally or ventrally, emerging, if at all, from mesial or ventral side of peniferum ..... 2
- 2.(1') External border of clasper apparatus with talon or simple excrescence ..... *Ankylocythere*
- 2'. External border of clasper apparatus entire or subserrate ..... 3
- 3.(2') Penis with prostatic and spermatoc elements distinctly diverging along part of their length ..... *Ascetocythere*
- 3'. Penis with prostatic and spermatoc elements contiguous throughout their lengths ..... 4
- 4.(3') Anteroventral end of peniferum with small posteriorly directed barblike prominence ..... *Harpagocythere*
- 4'. Anteroventral end of peniferum never with posteriorly curved projection ..... 5
- 5.(4') Anteroventral end of peniferum with dorsally curved beaklike projection, peniferum resembling inverted head of a bird ..... *Ornithocythere*
- 5'. Anteroventral end of peniferum never with dorsally curved beaklike projection ..... 6
- 6.(5') Clasper apparatus with ventral margin serrate ..... *Okriocythere*
- 6'. Clasper apparatus with ventral margin entire ..... 7
- 7.(6') Ventral portion of peniferum bulbous ..... *Cymocythere*
- 7'. Ventral portion of peniferum never bulbous ..... 8
- 8.(7') Finger guard present ..... 9
- 8'. Finger guard absent ..... 11
- 9.(8') Ventral portion of peniferum platelike with ventral margin concave ..... *Litocythere*
- 9'. Ventral portion of peniferum never platelike ..... 10
- 10.(9') Ventral margin of peniferum provided with anteroventrally directed acute or subacute process; accessory groove absent ..... *Aphelocythere*
- 10'. Ventral margin of peniferum not provided with anteroventrally directed acute or subacute process; accessory groove present although greatly reduced in *Dt. leptophylax* ..... *Dactylocythere*
- 11.(8') Distal tooth of mandible simple or with two or three cusps ..... *Entocythere*
- 11'. Distal tooth of mandible pectinate ..... 12
- 12.(11') Rami of clasper apparatus disposed at angle of at least 90 degrees ..... *Uncinocythere*
- 12'. Rami of clasper apparatus disposed at angle of no more than 70 degrees ..... *Donnaldsoncythere*

### Family ENTOCYATHERIDAE Hoff, 1942

**DIAGNOSIS.**—"Shell reniform to elliptical, thin chitinous, laterally compressed; valves slightly unequal in size, with or without protuberances, and with marginal or submarginal setae. Eyes, when present, fused and pigmented. Antennules consisting of 6 or 7 podomeres. Antennae with 4 podomeres, armed distally with 2 or 3 claws and basal podomere bearing long setiform flagellum (claw). Mandible well developed with all podomeres of palp fused except distal one. Thoracic legs similar to one another, each terminating in large curved

claw. Maxillae variable, consisting of a palp, and only one masticatory process. Copulatory apparatus of male complex; consisting of peniferum, penis, clasping apparatus, 1 or 2 fingers, and with or without finger guard" (Hart and Hart, 1974:16-17).

Of the five currently recognized subfamilies (Entocytherinae Hoff, 1942; Sphaeromicolinae Hart, 1962; Microsyssitridinae Hart, Nair, and Hart, 1967; Notocytherinae Hart and Hart, 1967; and Hartiellinae Danielopol, 1971), only the Entocytherinae is represented in the North Carolina fauna. For additional information concerning the family and the other subfamilies, see Hart and Hart (1974).

In this annotated list, the measurements included are based almost exclusively on specimens from North Carolina. Precise locality data are included only for those species reported from no more than 20 localities; for the more commonly occurring ostracods, the localities are indicated only on the accompanying maps. In instances in which two localities are close together, they are represented on the map by a single spot. The "Hosts" and "Entocytherid Associates" listed include only those from North Carolina. For records of hosts elsewhere, see Hart and Hart (1974).

#### Subfamily ENTOCYATHERINAE Hoff, 1942

**DIAGNOSIS.**—"Distal spine and mandibular palp never spatulate; respiratory plate of maxilla well developed; maxilla well developed; maxilla with masticatory lobe ending in setae. Peniferum elongate, bearing curved to angular penis, with only relatively slightly convex posterior margin" (Hart and Hart, 1974:17).

**RANGE.**—Southern Canada, the United States (excluding Alaska, introduced into Hawaii), Mexico, and Cuba (including Isla de Pinos).

**HOSTS.**—Crayfishes of the families Astacidae and

Cambaridae, and, in the state of Veracruz, Mexico, a crab belonging to the family Pseudothelphusidae, *Pseudothelphusa (Tehuana) veracruzana* Rodríguez and Smalley (see Hobbs, 1971:26-28).

#### Genus *Ankylocythere* Hart, 1962

*Ankylocythere* Hart, 1962:126.

**DIAGNOSIS.**—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum tapering, bifid, truncate, often with anteroventral subacute exten-

#### Key to North Carolina Species of Genus *Ankylocythere*

1. Postaxial border of horizontal ramus of clasping apparatus with low, rounded excrescence ..... *telmoecia*
- Postaxial border of horizontal ramus of clasping apparatus with well developed talon ..... 2
2. Clasping apparatus with length of talon more than twice least diameter of horizontal ramus, talon extending distally at least to level midway between tooth on preaxial border and proximal terminal denticle; 2 terminal denticles present ..... *ancyla*
- Clasping apparatus with length of talon less than twice least diameter of horizontal ramus, talon never extending distally to level midway between tooth on (preaxial) border and proximal terminal denticle; 2 or 3 terminal denticles present ..... *tiphophila*

sion; accessory groove lacking. Penis small, its length less than anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasping apparatus extending ventrally beyond ventral margin of peniferum, with distinct horizontal and vertical rami; preaxial border of horizontal ramus with 1 or 2 teeth (sometimes serrate proximally), postaxial border with talon or excrescence, and apex with 2 or 3 denticles. Female without pectinate appendix at base of apical claws of second antenna; genital complex consisting of slender, conical, weakly sclerotized papilla.

TYPE-SPECIES.—*Entocythere heterodonta* Rioja, 1940:593.

RANGE.—From Campeche and Chiapas, Mexico, to Illinois, and eastward to Maryland and Florida. Also present on Cuba and Isla de Pinos.

*Ankylocythere ancyla* Crawford

FIGURE 3, MAP 3

*Ankylocythere ancyla* Crawford, 1965:148-149, figs. 1-9.—

Hobbs, 1966:70, fig. 13.—Hart and Hart, 1974:21, 22, pl. 1: figs. 1-6; pl. 45.

*Ankylocythere hobbsi*.—Hart and Hart, 1974:28 [in part], fig. 45 [in part].

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.35-0.43 (0.40); ♀, 0.41-0.45 (0.43). Shell height: ♂, 0.20-0.25

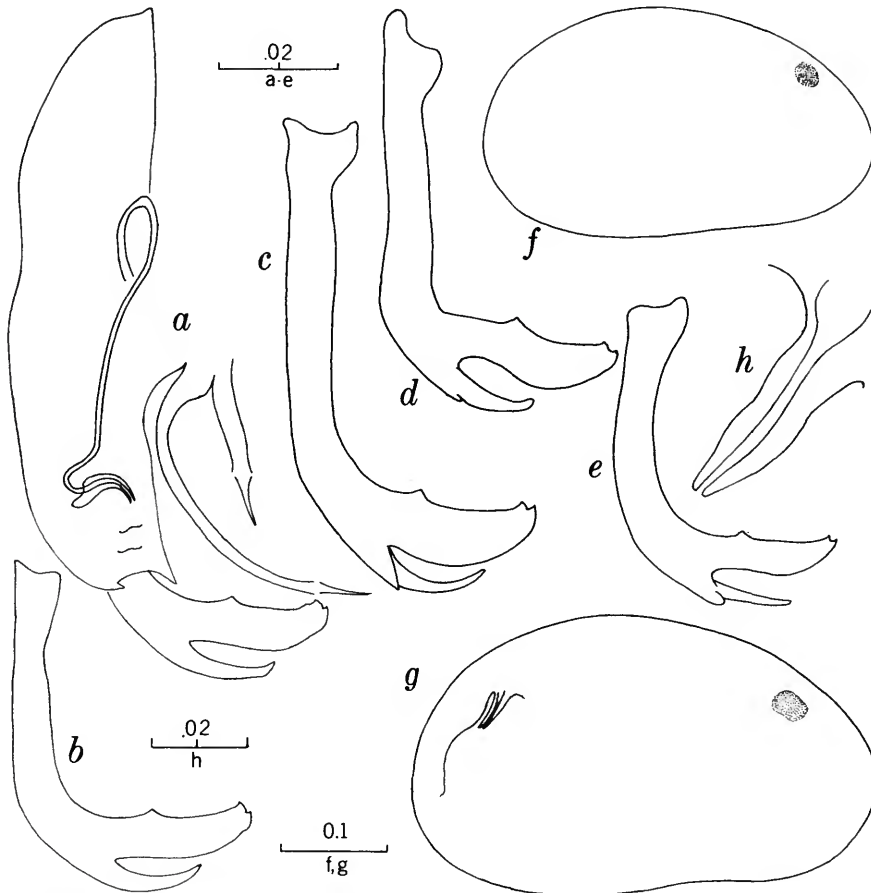


FIGURE 3.—*Ankylocythere ancyla* (a,b,f, from Rowan County): a, copulatory complex of male; b, clasping apparatus of male; c, same, Sampson County; d, same, Alexander County; e, same, Randolph County; f, shell of male; g, shell of female, Brunswick County; h, female genitalia, Catawba County (scales in mm).

(0.22); ♀, 0.24–0.27 (0.25). Peniferum (Figure 3a) excavate ventrally, excavation delimited anteriorly and posteriorly by acute angles. Vertical ramus of clasping apparatus (Figure 3b–e) longer than horizontal ramus and with preaxial and postaxial borders entire; horizontal ramus with single tooth near midlength of preaxial border; postaxial border with long talon arising distinctly proximal to level of tooth on preaxial border and, extending subparallel to ramus, reaching approximately midway between tooth and two terminal denticles; talon frequently bearing tubercle extending distally from near base. Female with genital apparatus as in Figure 3g,h.

**TYPE-LOCALITY.**—Greensboro, Guilford County, North Carolina; host: *Cambarus (Depressicambarus) catagius* Hobbs and Perkins, 1967; reported by Crawford (1965:149) as "crayfish related to *Cambarus latimanus* (LeConte, 1856)."

**RANGE.**—Along the Atlantic and Gulf slopes from the Mobile River drainage in Alabama and Mississippi northeastward to the Potomac drainage in Virginia, and in the New River Basin of North Carolina.

**NORTH CAROLINA RECORDS.**—Widespread in the state in all of the provinces, in the major drainage systems flowing eastward between the Broad and Roanoke basins, and in the New River system in Alleghany County (Map 3). Hart and Hart (1974:22) reported this ostracod from the following counties: Alamance (as *An. hobbsi* (Hoff, 1944)), Bladen, Chatham, Columbus, Orange, Randolph, Wilson, and Yadkin counties.

**HOSTS.**—Twelve species of crayfishes (see Table 2).

**ENTOCYTHERID ASSOCIATES.**—Seventeen species (see Table 3).

**REMARKS.**—The talon of the clasping apparatus of *Ankylocythere ancyla* is highly variable: in some localities a basal tubercle (Figure 3d), or projection, is present that may extend distally for half the length of the talon (Figure 3e); in other localities, the talon lacks any ornamentation (Figure 3b). In contrast, both types of talons have been encountered in a single population, and in one specimen from 4.1 miles (6.6 km) west of Red Springs (State Route 11), Robeson County, the talon on one clasping apparatus has a well defined tubercle extending from its base, and the other has none. Specimens have also been encountered in which

the vertical ramus appears to be proportionately longer than previously observed in members of this species (Figure 3c). None of these variations has been correlated with specific drainage systems or physiographic provinces in the state.

The Alamance County record for *An. hobbsi* cited by Hart and Hart (1974:28) is based on a misidentification of *An. ancyla*.

### *Ankylocythere telmoecea* (Crawford)

FIGURE 4, MAP 4

*Entocythere telmoecea* Crawford, 1959:167–173, figs. 24–30.  
*Ankylocythere telmoecea*.—Hart, 1962:128.—Hobbs, 1966:68, fig. 9.—Hart and Hart, 1974:32–33, pl. 4: figs. 1–5; pl. 46.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.36–0.39 (0.37); ♀, 0.41–0.45 (0.43). Shell height: ♂, 0.20–0.23 (0.21); ♀, 0.24–0.27 (0.25). Peniferum (Figure 4a) truncate ventrally with thickened, acute anteroventral angle; vertical ramus of clasping apparatus (Figure 4e,f) with preaxial and postaxial borders entire, its length subequal to that of horizontal ramus; horizontal ramus with single tooth on preaxial border approximately at midlength; postaxial border with low excrescence opposite or slightly proximal to tooth on preaxial border, or with oblique ridge slightly distal to tooth; apex of ramus usually with 2, occasionally 3, denticles. Female with genital apparatus as in Figure 4c,d.

**TYPE-LOCALITY.**—Gills Creek, 2.7 miles (4.3 km) south-southeast of the University of South Carolina stadium on State Route 48, Richland County, South Carolina; host: *Procambarus (S.) troglodytes* (LeConte, 1856:400).

**RANGE.**—From the Flint River drainage in Georgia to the York Basin in Virginia.

**NORTH CAROLINA RECORDS.**—Sixteen localities in the Piedmont, Inner Coastal Plain, and Tidewater regions from the Broad to the Perquimans drainage systems. **CATAWBA BASIN, MECKLENBERG COUNTY:** (1) Steel Creek, 4.8 mi (7.7 km) S Shopton on St Rte 28 (host: *P. (O.) acutus acutus*; no associate); **MONTGOMERY COUNTY:** (2) Hamer Creek, 3 mi (4.8 km) N Richmond Co line on St Rte 73 (hosts: *C. (D.) reduncus*, *C. (P.)* sp. C, *P. (O.) a. acutus*; associate: *An. ancyla*); (3) creek, 4.6 mi (7.4 km) W Mt. Gilead on St Rte 73 (hosts: *C. (C.)* sp. A, *C. (P.)* sp. C, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. megadactylus*, *Dt. suteri*); **UNION COUNTY:** (4) 5.5 mi (8.9 km) NE Waxhaw on St Rte 75 (host: *P. (O.) a. acutus*; no associate). **CAPE FEAR BASIN, DUPLIN COUNTY:** (5) Island Creek, 1.8 mi (2.9 km) N Tin City on St Rte 11



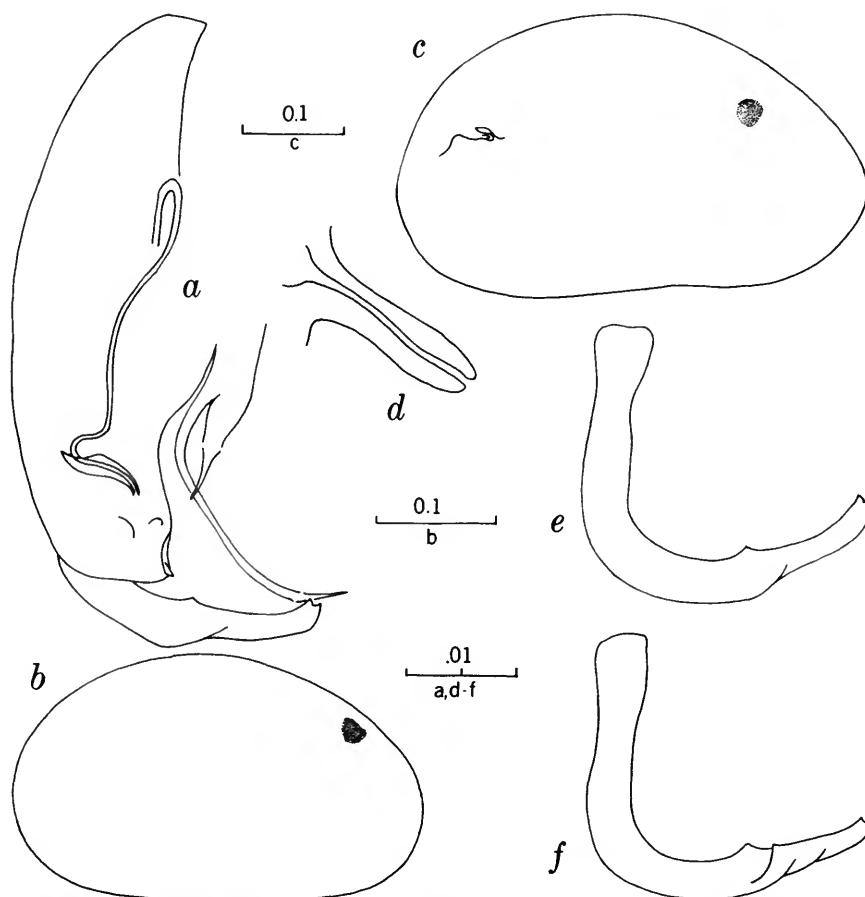


FIGURE 4.—*Ankylocythere telmoecia* (a,d-f, from Pender County; b,c, from Pasquotank County): a, copulatory complex of male; b, shell of male; c, shell of female; d, female genitalia; e,f, clasping apparatus of male (scales in mm).

(hosts: *C. (D.) latimanus*, *P. (O.) a. acutus*; no associate); LEE COUNTY: (6) 1.1 mi (1.8 km) S Sanford on U.S. Hwy 1 (host: *P. (O.) a. acutus*; no associate); (7) 1.5 mi (2.4 km) S Sanford on U.S. Hwy 1 (host: *P. (O.) a. acutus*; associate: *An. ancyla*); PENDER COUNTY: (8) 14.7 mi (23.7 km) N Rock Point on U.S. Hwy 117 (host: *P. (O.) a. acutus*; associate: *E. internotalus*). NEUSE BASIN. PAMLICO COUNTY: (9) tributary to Fork Run, about 2 mi (3.2 km) NE Arapahoe (host: *P. (O.) a. acutus*; no associate). PAMLICO BASIN. NASH COUNTY: (10) locality on St Rte 48 (host: *P. (O.) a. acutus*; no associate). PEE DEE BASIN. DAVIDSON COUNTY: (11) tributary to Yadkin River, 0.4 mi (0.6 km) W jct of St Rte 109 and secondary road to Lexington (hosts: *C. (D.) reduncus*, *P. (O.) a. acutus*; associate: *Dt. megadactylus*); RANDOLPH COUNTY: (12) 2.8 mi (4.5 km) NE Davidson Co line on St Rte 49 (hosts: *C. (P.) sp. C*, *P. (O.) a. acutus*; associates unknown (Hart and Hart, 1974: 32)). PERQUIMANS BASIN. PASQUOTANK COUNTY: (13) 2.9 mi

(4.7 km) NE of Perquimans County line on Co Rd 1001 (host: *P. (O.) a. acutus*; no associate); (14) 4 mi (6.4 km) SW Elizabeth City on U.S. Hwy 17 (host: *P. (O.) a. acutus*; associate: *An. tiphophila*); PERQUIMANS COUNTY: (15) 4.5 mi (7.2 km) N Windfall Post Office on U.S. Hwy 37 (hosts: *F. (C.) uhleri*, *P. (O.) a. acutus*; associate: *An. tiphophila*); (16) 5 mi (8.1 km) W Hertford on U.S. Hwy 17 (hosts: *F. (C.) uhleri*, *P. (O.) a. acutus*; associate: *An. tiphophila*).

HOSTS.—*Cambarus (C.) sp. A*, *C. (D.) latimanus*, *C. (D.) reduncus*, *C. (P.) sp. C*, *Fallicambarus (C.) uhleri*, and *Procambarus (O.) acutus acutus*.

ENTOCYTHERID ASSOCIATES.—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere megadactylus*, *Dt. suteri*, and *Entocythere internotalus*.

REMARKS.—Variation in the clasping apparatus

of this species is more apparent than real, for the differences noted in the appearance of the excrescence on the postaxial border of the horizontal ramus of the clasping apparatus are due largely to the angle at which the ramus is viewed. In lateral aspect, the excrescence is distinctly ventral in position and lies slightly proximal to the tooth on the preaxial border of the ramus (Figure 4e). If the latter is slightly tilted so that it is seen more ventrally, the excrescence appears to move distally and does not project so distinctly ventrally (Figure 4f). The distal extremity of the ramus is armed with either 2 or 3 denticles.

***Ankylocythere tiphophila* (Crawford)**

FIGURE 5, MAP 5

*Entocythere tiphophila* Crawford, 1959:173-178, figs. 31-37.

*Ankylocythere tiphophila*.—Hart, 1962:128.—Hart and Hart, 1974:33, pl. 4: figs. 6-8; pl. 45.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.35-0.38 (0.36);

♀, 0.39-0.43 (0.41). Shell height: ♂, 0.18-0.22 (0.20); ♀, 0.21-0.25 (0.24). Peniferum (Figure 5a) very shallowly excavate ventrally with distinct acuminate anteroventral angle. Vertical ramus of clasping apparatus (Figure 5b) with preaxial and postaxial borders entire and longer than horizontal ramus; horizontal ramus with single tooth near mid-length of preaxial border; postaxial border with prominent talon arising ventrally or slightly proximoventrally to tooth on preaxial border and extending anteroventrally at angle of approximately 60 degrees to shaft of ramus, latter terminating in 2 or 3 apical denticles. Female genitalia as in Figure 5d,e.

TYPE-LOCALITY.—Roadside ditch, 9.1 miles southeast of the University of South Carolina stadium, Richland County, South Carolina, on State Route 48; hosts: *Procambarus* (*S.*) *troglydytes* and *Fallinacambarus* (*C.*) *uhleri*.

RANGE.—Lower Piedmont and Coastal Plain provinces from the Escambia River system in Florida northward to the York River Basin in

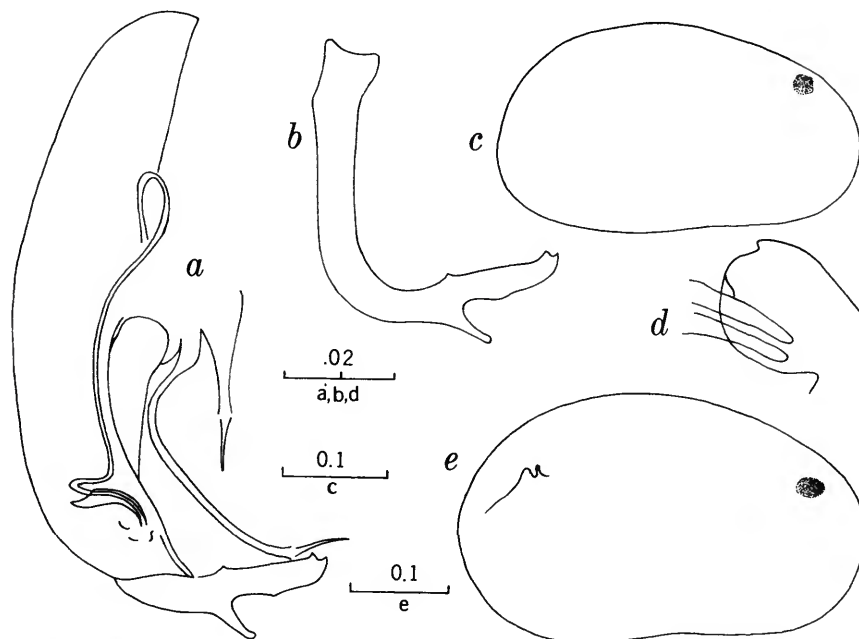


FIGURE 5.—*Ankylocythere tiphophila* from Perquimans County: a, copulatory complex of male; b, clasping of apparatus of male; c, shell of male; d, female genitalia; e, shell of female (scales in mm).

Virginia. Hart and Hart (1974:33) also reported it from two localities in Ohio.

NORTH CAROLINA RECORDS.—Twenty-seven localities in the lower Piedmont, Inner Coastal Plain, and Tidewater regions from the Pee Dee Basin northward to the North River drainage system.

HOSTS.—*Cambarus* (C.) sp. A, *C. (D.) reduncus*, *C. (L.) d. diogenes*, *C. (P.)* sp. C, *Fallicambarus (C.) uhleri*, *Procambarus (O.) a. acutus*, *P. (O.) blandingii*, *P. (O.) medialis*, *P. (O.) pearsei*, and *P. (O.) plumimanus*.

ENTOCYOTHERID ASSOCIATES.—*Ankylocythere ancyla*, *An. telmoecea*, *Dactylocythere jeanae*, *Dt. peedeensis*, *Dt. runki*, *Dt. striophylax*, *Dt. suteri*, *Donnaldsoncythere leptodrilus*, *Entocythere costata*, *E. harrisi*, *E. internotalus*, *Okriocythere cheia*, and *Uncinocythere simondsi*.

#### *Aphelocythere*, new genus

DIAGNOSIS.—Terminal tooth of mandible with cusps. Copulatory complex of male with finger guard; peniferum not tapering ventrally, with ventral margin subtruncate but produced anteroventrally in subacute to acute process. Peniferal and accessory groove lacking. Penis complex with spermatid and prostatic elements contiguous throughout their length; penis situated at base of distal fourth of peniferum, its length approximately one-half anterior-posterior dimension of peniferum at level of base of penis. Clasp apparatus clearly divisible into vertical and horizontal rami dispersed at angle of approximately 90°; preaxial and postaxial borders of vertical ramus and postaxial border of horizontal ramus entire; preaxial border of horizontal ramus with 2 or 3 teeth on distal third; and 3 apical denticles present.

TYPE-SPECIES.—*Aphelocythere acuta* (see below).

REMARKS.—Members of this monotypic genus have a finger guard as do those of the genera *Cymocythere*, *Dactylocythere*, *Harpagocythere*, *Litocythere*, *Phymocythere*, and *Saggitocythere*; it differs from *Dactylocythere* and *Saggitocythere* in lacking accessory and peniferal grooves; from *Phymocythere* it differs in having contiguous prostatic and spermatid elements of the penis. It is distinct from *Cymocythere*, *Harpagocythere*, and *Litocythere* in possessing a subacute or acute anteroventral process on the peniferum.

GENDER.—Feminine.

ETYMOLOGY.—From the Greek "Aphelles," meaning simple, plus generic name *Cythere*, alluding to the absence of accessory and peniferal grooves in the peniferum.

#### *Aphelocythere acuta*, new species

FIGURE 6, MAP 3

DIAGNOSIS.—Same as that for genus; in addition, shell length in mm (numbers in parentheses represent averages): ♂, 0.38–0.39 (0.38); ♀, 0.39–0.41 (0.40). Shell height: ♂, 0.20–0.22 (0.21); ♀, 0.23–0.25 (0.24). Finger guard bifid distally with one ramus distinctly longer than other.

MALE.—Eye situated only little less than one-fourth shell length from anterior margin. Shell (Figure 6d) elongate ovate with greatest height slightly posterior to midlength; broadly rounded posteriorly, lacking posteroventral prominence; ventral margin almost straight to weakly convex; submarginal setae lacking dorsally and somewhat closer together anteriorly and posteriorly than ventrally.

Copulatory complex (Figure 6a) with clasping apparatus extending ventrally below ventral margin of peniferum. Latter not tapering ventrally, and ventralmost part subtruncate but produced at cephalic angle in subacute to acute process. Accessory and peniferal grooves absent. Finger guard comparatively slender, with rami of bifid tip of unequal lengths; dorsal finger robust and with forked tip; ventral finger with strong (about 80°–90°) subangular bend slightly beyond basal fourth and very gently curved to bend. Clasp apparatus L-shaped with rami subequal in length, both entire except for preaxial border of horizontal ramus, latter bearing 2 or 3 teeth along distal third followed by 3 apical denticles; proximalmost tooth very low and broad, sometimes hardly discernible.

FEMALE.—Eye situated slightly less than one-fifth shell length from anterior margin. Shell (Figure 6e) highly vaulted, approximately three-fifths as high as long; greatest height distinctly posterior to midlength; posteroventrally projecting prominence lacking, and ventral margin conspicuously concave anterior to midlength; submarginal setae distributed as in male.

Genital apparatus (Figure 6f) consisting of sclerotized acute conical tubercle.

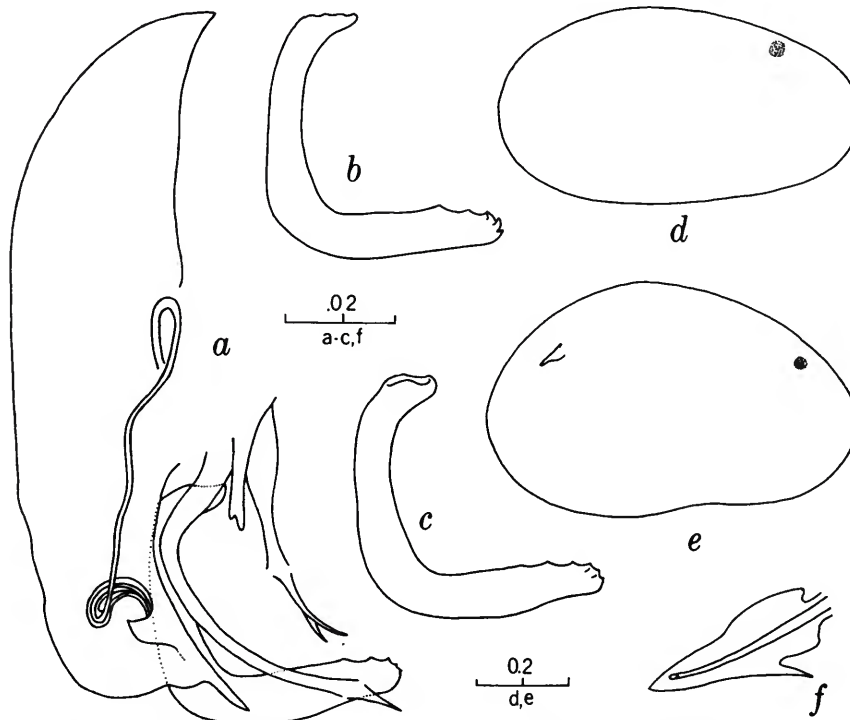


FIGURE 6.—*Aphelocythere acuta*, new species, from Jackson County: *a*, copulatory complex of holotype; *b,c*, clasper apparatus of same; *d*, shell of same; *e*, shell of allotype; *f*, genitalia of allotype (scales in mm).

**TYPE-LOCALITY.**—Cascading mountain brook (Savannah River basin), 0.7 mile (1.1 km) north of the South Carolina line on U.S. Highway 178, Transylvania County, North Carolina; hosts: *Cambarus (J.) asperimanus* and *C. (C.) bartonii*.

**TYPES.**—The holotypic male and allotypic female are deposited in the National Museum of Natural History, Smithsonian Institution, numbers 155324 and 155325, respectively. Paratypes are in the British Museum, Smithsonian Institution, and in the collections of H. H. Hobbs III and the junior author.

**RANGE.**—This ostracod is known from only three localities, all in the Mountain Province, in headwaters of the French Broad and Savannah rivers in North Carolina.

**NORTH CAROLINA RECORDS.**—**FRENCH BROAD BASIN.** TRANSYLVANIA COUNTY: (1) French Broad River at U.S. Hwy 64 (host: *C. (J.) asperimanus*; associate: *Dn. donaldsonensis*). **SAVANNAH BASIN.** TRANSYLVANIA COUNTY: (2) Type-

locality; (3) creek, 1.1 mi (1.8 km) N South Carolina line on U.S. Hwy 178 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *C. clavata*, *Dn. donaldsonensis*, *U. simondsii*).

**HOSTS.**—*Cambarus (C.) bartonii* and *C. (J.) asperimanus*.

**ENTOCYOTHERID ASSOCIATES.**—*Cymocythere clavata*, *Donaldsoncythere donaldsonensis*, and *Ucinocythere simondsii*.

**RELATIONSHIPS.**—*Aphelocythere acuta* is probably as closely allied to *Ucinocythere stubbsi* Hobbs and Walton (1966:9) as to any other member of the subfamily. They possess a similar clasper apparatus, and the penis guide on the peniferum together with the subacutely produced anteroventral extremity of the latter suggest a rather close affinity between the two. *Aphelocythere acuta*, however, differs markedly from *U. stubbsi* in possessing a finger guard, and the ventral surface of the peniferum is weakly emarginate rather than being deeply cleft; furthermore, the genital apparatus

of the female is distinctly more acute and more sharply delimited basally.

ETYMOLOGY.—The name *acuta* was selected in token of the acute process on the anteroventral extremity of the peniferum.

### Genus *Ascetocythere* Hart, 1962

*Ascetocythere* Hart, 1962:128.

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male with reduced finger guard. Ventral portion of peniferum bulbiform with one or more variously shaped ventrally and/or cephalically projecting prominences; accessory groove lacking. Penis long, its length greater than anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements widely separated basally and converging to apex. Clasping apparatus not reaching ventral margin of peniferum, horizontal and vertical rami seldom distinct; preaxial border of distal portion of horizontal

ramus unarmed or with 1 to 3 teeth, postaxial border entire, and apex with 3 to 5 denticles. Female without pectinate appendix at base of apical claws of second antenna; genital complex variable but consisting essentially of small genital papilla surrounded by irregular amorphous hyalin mass.

TYPE-SPECIES.—*Entocythere asceta* Hobbs and Walton, 1962:42.

RANGE.—Southern Appalachian Mountains and Cumberland Plateau from Pennsylvania to Kentucky, North Carolina, and eastern Tennessee. Only one species is known to occur in North Carolina.

### *Ascetocythere cosmata* Hobbs and Hart

FIGURE 7, MAP 6

*Ascetocythere cosmata* Hobbs and Hart, 1966:46-47, figs. 24, 25.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.39-0.44 (0.41); ♀, 0.41-0.43 (0.42). Shell height: ♂, 0.21-0.25

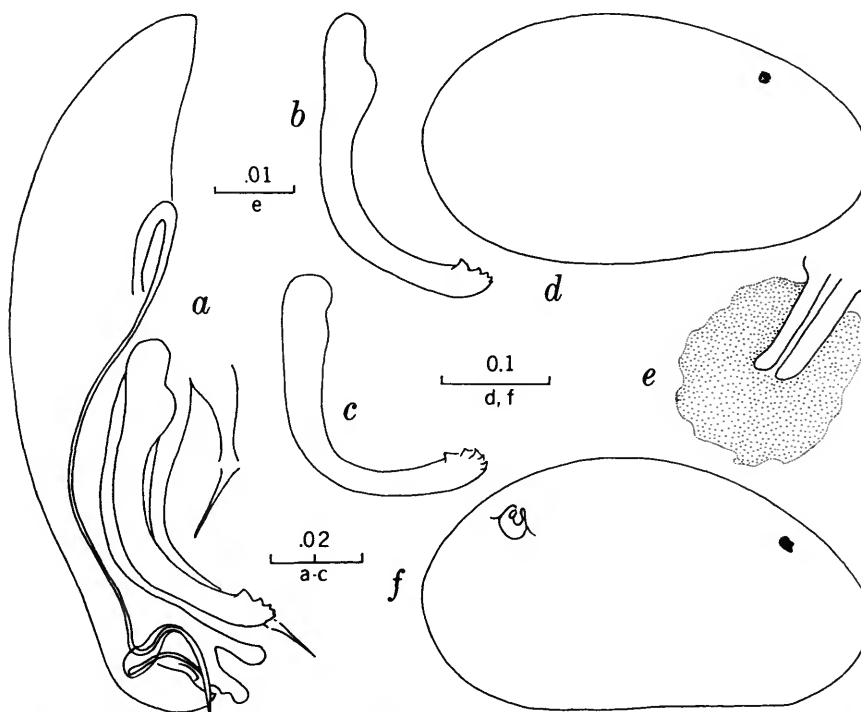


FIGURE 7.—*Ascetocythere cosmata* from Avery County: a, copulatory complex of male; b, c, clasping apparatus of male; d, shell of male; e, female genitalia; f, shell of female (scales in mm).

(0.23); ♀, 0.23–0.26 (0.24). Peniferum (Figure 7a) with swollen subterminal enlargement bearing 3 anteroventrally projecting prominences, posterior-most acute, others rounded. Clasp apparatus (Figure 7b,c) well developed, not clearly divisible into horizontal and vertical rami; preaxial and postaxial borders entire; distal extremity armed with 5 apical denticles. Female with genital complex (Figure 7e) consisting of short tubular papilla surrounded by hyalin mass.

**TYPE-LOCALITY.**—Seepage area, 4 miles north of the junction of State Route 89 and the Blue Ridge Parkway, Grayson County, Virginia; host: *Cambarus (Jugicambarus) dubius* Faxon, 1884:114 (reported by Hobbs and Hart, 1966:46, as *Cambarus carolinus*).

**RANGE.**—The Catawba and New river basins in Alleghany and Avery counties, North Carolina, and Grayson County, Virginia.

**NORTH CAROLINA RECORDS.**—Known from only 3 localities in the Mountain Province. **CATAWBA BASIN.** AVERY COUNTY: (1) tributary of Linville River near U.S. Hwy 221 at Linville (host: *C. (J.) asperimanus*; associate: *Li. lucileae*); (2) burrows along creek 0.5 mi (0.8 km) N jct of St Rte 181 and Co Rd 1345 on latter (host: *C. (J.) dubius*; associates: *E. dentata*, *U. simondsii*). **NEW BASIN.** ALLEGHANY COUNTY: (3) burrows along creek at Roaring Gap (host: *C. (J.) dubius*; associate: *U. simondsii*).

**HOSTS.**—*Cambarus (J.) asperimanus* and *C. (J.) dubius*.

**ENTOCYThERID ASSOCIATES.**—*Entocythere dentata*, *Litocythere lucileae*, and *Uncinocythere simondsii*.

**REMARKS.**—Only one specimen of this species has been found on a crayfish collected outside of a burrow (the first locality cited above), and this is the only record of its being associated with a crayfish other than *C. (J.) dubius*. Like most of its congeners, it appears to be confined largely to crayfishes that spend most of their lives in the sub-surface waters of burrows.

### Genus *Cymocythere* Hart, 1962

*Cymocythere* Hart, 1962:128.

**DIAGNOSIS.**—Terminal tooth of mandible pectinate. Copulatory complex of male with slender, bifid finger guard. Ventral portion of peniferum somewhat bulbiform, slightly excavate, entire, or with broadly rounded lobe; accessory groove lacking. Penis small, length less than antero-

posterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasp apparatus not reaching ventral margin of peniferum and with or without distinct horizontal and vertical rami; preaxial border of horizontal ramus with as many as 3 teeth and 3 apical denticles, or with 4 or 5 denticles crowded apically, postaxial border entire. Female without pectinate appendix at base of terminal claws of second antenna; genital complex consisting of posterodorsally situated, weakly sclerotized papilla.

**TYPE-SPECIES.**—*Entocythere cyma* Hobbs and Walton, 1960:18.

**RANGE.**—Southern flank of Appalachians from North Carolina and Tennessee to Georgia and Alabama. Hart and Hart (1974:43) indicated that North Carolina is within the range of the genus but cited neither a species nor a specific locality for the state. Only one species is known to occur in North Carolina.

### *Cymocythere clavata* Crawford

FIGURE 8, MAP 7

*Cymocythere clavata* Crawford, 1965:149–151, figs. 4, 5, 8, 9.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.38–0.39 (0.38); ♀, 0.36–0.40 (0.38). Shell height: ♂, 0.21–0.23 (0.22); ♀, 0.22–0.23 (0.23). Peniferum (Figure 8a) with portion ventral to base of clasp apparatus constituting at least two-thirds of length of peniferum, and with penis directed distally; preaxial border of clasp apparatus (Figure 8b) with 1 or 2 emarginations, and apex with 4 denticles. Female with genital complex (Figure 8c) consisting of short subacute papilla flanked posteriorly by complex lappet.

**TYPE-LOCALITY.**—East Fork of the Chattooga River at its junction with Indian Camp Creek, 21 miles (33.8 km) northwest of Walhalla, Oconee County, South Carolina; hosts: *Cambarus (C.) bartonii* and *C. (J.) asperimanus*.

**RANGE.**—Savannah River drainage in North Carolina and South Carolina.

**NORTH CAROLINA RECORDS.**—Known from only three localities in the Mountain Province, **FRENCH BROAD BASIN.** TRANSYLVANIA COUNTY: (1) French Broad River at U.S. Hwy 64 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *Ap. acuta*, *Dn. donaldsonensis*, *U. simondsii*). **SAVANNAH**

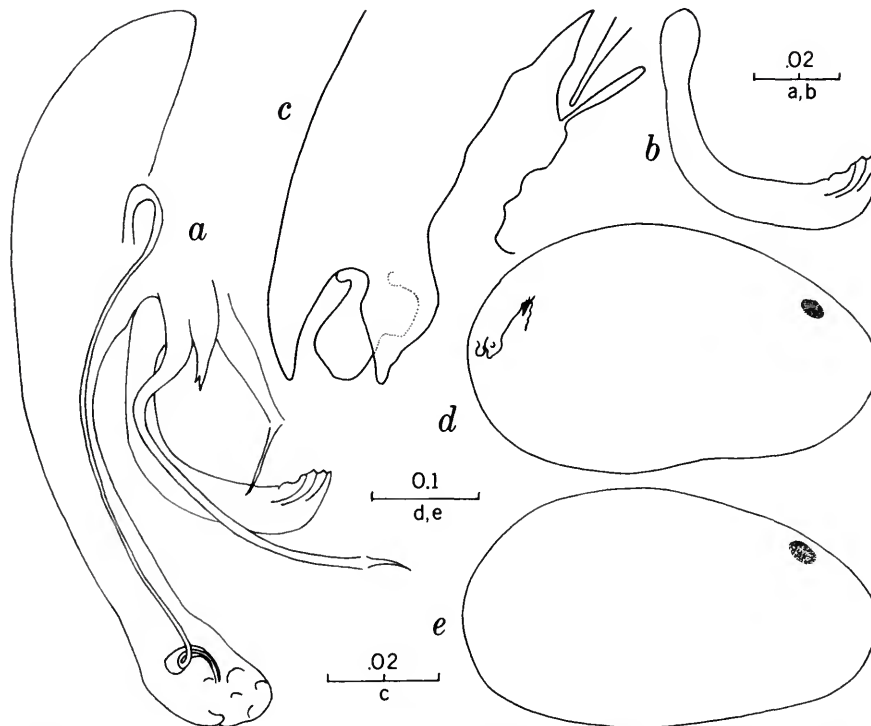


FIGURE 8.—*Cymocythere clavata* from Transylvania County: a, copulatory complex of male; b, clasper apparatus of male; c, female genitalia; d, shell of female; e, shell of male (scales in mm).

BASIN. TRANSYLVANIA COUNTY: (2) Big Hogback Creek at U.S. Hwy 64 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associate: *Dn. donnaldsonensis*); (3) creek at Camp Toxaway, E of Cashiers on U.S. Hwy 64 (host: *C. (J.) asperimanus*; no associate).

HOSTS.—*Cambarus (C.) bartonii* and *C. (J.) asperimanus*.

ENTOCYTHERID ASSOCIATES.—*Aphelocythere acuta*, *Donnaldsoncythere donnaldsonensis*, and *Uncinocythere simondsi*.

#### Genus *Dactylocythere* Hart, 1962

*Dactylocythere* Hart, 1962:129.

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male with prominent finger guard. Ventral portion of peniferum variously shaped but usually rounded, anteroventral extremity rounded or angular; accessory groove always present and usually well developed except

in *Dt. leptophylax*. Penis small, length less than anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasper apparatus extending ventrally beyond ventral margin of peniferum except in *Dt. leptophylax* in which posteroventral margin of peniferum provided with 2 or 3 conspicuous tubercles. Clasper apparatus C- to L-shaped; preaxial border of horizontal ramus without or with as many as 4 teeth, postaxial border entire, and apex naked or bearing as many as 4 denticles. Female without pectinate appendix at base of terminal claws of second antenna; genital complex almost always with J-shaped rod and amiculum (not present in *Dt. isabelae* and *Dt. leptophylax*).

TYPE-SPECIES.—*Entocythere runki* Hobbs, 1955: 330.

RANGE.—From Pennsylvania and Michigan southward to Alabama, Georgia, and northwestern Florida.

Key to North Carolina Species of Genus *Dactylocythere*

1. Shell with posteroventral prominence ..... 2  
 1'. Shell lacking posteroventral prominence ..... 3  
 2.(1) Finger guard distinctly arched, sharply truncate or with 2 or 3 subacute apices ventrally; junction of horizontal and vertical rami of clasping apparatus distinctly thickened and former with series of step-like excavations decreasing in height distally from slightly distal to midlength ..... *daphnioides*  
 2'. Finger guard not distinctly arched, tapering, and rounded ventrally; junction of horizontal and vertical rami of clasping apparatus not thickened and former with low prominences in distal third ..... *peedeensis*  
 3.(1') Clasping apparatus with distal portion expanded; peniferum with tuberculiform prominences posteroventrally ..... *leptophylax*  
 3'. Clasping apparatus with distal portion tapering; peniferum never with tuberculiform prominences posteroventrally ..... 4  
 4.(3') Preaxial border of horizontal ramus of clasping apparatus entire, without prominences of any kind and usually without apical denticles ..... *falcata*  
 4'. Preaxial border of horizontal ramus with 1 or more prominences (rounded elevations, teeth, ridges, or annulations); if without apical denticles then with subapical annulations ..... 5  
 5.(4') Finger guard with prominent rounded bulge on posterior surface ..... 6  
 5'. Finger guard lacking prominent rounded bulge on posterior surface ..... 7  
 6.(5) Vertical ramus of clasping apparatus with weak shoulder on postaxial border; junction of rami rounded and not thickened; bulge on posterior surface of finger guard moderately well developed ..... *isabelae*  
 6'. Vertical ramus of clasping apparatus without shoulder on postaxial border; junction of rami with postaxial margin subangular and distinctly thickened; bulge on posterior surface of finger guard very large ..... *megadactylus*  
 7.(5') Peniferum with anteroventral extremity angular ..... 8  
 7'. Peniferum with anteroventral extremity rounded ..... 9  
 8.(7) Sternal spine present; horizontal ramus of clasping apparatus with series of steplike excavations decreasing in height distally ..... *runki*  
 8'. Sternal spine absent; horizontal ramus of clasping apparatus not provided with series of steplike excavations ..... *chelomata*  
 9.(7') Preaxial border of horizontal ramus of clasping apparatus with 3 teeth along distal two-thirds ..... *prinsi*  
 9'. Preaxial border of horizontal ramus of clasping apparatus with or without teeth, if present confined to distal one-third ..... 10  
 10.(9') Horizontal ramus of clasping apparatus terminating in 3 apical denticles; postaxial border of vertical ramus with strong acute, or subacute, shoulder ..... *jeanae*  
 10'. Horizontal ramus of clasping apparatus terminating in 2 apical denticles; postaxial border of vertical ramus with or without weak shoulder ..... 11  
 11.(10') Distal part of horizontal ramus of clasping apparatus ringed by annulations frequently forming small ridges on preaxial surface ..... *striophylax*  
 11'. Distal part of horizontal ramus of clasping apparatus with low elevations or teeth and 2 apical denticles ..... 12  
 12.(11') Finger guard trilobed and not tapering distally ..... *suteri*  
 12'. Finger guard simple, tapering distally ..... *peedeensis*

*Dactylocythere chelomata* (Crawford)

FIGURE 9, MAP 8

*Entocythere chelomata* Crawford, 1961:242-244, figs. 15-21.*Dactylocythere chelomata*.—Hart, 1962:130.—Hart and Hart, 1974:53, plate 12: figs. 11-15; plate 48.

DIAGNOSIS.—Shell length in mm (numbers in

parentheses represent averages): ♂, 0.42-0.47 (0.45); ♀, 0.44-0.48 (0.46). Shell height: ♂, 0.25-0.27 (0.26); ♀, 0.26-0.30 (0.28). Shell (Figure 9*e,d*) without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum (Figure 9*a*) directed anteroventrally, tapering to subacute apex; width of extremity of peniferal groove as great as



least diameter of vertical ramus of clasping apparatus. Accessory groove simple and extending dorsally to level of spermatic loop. Finger guard comparatively massive, tapering distally and terminating in 3 lobes. Clasping apparatus (Figure 9a,b) without shoulder or hump on postaxial border of vertical ramus; junction of rami slightly thickened, with posteroventral margin rounded; preaxial border of horizontal ramus with 1 tooth slightly distal to midlength of horizontal ramus, and 2 small preapical ones; apex of ramus with 3 apical denticles.

TYPE-LOCALITY.—“West Fork of the Little Pigeon River, one mile [1.6 km] south of Gatlinburg, Sevier County, Tennessee, on U.S. Highway 441, in the Great Smoky Mountain National Park. The hosts are *Cambarus longulus longirostris* [= *C. (H.) longirostris*], *Cambarus bartonii bartonii* and *Orconectes juvenilis*” (Crawford, 1961:244).

RANGE.—From the Pigeon River basin in Ten-

nessee south to the Little Tennessee and Hiwassee river systems in North Carolina.

NORTH CAROLINA RECORDS.—Two localities within the Mountain Province. HIWASSEE BASIN. CHEROKEE COUNTY: (1) “Valley River at Andrews” (hosts: *C. (C.) bartonii*, *C. (H.) longirostris*; associates: none reported) (Crawford, 1961:244). LITTLE TENNESSEE BASIN. MACON COUNTY: (2) “Sugar Fork (Cullasaga) River northwest of Highlands” (host: *C. (C.) bartonii*; associates: none reported) (Crawford, 1961:244).

HOSTS.—*Cambarus (C.) bartonii* and *C. (H.) longirostris*.

ENTOCYTHERID ASSOCIATES.—None was reported from North Carolina, but *Dactylocythere daphnioides* and *Entocythere humesi* Hoff (1943) (= *Donaldsoncythere donaldsonensis*) were found with it in the type-locality.

REMARKS.—The only specimens of this ostracod that we have examined are several from the type series collected in the type-locality.

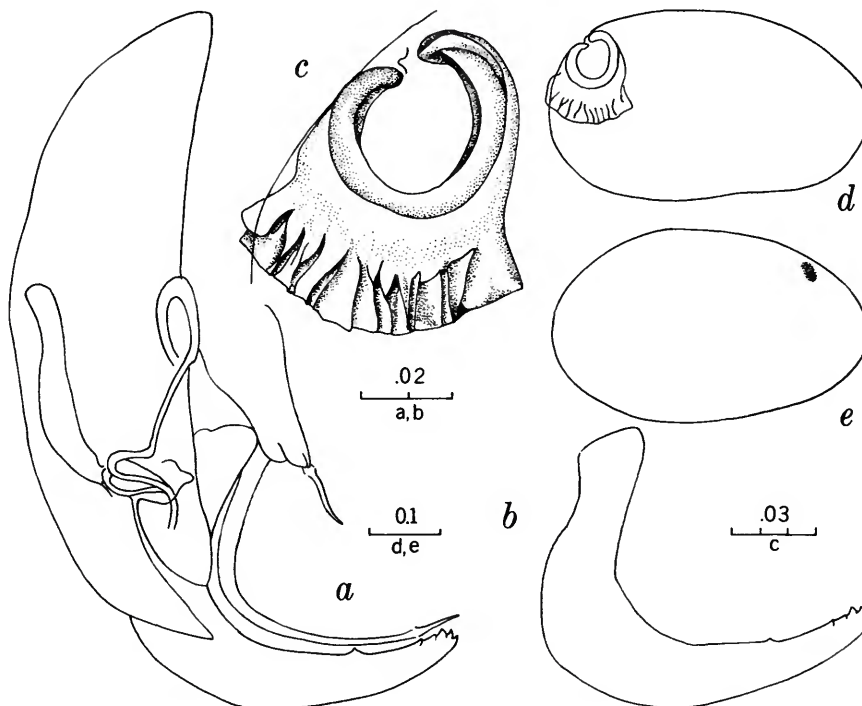


FIGURE 9.—*Dactylocythere chelomata* from Sevier County, Tennessee: a, copulatory complex of holotype; b, clasping apparatus of same; c, genitalia of allotype; d, shell of allotype; e, shell of holotype (scales in mm).

*Dactylocythere daphnioides* (Hobbs)

FIGURE 10, MAP 9

*Entocythere daphnioides* Hobbs, 1955:325-330, figs. 1, 2, 5-9.

*Entocythere daphnioides* Ferguson, 1958:198 [erroneous spelling].

*Dactylocythere daphnioides*.—Hart, 1962:130.—Hart and Hart, 1974:55-56, pl. 14: figs. 1-5; pl. 48.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.48-0.55 (0.51); ♀, 0.53-0.60 (0.56). Shell height: ♂, 0.27-0.31 (0.29); ♀, 0.29-0.37 (0.31). Shell (Figure 10*d,f*) with rounded to acute posteroventral prominence. Sternal spine only slightly curved and directed posteriorly or posteroventrally. Ventral extremity of peniferum (Figure 10*a*) directed anteroventrally, tapering to subacute apex; width of distal end of peniferal groove no greater than half least diameter of vertical ramus of clasping apparatus. Accessory groove complex and extending dorsally to or almost

to level of dorsal margin of spermatic loop. Finger guard comparatively heavy, strongly concave posteriorly, and subtruncate distally with 3 short subangular prominences. Clasping apparatus (Figure 10*b,c*) with rounded hump on posterior margin of vertical ramus slightly proximal to midlength; junction of horizontal and vertical rami distinctly thickened, and posteroventral margin rounded; preaxial border of horizontal ramus with 3 teeth (distal 2 sometimes appearing as slight elevations set off basally by oblique lines on mesial surface), followed by 3 apical denticles. Female genital complex consisting of J-shaped rod and flared amiculum (Figure 10*e,f*).

**TYPE-LOCALITY.**—East Fork of the Greenbrier River at U.S. Highway 250, east of Durbin, Pocahontas County, West Virginia; hosts: *Cambarus* (*H.*) *chasmodactylus*, and *C. (P.) robustus*.

**RANGE.**—From headwaters of the Little Ten-

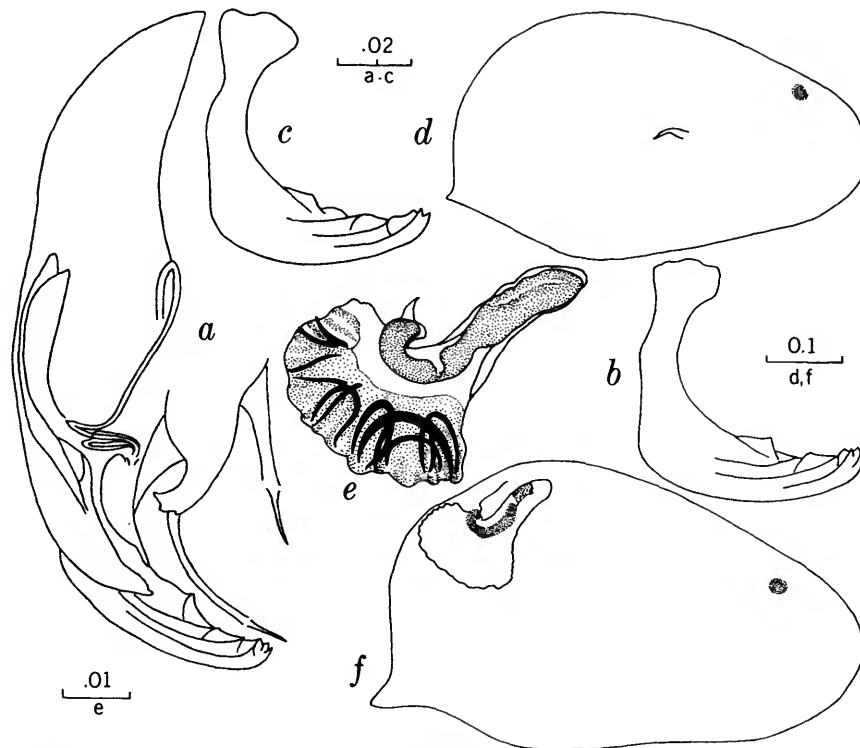


FIGURE 10.—*Dactylocythere daphnioides* from Ashe County: *a*, copulatory complex of male; *b*, clasping apparatus of male; *c*, same (Iredell County); *d*, shell of male; *e*, female genitalia; *f*, shell of female (scales in mm).

nessee and Pee Dee drainage systems in North Carolina northward to the New and Big Sandy systems in Virginia and West Virginia. The Kentucky and Missouri localities cited by Hart and Hart (1974:56) should be confirmed.

**NORTH CAROLINA RECORDS.**—Twenty-seven localities in the Mountain and upper Piedmont provinces in headwaters of the Pee Dee, Catawba, Little Tennessee, French Broad, Nolichucky, Watauga, and New rivers. Hart and Hart (1974:56) recorded it from several localities in Alleghany and Ashe counties as well as from Avery, Transylvania, and Watauga counties.

**HOSTS.**—*Cambarus (C.) bartonii*, *C. (H.) chasmodactylus*, *C. (H.) longirostris*, *C. (H.) longulus*, *C. (J.) asperimanus*, *C. (P.) reburrus*, *C. (P.) robustus*, and *C. (P.)* sp. C.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *Dactylocythere chelomata*, *Dt. falcata*, *Dt. megadactylus*, *Dt. runki*, *Dt. striophylax*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Dn. leptodrilus*, *Entocythere dentata*, *E. harrisi*, *E. reddelli*, *Litocythere lucileae*, and *Ucinocythere simondsi*.

### *Dactylocythere falcata* (Hobbs and Walton)

FIGURE 11, MAP 3

*Entocythere falcata* Hobbs and Walton, 1961:379–381, figs. 2, 3, 7, 8.

*Dactylocythere falcata*.—Hart, 1962:130.—Hart and Hart, 1974:58–59, pl. 15: figs. 1–5; pl. 49 [in part?].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.37–0.47 (0.44); ♀, 0.46–0.48 (0.47). Shell height: ♂, 0.23–0.27 (0.25); ♀, 0.25–0.29 (0.27). Shell (Figure 11*d,e*) without posteroventral prominence. Sternal spine slightly curved and directed posteriorly or posteroventrally. Ventral extremity of peniferum (Figure 11*a*) directed anteroventrally, subtruncate, with width of end of peniferal groove as wide as least diameter of vertical ramus of clasping apparatus. Accessory groove complex, extending dorsally much beyond spermatic loop, almost half distance between dorsal extremity of loop and dorsal margin of peniferum. Finger guard comparatively slender, concave posteriorly and subtruncate distally with 2 short terminal lobes, posterior one sometimes sub-

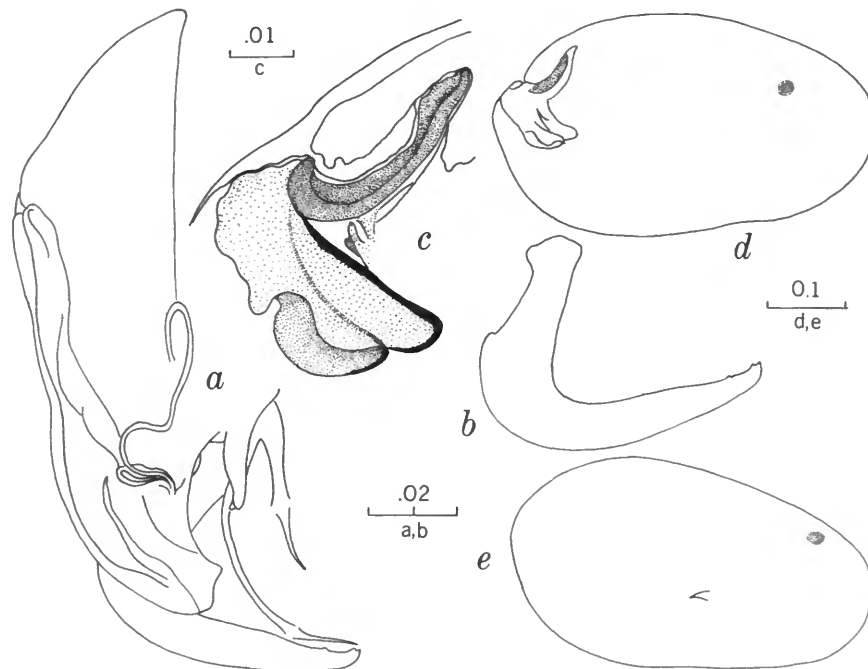


FIGURE 11.—*Dactylocythere falcata* from Yancey County: *a*, copulatory complex of male; *b*, clasper of male; *c*, female genitalia; *d*, shell of female; *e*, shell of male (scales in mm).

angular. Clasping apparatus (Figure 11*b*) with angular shoulder on postaxial border of vertical ramus near midlength; junction of rami not thickened, and posteroventral margin rounded; preaxial border of horizontal ramus entire or with minute denticle near base of distal sixth; apex of ramus with or without two minute denticles. Female genitalia consisting of J-shaped rod and alariform amiculum (Figure 11*c,d*).

**TYPE-LOCALITY.**—Small spring-fed creek, 3.0 miles (4.8 km) south of Charleston, Bradley County, Tennessee, on U.S. Highway 11; host: *Cambarus (H.) longirostris*.

**RANGE.**—From the Coosa River drainage in Georgia and northeastern Alabama to the Tennessee Basin in Virginia, and east of the Appalachian Divide in the upper James and Roanoke drainage systems in Virginia. The records from Missouri and Canada cited by Hart and Hart (1974:58,59) should be confirmed.

**NORTH CAROLINA RECORDS.**—Three localities in the Mountain Province. **HIWASSEE BASIN.** CHEROKEE COUNTY: (1) 6.9 mi (11.1 km) E of Tennessee line on U.S. Hwy 64 (hosts: *C. (J.) nodosus*, *C. (P.)* sp. D; associate: *Dt. leptophylax*); **CLAY COUNTY:** (2) Steve Branch, 3 mi (4.8 km) S Tuni Gap on Hayesville-Andrews Rd (hosts: *C. (C.) bartonii*; no associate). **NOLICHUCKY BASIN.** MITCHELL-YANCEY county line: (3) Big Crabtree Creek, 2.3 mi (3.7 km) N St Rte 19 on Co Rd 1002 (hosts: *C. (H.) longirostris*, *C. (P.) robustus*; associates: *Dt. daphnioides*, *Dt. runki*, *Dn. donnaldsonensis*).

**HOSTS.**—*Cambarus (C.) bartonii*, *C. (H.) longirostris*, *C. (J.) nodosus*, *C. (P.) robustus*, and *C. (P.)* sp. D.

**ENTOCYTHERID ASSOCIATES.**—*Dactylocythere daphnioides*, *Dt. leptophylax*, *Dt. runki*, and *Donnaldsoncythere donnaldsonensis*.

### *Dactylocythere isabelae*, new species

FIGURE 12, MAP 9

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.43–0.46 (0.44); ♀, 0.47–0.50 (0.49). Shell height: ♂, 0.22–0.26 (0.24); ♀, 0.27–0.31 (0.29). Shell without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum directed anteroventrally, acute, and width of end of peniferal groove as great as least diameter of vertical ramus of clasping apparatus. Accessory groove rather complex dorsally

and extending to level of dorsal margin of spermatid loop. Finger guard heavy, distally bifid, with prominent caudal bulge (approaching that of *Dt. megadactylus*). Clasping apparatus with shoulder on postaxial border of vertical ramus; junction of rami not conspicuously thickened; preaxial border of horizontal ramus with teeth restricted to 2 small ones no larger than, and immediately proximal to, 3 apical denticles.

**MALE.**—Eye situated between one-fourth and one-fifth shell length from anterior margin. Shell (Figure 12*d*) subovate with greatest height posterior to midlength; ventral margin very gently curved; submarginal setae distinctly more abundant anteriorly and posteriorly than ventrally, and absent dorsally.

Copulatory complex (Figure 12*a,b*) with clasping apparatus extending ventrally beyond ventral extremity of peniferum. Peniferum tapering ventrally, with ventralmost portion terminating in acute tip directed almost cephalically. Peniferal groove broad, as wide as least diameter of vertical ramus of clasping apparatus. Penis situated at base of ventral fourth of peniferum, its length about equivalent to width of peniferum at level of penis. Finger guard massive, with bifid ventral extremity, and very broad at level immediately dorsal to penis. Dorsal finger comparatively long and slender with distal setiform element bifid, ventral finger with single gentle curve, distal portion extending subparallel to ventral margin of peniferum. Accessory groove rather complex dorsally, reaching level of dorsal extremity of spermatid loop. Clasping apparatus C-shaped with angular shoulder on postaxial border of vertical ramus, otherwise both pre- and postaxial borders entire except for 2 small teeth on distal end of preaxial border no larger than, and grouped with, 3 terminal denticles.

**FEMALE.**—Eye situated about one-sixth shell length from anterior end. Shell (Figure 12*e*) subovate with greatest height near midlength, its ventral margin very weakly concave; submarginal setae as in male.

Genital apparatus (Figure 12*c*) consisting of comparatively long, slender tubular pendant suspended in posterodorsal part of body; differing from most members of genus in lacking amiculum and J-shaped rod.

**TYPE-LOCALITY.**—Crayfish burrows along spring-branch tributary to Lyle Creek (Catawba Basin),

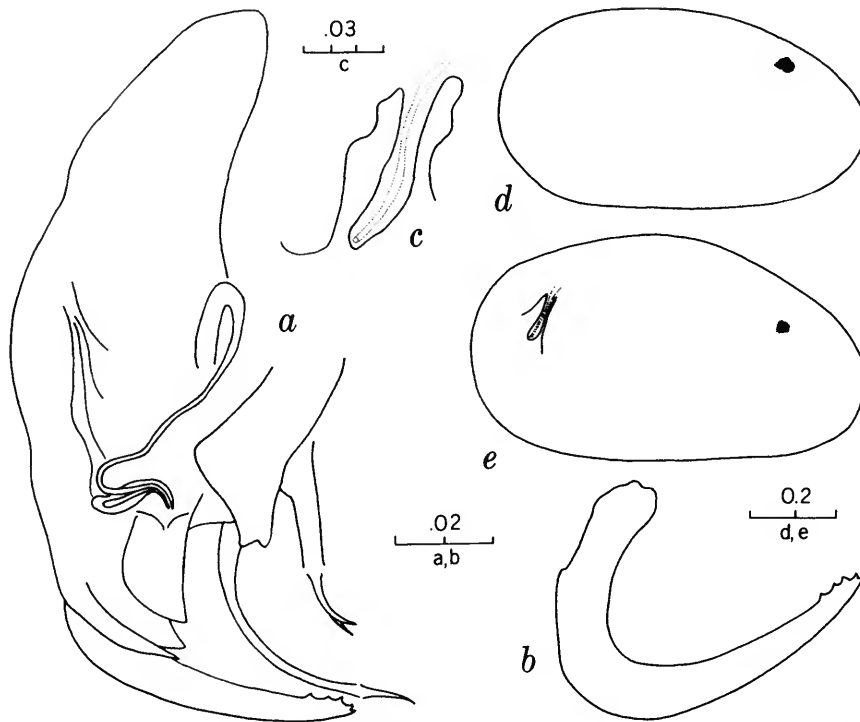


FIGURE 12.—*Dactylocythere isabelae*, new species, from type-locality: *a*, copulatory complex of holotype; *b*, clasping apparatus of holotype; *c*, genitalia of allotype; *d*, shell of holotype; *e*, shell of allotype (scales in mm).

2.5 miles (4.0 km) north of Conover, off State Route 16, Catawba County, North Carolina, on *Cambarus* (*D.*) sp. B, a crayfish closely allied to, if not conspecific with, *C. (D.) reduncus*.

**TYPES.**—The holotypic male and allotypic female are deposited in the National Museum of Natural History, Smithsonian Institution, numbers 155326 and 155327, respectively. Paratypes are in the British Museum, Smithsonian Institution, and in the collections of H. H. Hobbs III and the junior author.

**RANGE.**—This ostracod is known only from the type-locality, located in the Piedmont Province of North Carolina.

**NORTH CAROLINA RECORDS.**—Known only from the type-locality.

**HOST.**—*Cambarus (Depressicambarus)* sp. B.

**ENTOCYTHERID ASSOCIATE.**—*Ankylocythere ancyla*.

**RELATIONSHIPS.**—*Dactylocythere isabelae* seems to

share more features with *Dt. chelomata*, *Dt. jeanae*, *Dt. megadactylus*, and *Dt. suteri* than with most of its congeners. None of those listed has a sternal spine. All except *Dt. megadactylus* have a C-shaped clasping apparatus with reduced denticles, and the latter has a massive finger guard very similar to that of *Dt. isabelae*. Differing from all of them, the female of the latter lacks a J-shaped rod and an amiculum. It and *Dt. chelomata* have an acute anteroventral extremity of the peniferum as opposed to a rounded one in *Dt. jeanae* and *Dt. suteri*, and the clasping apparatus of *Dt. chelomata* differs from that of *Dt. isabelae* in having a spine near midlength of the preaxial border of the horizontal ramus.

**ETYMOLOGY.**—This ostracod is named in honor of our mutual friend, Isabel Pérez Farfante, who has assisted us in our ostracod investigation on numerous occasions.

*Dactyloctenere jeanae* Hobbs

FIGURE 13, MAP 6

*Dactyloctenere jeanae* Hobbs, 1967:6-8, fig. 1g,h,i.—Hart and Hart, 1974:59-60, pl. 15: figs. 6-10; pl. 49.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.42-0.53 (0.48); ♀, 0.46-0.50 (0.48). Shell height: ♂, 0.24-0.28 (0.27); ♀, 0.27-0.32 (0.29). Shell (Figure 13c,e) without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum (Figure 13a) forming rounded lobe; aperture of peniferal groove subequal in diameter to least diameter of vertical ramus of clasping apparatus. Accessory groove simple, extending dorsally approximately to level of dorsal margin of spermatic loop. Finger guard moderately slender, almost straight and with notched distal extremity. Clasping apparatus (Figure 13b) with angular or rounded prominence on posterior margin of vertical ramus; junction of rami not thickened and posteroventral margin rounded;

preaxial border of horizontal ramus with 2 teeth (distal one sometimes vestigial) along distal third of ramus; distal extremity with 3 apical denticles. Female genitalia consisting of curved rod and flared amiculum (Figure 13d,e).

TYPE-LOCALITY.—Roadside ditch in Virginia Beach on State Route 605 near Stumpy Lake, Princess Anne County, Virginia; host: *Cambarus* (*L.*) *d. diogenes*.

RANGE.—The Coastal Plain Province from the Neuse River system in North Carolina northward to the Maurice River drainage in New Jersey.

NORTH CAROLINA RECORDS.—Fifteen localities in the Inner Coastal Plain and Tidewater from the Neuse River system to the Chowan and Pasquotank river basins. ALLIGATOR BASIN. DARE COUNTY: (1) roadside ditch, 5.5 mi (8.9 km) W U.S. Hwy 264 on U.S. Hwy 64 (host: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates on former: *Ok. cheia*, *Or. waltonae*); TYRRELL COUNTY: (2) roadside ditch, 5.0 mi (8.1 km) W Dare Co line on U.S. Hwy 64 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. tiphophila*, *Ok. cheia*); WASHINGTON COUNTY: (3) roadside ditch, 4.0 mi (6.4 km) E Plymouth on

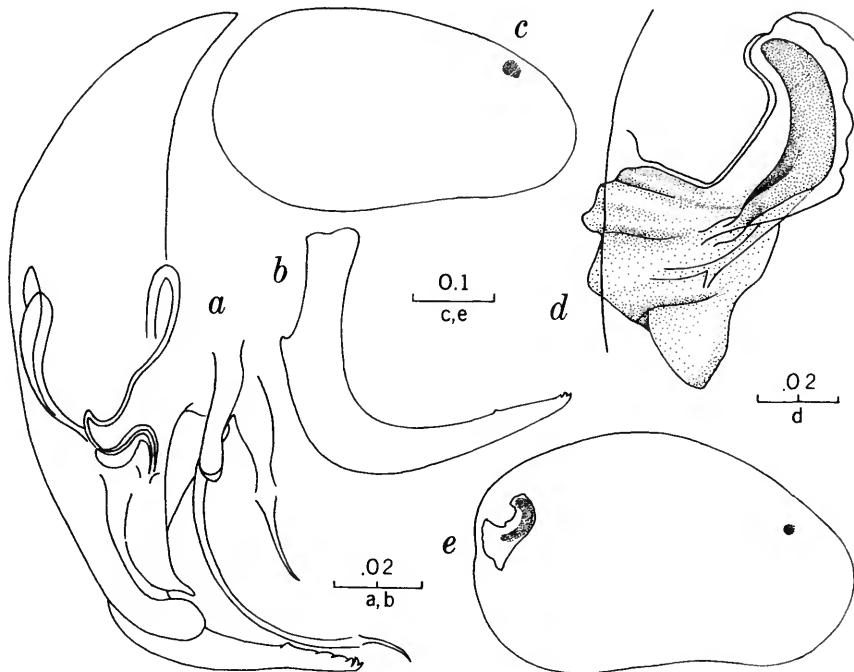


FIGURE 13.—*Dactyloctenere jeanae* (male from Washington County; female from Beaufort County): a, copulatory complex of male; b, clasping apparatus of male; c, shell of male; d, female genitalia; e, shell of female (scales in mm).

U.S. Hwy 64 (hosts: *C. (L.) d. diogenes*, *F. (C.) uhleri*, *P. (O.) a. acutus*; associates: *An. tiphophila*, *Ok. cheia*). CHOWAN BASIN. CHOWAN COUNTY: (4) roadside ditch, 1.2 mi (1.9 km) S Gates Co line on St Rte 32 (host: *C. (L.) d. diogenes*; no associate); (5) swamp stream, 2.6 mi (4.2 km) S Gates Co line on St Rte 32 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; no associate); HERTFORD COUNTY: (6) seepage area and creek, 1.1 mi (1.8 km) S Virginia line on U.S. Hwy 258 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. ancyla*, *E. harrisi*, *E. internotalus*, *Ok. cheia*); NORTHAMPTON COUNTY: (7) roadside ditch in Woodland (host: *C. (L.) d. diogenes*; associate: *Ok. cheia*). NEUSE BASIN. GREENE COUNTY: (8) 3.8 mi (6.1 km) N Snowhill on U.S. Hwy 258 (host: *C. (L.) d. diogenes*; associate: *An. ancyla*); WAYNE COUNTY: (9) Nahonta Swamp, 3.7 mi (6 km) S Freemont on U.S. Hwy 117 (host: *C. (L.) d. diogenes*; no associate). PAMLICO BASIN. BEAUFORT COUNTY: (10) roadside ditch N St Rte 264 on St Rte 32 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. ancyla*, *An. tiphophila*, *E. harrisi*, *Ok. cheia*); EDGECOMBE COUNTY: (11) roadside ditch, 2.2 mi (3.5 km) S St Rte 97 on U.S. Hwy 258 (host: *C. (L.) d. diogenes*; associate: *Ok. cheia*); HALIFAX COUNTY: (12) burrows adjacent to Deep Creek, 2 mi (3.2 km) S Scotland Neck on U.S. Hwy 258 (host: *C. (L.) d. diogenes*; no associate); HYDE COUNTY: (13) roadside ditch in Fairfield (host: *C. (L.) d. diogenes*; associates: *An. tiphophila*, *Ok. cheia*). PASQUOTANK BASIN. PASQUOTANK COUNTY: (14) roadside ditch 2.9 mi (4.7 km) NE Perquimans Co line on Co Rd 1001 (host: *C. (L.) d. diogenes*; associates: *Ok. cheia*, *Or. waltonae*). ROANOKE BASIN. BERTIE COUNTY: (15) roadside ditch, 8.8 mi (14.1 km) S Powellsville on U.S. Hwy 13 (host: *C. (L.) d. diogenes*; associate: *Ok. cheia*).

**HOSTS.**—*Cambarus (L.) diogenes diogenes*, *Falli-cambarus (C.) uhleri*, and *Procambarus (O.) acutus acutus*.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *An. tiphophila*, *Entocythere harrisi*, *E. internotalus*, *Okriocythere cheia*, and *Ornithocythere waltonae*.

### *Dactylocythere leptophylax* (Crawford)

FIGURE 14, MAP 10

*Entocythere leptophylax* Crawford, 1961:238-242, figs. 9-14.  
*Dactylocythere leptophylax*.—Hart, 1962:130.—Hart and Hart, 1974:61-62, pl. 16: figs. 1-5, pl. 48.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.36-0.42 (0.39); ♀, 0.36-0.41 (0.39). Shell height: ♂, 0.20-0.25 (0.23); ♀, 0.19-0.23 (0.22). Shell (Figure 14*d,e*) lacking posteroventral prominence. Sternal spine present. Ventral extremity of peniferum (Figure 14*a,g*) subtruncate to acute with subacute anteroventral angle and bearing 2 or 3 small tubercles on

ventral margin; peniferal groove not evident. Accessory groove simple and very short, not nearly reaching base of spermatic loop. Finger guard moderately slender to heavy and terminating in 1 to 3 prominences. Clasp apparatus (Figure 14*b,c,h,i*) strongly curved, lacking hump on postaxial border of vertical ramus; horizontal ramus thickened in proximal portion of distal third and bearing series of 6 small teeth along distal preaxial border, distalmost forming apex of clasp apparatus.

**TYPE-LOCALITY.**—East Fork of the Chattooga River at its junction with Indian Camp Creek, 21 miles (33.8 km) northwest of Walhalla, Oconee County, South Carolina; hosts: *Cambarus (C.) bartonii* and *C. (J.) asperimanus*.

**RANGE.**—From the Choctawhatchee River basin in Florida northward to the upper Savannah and Coosa drainage systems in South Carolina and Georgia, and in the Tennessee River system in southwestern North Carolina and eastern Tennessee.

**NORTH CAROLINA RECORDS.**—Confined to tributaries of the Hiwassee, Little Tennessee, and Savannah river basins in the Mountain Province. HIWASSEE BASIN. CHEROKEE COUNTY: (1) Rose Creek, 1.8 mi (2.9 km) off Beaver Dam Rd (hosts: *C. (C.) bartonii*, *C. (P.)* sp. D; no associates); (2) 6.9 mi (11.1 km) E Tennessee line on U.S. Hwy 64 (hosts: *C. (J.) nodosus*, *C. (P.)* sp. D; associate: *Dt. falcata*); (3) 1.6 mi (2.6 km) W U.S. Hwy 64 on St Rte 60 (host: *C. (J.) nodosus*; no associate); CLAY COUNTY: (4) Steve Branch, 3 mi (4.8 km) S Tuni Gap on Hayesville-Andrews Rd (host: *C. (C.) bartonii*; associates: *Dt. falcata*, *Dn. donaldsonensis*). LITTLE TENNESSEE BASIN. GRAHAM COUNTY: (5) creek, 0.6 mi (1 km) SW U.S. Hwy 129 on U.S. Hwy 19 (host: *C. (C.) bartonii*; no associate); MACON COUNTY: (6) Bald Forest Creek, W Otto, on paved road near Allen Mountain (host: *C. (C.) bartonii*; no associate). SAVANNAH BASIN. JACKSON COUNTY: (7) tributary to Whitewater River, 5.6 mi (9 km) S U.S. Hwy 64 on St Rte 107 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *Dt. prinsi*, *Dn. donaldsonensis*, *H. baileyi*).

**HOSTS.**—*Cambarus (C.) bartonii*, *C. (J.) asperimanus*, *C. (J.) nodosus*, and *C. (Puncticambarus)* sp. D.

**ENTOCYTHERID ASSOCIATES.**—*Dactylocythere falcata*, *Dt. prinsi*, *Donnaldsoncythere donaldsonensis*, *Harpagocythere baileyi*.

**REMARKS.**—There are rather conspicuous variations in the ventral portion of the peniferum and in the finger guard of the copulatory complex of the males. The peniferum may bear a shallow notch

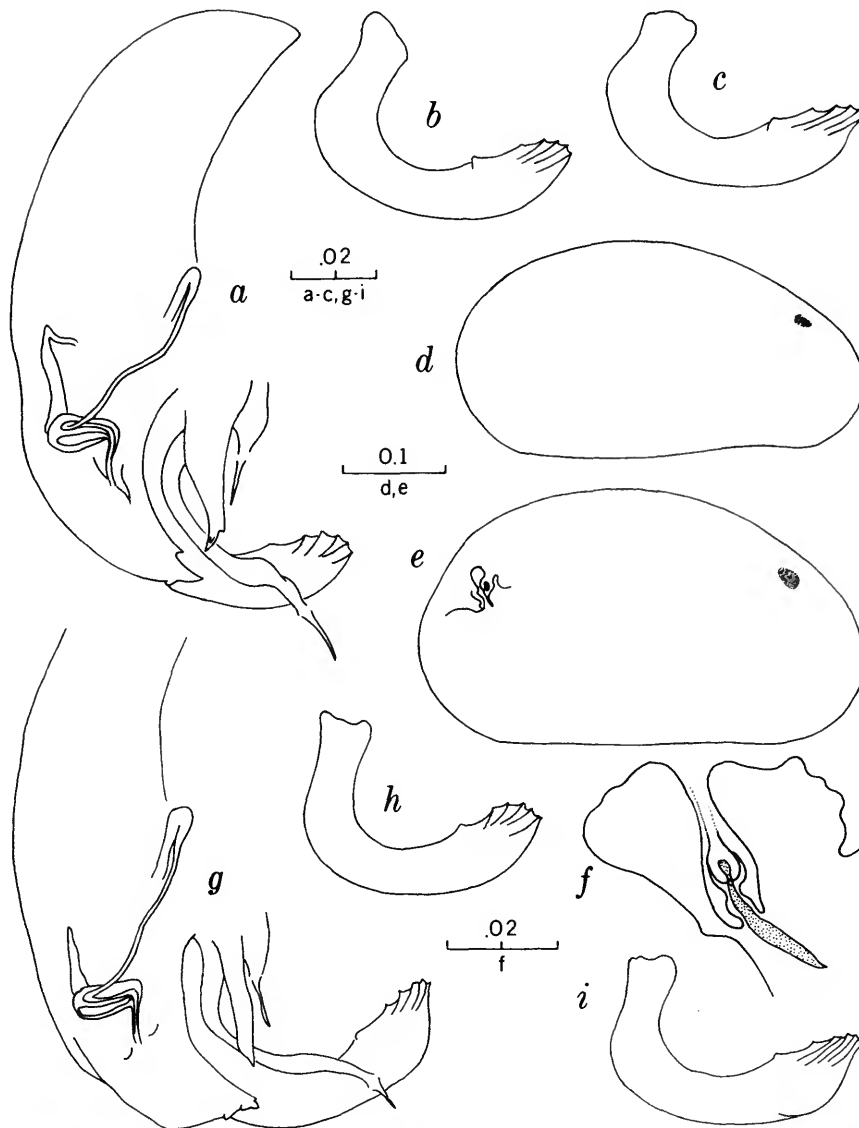


FIGURE 14.—*Dactylocythere leptophylax* (a,h, from Graham County; b-g,i, from Cherokee County): a, copulatory complex of male; b,c, claspings apparatus of male; d, shell of male; e, shell of female; f, female genitalia; g, copulatory complex of male; h, claspings apparatus of male; i, same (scales in mm).

at the anteroventral extremity or there may be a small anteapical, subspiniform tubercle on the anterior margin, or the anterior margin and angle may be entire. The finger guard may be rather sim-

ple, tapering to a single apex or it may be bifid or trifid. Entirely too few specimens are available to determine whether or not these variations are associated with a restricted portion of the range.



*Dactyloctenre megadactylus* Hart and Hart

FIGURE 15, MAP 7

*Dactyloctenre megadactylus* Hart and Hart, 1971:110-111, fig. 5a-e.—Hart and Hart, 1974:63-64, pl. 17: figs. 6-10, pl. 48.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.48-0.53 (0.50); ♀, 0.49-0.54 (0.53). Shell height: ♂, 0.27-0.30 (0.28); ♀, 0.30-0.34 (0.32). Shell (Figure 15f,g) without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum (Figure

15a) directed anteroventrally, tapering to subacute apex; width of extremity of peniferal groove slightly greater than half least diameter of vertical ramus of clasping apparatus. Accessory groove only moderately complex and reaching to, or slightly dorsal to, dorsal extremity of spermatic loop. Finger guard massive, its basal portion greatly expanded posteriorly; distal half of posterior margin broadly and weakly concave, and distal extremity rounded, shallowly bilobed, with posterior lobe much larger than anterior. Clasping apparatus (Figure 15 b-d) without shoulder or hump on postaxial

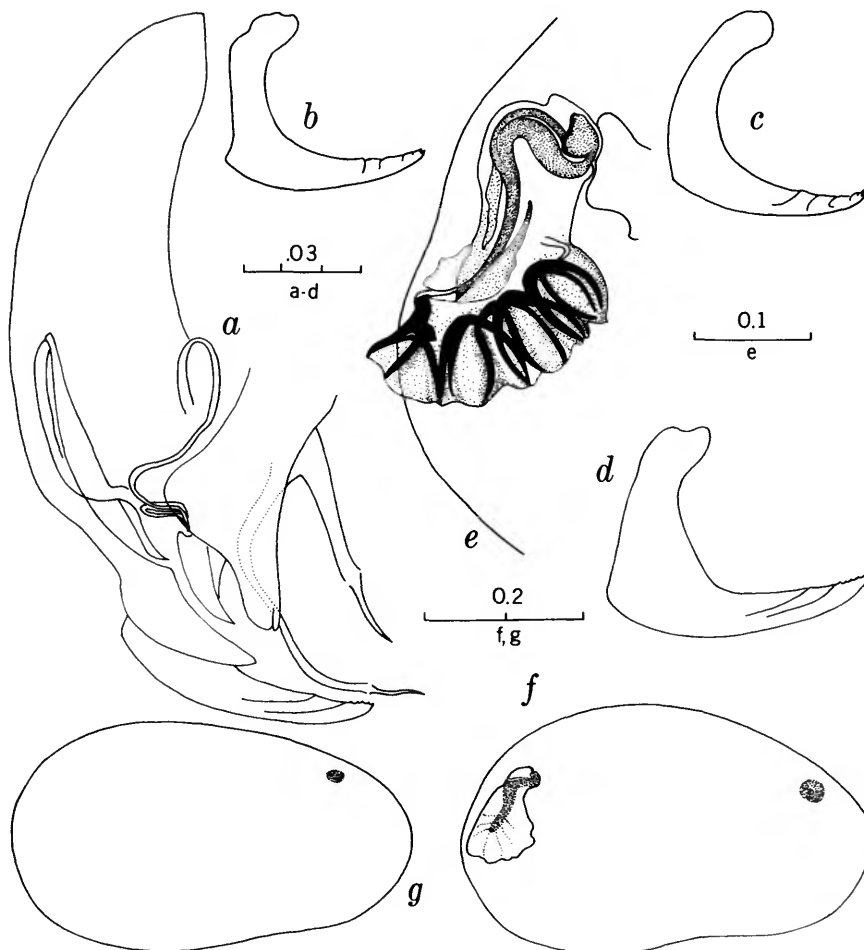


FIGURE 15.—*Dactyloctenre megadactylus* (a,d,g, from Rowan County, b,c, from Rockingham County; e,f, from Davidson County): a, copulatory complex of male; b-d, clasping apparatus of male; e, female genitalia; f, shell of female; g, shell of male (scales in mm).

border of vertical ramus; junction of rami greatly thickened and posteroventral margin subangular; horizontal ramus with preaxial border bearing 1 to 4 slight elevations, or very small teeth, on distal third, set off basally by oblique lines on mesial surface of ramus, these followed by 3 apical denticles. Female genitalia (Figure 15e,f) consisting of undulating rod and flared amiculum.

**TYPE-LOCALITY.**—Tributary of the Yadkin River (Pee Dee Basin), 2.8 miles (4.5 km) northeast of Randolph-Davidson County line, Randolph County, North Carolina, on State Route 49; hosts: *Cambarus* (*P.*) sp. C. and *Procambarus* (*O.*) *a. acutus*.

**RANGE.**—In the Piedmont Province from the Broad River (Catawba Basin) in North Carolina northward to the James River in Virginia where it was reported in the Valley and Ridge Province by Hart and Hart (1974:64) in Botetourt County.

**NORTH CAROLINA RECORDS.**—Thirty-seven localities in the Catawba, Pee Dee, Cape Fear, and Roanoke drainage systems in which it is confined to the Piedmont Province. Hart and Hart (1974:64) reported it from three localities, one each in Randolph, Rowan, and Yadkin counties.

**HOSTS.**—*Cambarus* (*C.*) *bartonii*, *C. (C.)* sp. A., *C. (D.) latimanus*, *C. (D.) reduncus*, *C. (H.) longulus*, *C. (J.) asperimanus*, *C. (P.) reburrus*, *C. (P.)* sp. C., and *Procambarus* (*O.*) *a. acutus*.

**ENTOCYOTHERID ASSOCIATES.**—*Ankylocythere ancyra*, *An. telmoecea*, *Dactylocythere daphnioides*, *Dt. peedeensis*, *Dt. runki*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Dn. leptodrilus*, *Entocythere harisi*, *E. internotalus*, *E. reddelli*, *Litocythere lucileae*, and *Uncinocythere simondsi*.

**REMARKS.**—The only conspicuous variation noted in this species is in the development of the postaxial angular junction of the horizontal and vertical rami of the clasping apparatus of the male. In some specimens it is produced posteriorly in an acute or subacute prominence (Figure 15b); in others (Figures 15c,d) the junction is angular or subangular but lacking a prominence. Although one of the two types seems to predominate in a local population, such proportions are not limited to a specific part of the range of the species.

### *Dactylocythere peedeensis*, new species

FIGURE 16, MAP 8

**DIAGNOSIS.**—Shell length in mm (numbers in

parentheses represent averages): ♂, 0.48–0.51 (0.49); ♀, 0.49–0.53 (0.52). Shell height: ♂, 0.28–0.30 (0.30); ♀, all estimated at 0.31–0.32 (0.32). Shell usually with weak posteroventral prominence. Sternal spine usually discernible, subspiculiform. Ventral extremity of peniferum rounded; width of ventral extremity of peniferal groove subequal to least diameter of vertical ramus of clasping apparatus. Accessory groove complex proximally with broad lobe subtruncate and reaching level of dorsal margin of spermatic loop. Finger guard massive, simple distally, its posterior margin weakly concave. Clasping apparatus with subangular prominence on postaxial margin of vertical ramus; junction of rami not thickened, and postaxial junction of rami rounded; preaxial border of slender horizontal ramus with 4 elevations, or small teeth, on distal third set off basally by oblique lines on mesial surface of ramus; elevations not appreciably lower distally; apex of ramus with 2 apical denticles.

**MALE.**—Eye situated between one-fourth and one-fifth shell length from anterior margin. Shell (Figure 16c–e) subtriangular with greatest height distinctly posterior to midlength, and usually bearing small posteroventral prominence; ventral margin slightly concave; submarginal setae present around entire margin, somewhat closer together anteriorly and posteriorly than dorsally and ventrally.

Copulatory complex (Figure 16a,b) with clasping apparatus extending ventrally beyond ventral extremity of peniferum. Latter tapering ventrally, with ventralmost portion terminating in rounded lobe directed cephaloventrally. Peniferal groove broad, as wide as least diameter of vertical ramus of clasping apparatus and with rounded membranous lobe inserted between sclerotized areas flanking groove. Penis situated at base of ventral third of peniferum, its length slightly less than width of peniferum at level of penis. Finger guard massive, somewhat tapered ventrally and not conspicuously broad at level immediately dorsal to penis. Dorsal finger comparatively long and slender with distal setiform element simple; ventral finger gently curved throughout its length. Accessory groove rather complex dorsally, subtruncate part reaching level of dorsal extremity of spermatic loop. Clasping apparatus C-shaped with subangular shoulder on postaxial border of vertical ramus, otherwise remainder of postaxial border entire;

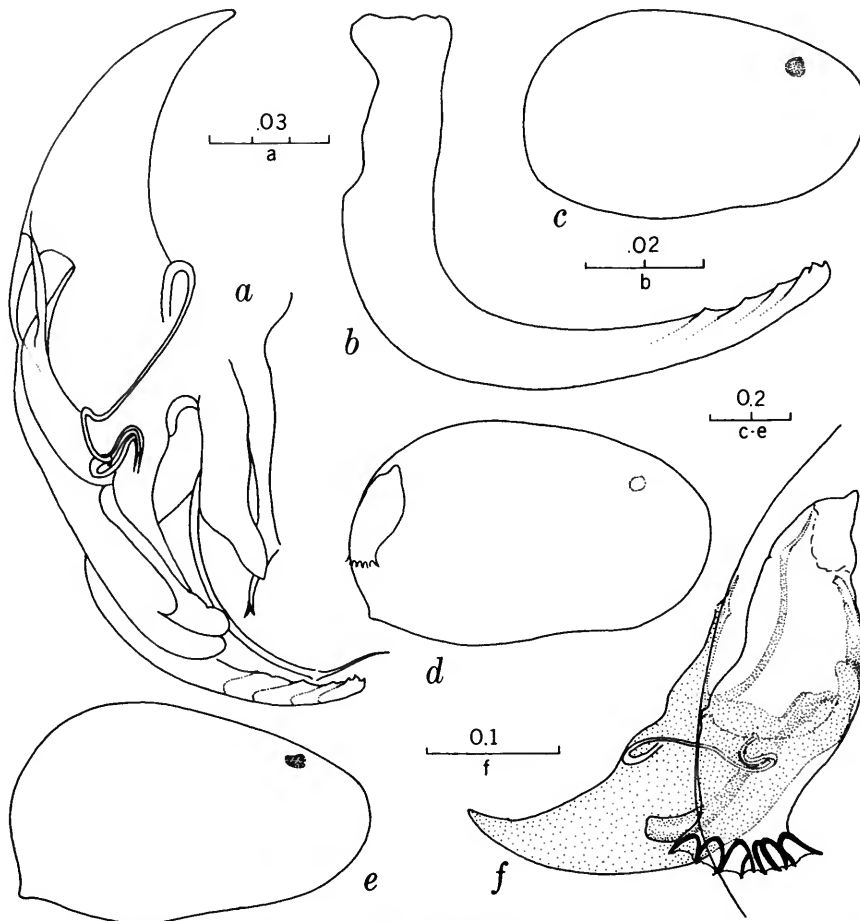


FIGURE 16.—*Dactylocythere peedeensis*, new species (*a,b,d,f*, from Randolph County; *c,e*, from Cabarrus County): *a*, copulatory complex of holotype; *b*, clasping apparatus of same; *c*, shell of paratypic male; *d*, shell of paratypic female; *e*, shell of paratypic male; *f*, genitalia of allotype and copulatory complex of paratypic male during amplexus (male elements stippled). (Scales in mm.)

distal third of preaxial border of horizontal ramus with 4 low elevations (small teeth) set off basally by oblique lines on mesial surface of ramus, elevations subequal in size and closely followed by 2 apical denticles.

**FEMALE.**—Eye situated about one-fifth shell length from anterior end. Shell (Figure 16*d*) subovate with greatest height distinctly posterior to midlength and bearing small posteroventral prominence; ventral margin more distinctly concave than in male; submarginal setae disposed as in male.

Genital apparatus (Figure 16*d,f*) with J-shaped rod only slightly curved and amiculum with rather short ventral portion flared, supported by U- or V-shaped thickenings. (The only specimen available in which the apparatus is not damaged by crushed shell is that illustrated. Very unusual is the participation of a triunguis female in a copulating pair, and in this illustration the stippled portion is the copulatory complex of the male. The finger guard of the latter is not included because of its over-

lying the dorsal finger and its outline being distorted by refraction from the shell margin.)

**TYPE-LOCALITY.**—Tributary to Little River (Pee Dee Basin) 1.0 mile (1.6 km) south of Seagrove on U.S. Highway 220, Randolph County, North Carolina; host: *Cambarus* (*P.*) sp. C.

**TYPES.**—The holotypic male, no. 155328, allotypic female and paratypic male, no. 155329, are deposited in the National Museum of Natural History, Smithsonian Institution. Paratypes are in the Smithsonian Institution and in the collections of H. H. Hobbs III and the junior author.

**RANGE.**—This ostracod is known from only three localities in the Pee Dee drainage system of North Carolina, all situated within the Piedmont Province of the State.

**NORTH CAROLINA RECORDS.**—PEE DEE BASIN. RANDOLPH COUNTY: (1) Type-locality (host: *C. (P.)* sp. C; associates: *An. ancyla*, *An. tiphophila*, *Dt. suteri*); CABARRUS COUNTY: (2) Coddle Creek, 4 mi (6.4 km) SW Concord on U.S. Hwy 29 (hosts: *C. (P.)* sp. C., *P. (O.) a. acutus*; no associates); UNION COUNTY: (3) Rocky River, 1.7 mi (2.7 km) NE Brief on Co Rd off U.S. Hwy 601 (hosts: *C. (P.)* sp. C, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. megadactylus*, *Dt. suteri*).

**HOSTS.**—*Cambarus* (*Puncticambarus*) sp. C and *Procambarus* (*O.*) *acutus acutus*.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere megadactylus*, and *Dt. suteri*.

**ETYMOLOGY.**—This ostracod bears the name of the Pee Dee River basin to which it is apparently confined.

**RELATIONSHIPS.**—There seems to be little doubt that *Dactylocythere peedeensis* is closely allied to *Dt. suteri*, *Dt. chelomata*, and *Dt. jeanae*, and more distinctly to *Dt. isabellae* and *Dt. megadactylus*. Most individuals may be distinguished from all of these species by possessing a small posteroventral prominence on the shell, in this respect resembling the shell of *Dt. daphnioides*. It is larger than all except some members of *Dt. megadactylus* (from which it can be distinguished by the distinctly slenderer finger guard and the rounded postaxial border of the junction of the rami of the clasping apparatus) and *Dt. jeanae* (from which it can be separated by the membranous lobe at the anteroventral extremity of the peniferum and by the more massive finger guard; in the female, the genital apparatus is more nearly vertical with the flared amiculum much shorter than in *Dt. jeanae*).

### *Dactylocythere prinsii* Hobbs and Walton

FIGURE 17, MAP 11

*Dactylocythere prinsii* Hobbs and Walton, 1968:242-243, fig. 2e-g.—Hart and Hart, 1974:66, pl. 18: figs. 8-10; pl. 49.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.39-0.41 (0.40). Shell height: ♂, 0.22-0.23 (0.22). Female unknown. Shell (Figure 17c) without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum (Figure 17a) rounded, and width of extremity of peniferal groove no greater than least diameter of vertical ramus of clasping apparatus. Accessory groove simple and short, not nearly reaching dorsal margin of spermatic loop. Finger guard very slender, only slightly concave posteriorly, and with finger-like distal extension. Clasping apparatus (Figure 17b) with postaxial margin of vertical ramus slightly bowed; junction of rami little thickened with posteroventral margin somewhat angulate; preaxial border of horizontal ramus with 3 well defined teeth along distal two-thirds; distal extremity with 3 denticles.

**TYPE-LOCALITY.**—Whitewater River at State Route 107, Jackson County, North Carolina; hosts: *Cambarus* (*C.*) *bartonii* and *C.* sp.

**RANGE.**—Known from only two localities in the Savannah River system (Mountain Province) in North Carolina.

**NORTH CAROLINA RECORDS.**—SAVANNAH BASIN. JACKSON COUNTY: (1) Type-locality (hosts: *C. (C.) bartonii*, and *C.* sp.; associate: *H. baileyi*); (2) creek 5.6 mi (9.0 km) S of U.S. Hwy 64 on St Rte 107 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *Dt. leptophylax*, *Dn. donaldsonensis*, *H. baileyi*).

**HOSTS.**—*Cambarus* (*C.*) *bartonii*, *C. (J.) asperimanus*, and *C.* sp.

**ENTOCYTHERID ASSOCIATES.**—*Dactylocythere leptophylax*, *Donaldsoncythere donaldsonensis*, and *Harpagocythere baileyi*.

### *Dactylocythere runki* (Hobbs)

FIGURE 18, MAP 12

*Entocythere runki* Hobbs, 1955:330-332, figs. 3, 4, 10.—Ferguson, 1958:198.

*Dactylocythere runki*.—Hart, 1962:130.—Hart and Hart, 1974: 67-68, pl. 19: figs. 6-9; pl. 49.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.45-0.50 (0.48);

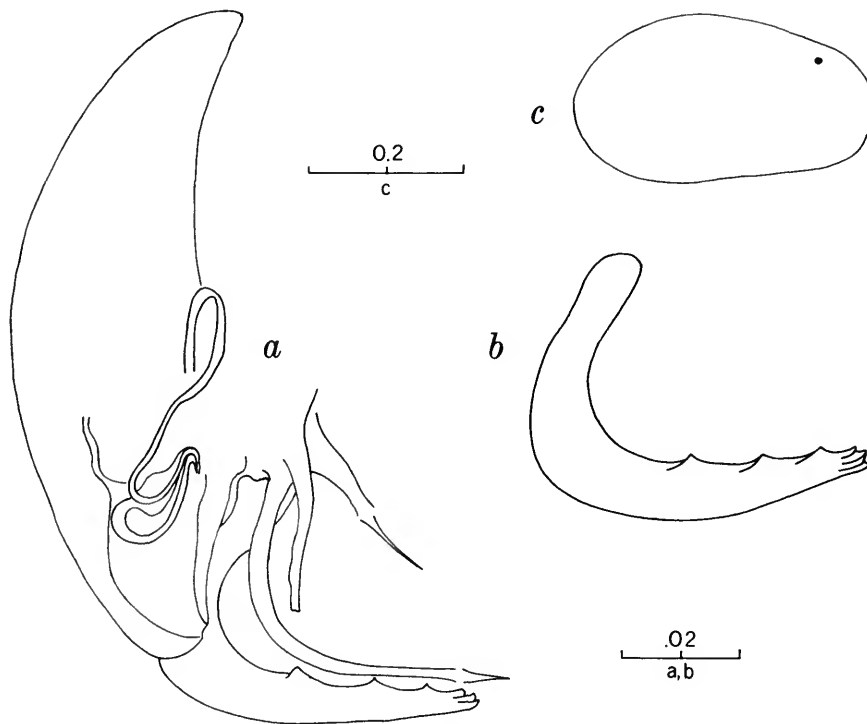


FIGURE 17.—*Dactylocythere prinsi* from Jackson County: *a*, copulatory complex of male; *b*, clasping apparatus of male; *c*, shell of male (scales in mm).

♀, 0.49–0.53 (0.51). Shell height: ♂, 0.27–0.29 (0.28); ♀, 0.29–0.32 (0.31). Shell (Figure 18*d,f*) without posteroventral prominence. Sternal spine arched dorsally and directed posteriorly or posteroventrally. Ventral extremity of peniferum (Figure 18*a*) directed anteroventrally, tapering to subacute apex; width of extremity of peniferal groove as great, or greater than, least diameter of vertical ramus of clasping apparatus. Accessory groove complex and extending dorsally slightly beyond dorsal margin of spermatic loop. Finger guard comparatively slender, concave posteriorly and with 2 apical, posteroventrally directed subacute prominences. Clasping apparatus (Figure 18*b,c*) with posterior margin of vertical ramus slightly arched or with weak hump near midlength; junction of rami somewhat thickened with posteroventral margin rounded; preaxial border of horizontal ramus with 1 strong tooth at or slightly proximal to midlength and 1 or 2 additional teeth or elevations along distal half of ramus (set off basally by oblique lines

on mesial surface), followed by 3 apical denticles. Female genitalia (Figure 18*d,e*) consisting of J-shaped rod and flared amiculum.

**TYPE-LOCALITY.**—Tributary to the New River, 15.9 miles (25.6 km) southwest of Galax on Blue Ridge Parkway, Alleghany County, North Carolina; hosts: *Cambarus* (*C.*) sp. A., *C. (H.) chasmodactylus*, and *C. (P.) robustus*.

**RANGE.**—West of the Appalachian Divide, from the Little Tennessee drainage system in North Carolina to the New River system in Virginia; east of the Appalachian Divide in the Catawba and Roanoke basins.

**NORTH CAROLINA RECORDS.**—Twenty-one localities in the Mountain and upper Piedmont provinces, in the headwaters of the Little Tennessee, French Broad, Nolichucky, Catawba (Broad), Watauga, New, and Roanoke rivers. Previous records cited by Hobbs (1955) and Hart and Hart (1974) do not include the French Broad, Nolichucky, Broad, or Roanoke drainages.

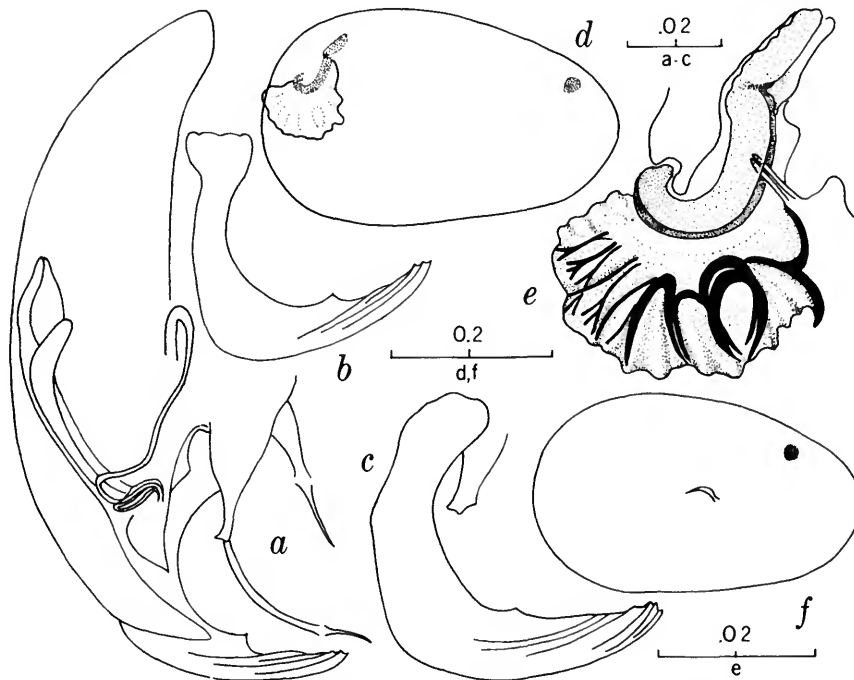


FIGURE 18.—*Dactylocythere runki* (a,b,d,f, from Alleghany County; c, from Swain County; e, from Watauga County): a, copulatory complex of male; b,c, clasp apparatus of male; d, shell of female; e, female genitalia; f, shell of male (scales in mm).

**HOSTS.**—*Cambarus* (*C.*) *bartonii*, *C.* (*C.*) sp. A, *C.* (*H.*) *chasmodactylus*, *C.* (*H.*) *longirostris*, *C.* (*H.*) *longulus*, *C.* (*P.*) *robustus*, and *C.* (*P.*) sp. C.

**ENTOCYOTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere daphnioides*, *Dt. falcata*, *Dt. megadactylus*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, and *Dn. leptodrilus*.

### *Dactylocythere striophylax* (Crawford)

FIGURE 19, MAP 8

*Entocythere striophylax* Crawford, 1959:157–162, figs. 10–17.  
*Dactylocythere striophylax*.—Hart, 1962:131.—Hart and Hart, 1974:71, pl. 21: figs. 1–5; pl. 48.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.40–0.46 (0.43); ♀, 0.46–0.48 (0.47). Shell height: ♂, 0.23–0.28 (0.26); ♀, 0.27–0.32 (0.29). Shell (Figure 19c,d) without posteroventral prominence. Sternal spine lack-

ing. Ventral extremity of peniferum (Figure 19a) rounded and shallowly emarginate; width of extremity of peniferal groove much less than least diameter of vertical ramus of clasp apparatus. Accessory groove simple, extending almost as far dorsally as dorsal margin of spermatic loop. Finger guard comparatively heavy, its posterior margin concave, and broadly truncate but slightly emarginate distally. Clasp apparatus (Figure 19b) with vertical ramus slightly arched posteriorly and lacking prominence on postaxial border; junction of rami not thickened and posteroventral margin rounded; preaxial border of horizontal ramus without teeth but with annulations in distal fourth, distalmost annulations sometimes elevated, resembling denticles. Female genitalia (Figure 19d,e) with bowed rod and flared amiculum.

**TYPE-LOCALITY.**—Cedar Creek at State Route 215, about 9.6 miles (15.5 km) north-northeast of city limits of Columbia, Richland County, South Caro-

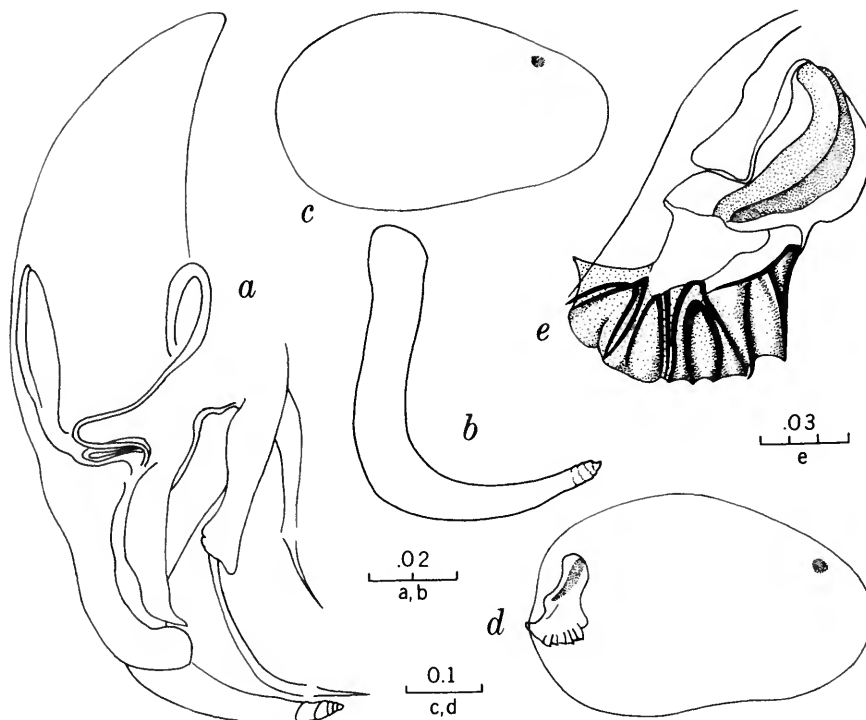


FIGURE 19.—*Dactylocythere striophylax* (a,c-e, from Cleveland County; b, from Scotland County): a, copulatory complex of male; b, clasper apparatus of male; c, shell of male; d, shell of female; e, female genitalia (scales in mm).

lina; hosts: *Cambarus* (*C.*) *bartonii*, *C.* (*D.*) *latimanus*, *C.* (*P.*) *spicatus* Hobbs (1956b:116), and *Procambarus* (*O.*) *a. acutus*.

RANGE.—From the Savannah Basin in South Carolina to the Pee Dee drainage system in North Carolina; also in the French Broad watershed of North Carolina.

NORTH CAROLINA RECORDS.—Confined to the Mountain and Piedmont provinces. CATAWBA BASIN. CLEVELAND COUNTY: (1) Potts Creek on Oak Ground Road, Co Rd 1001 (host: *C.* (*P.*) sp. C; no associate); (2) tributary to Buffalo Creek, 4 mi (6.4 km) N Shelby on St Rte 150 (hosts: *C.* (*C.*) sp. A, *C.* (*P.*) sp. C; associates: *An. tiphophila*, *Dt. suteri*, *E. harrisi*); (3) tributary to Buffalo Creek on Co Rd 274 (host: *C.* (*P.*) sp. C; no associate); McDOWELL COUNTY: (4) creek, 5.3 mi (8.5 km) S I-40 on Sugar Hill Rd, S of Marion (hosts: *C.* (*C.*) *bartonii*, *C.* (*P.*) sp. C; associate: *E. reddelli*); RUTHERFORD COUNTY: (5) Cane Creek, 1.3 mi (2.1 km) S McDowell Co line on U.S. Hwy 64 (host: *C.* (*P.*) sp. C; associate: *Dn. donnaldsonensis*). FRENCH BROAD BASIN. HAYWOOD COUNTY: (6) Homing Creek, 1.7 mi (2.7 km) E Canton on U.S. Hwy 19 (host: *C.* (*C.*) *bartonii*; associates: *Dt. daphnioides*, *Dn. donnaldsonensis*, *E. reddelli*); TRANSYLVANIA COUNTY: (7) tributary to

French Broad River, 4 mi (6.4 km) E Brevard on U.S. Hwy 64 (hosts: *C.* (*C.*) *bartonii*, *C.* (*J.*) *asperimanus*; associates: *Dn. donnaldsonensis*, *U. simonds*). PEE DEE BASIN. SCOTLAND COUNTY: (8) Shoe Heel Creek, 2 mi (3.2 km) SW Wagram on U.S. Hwy 15 (host: *P.* (*O.*) *a. acutus*; associate: *Dn. donnaldsonensis*).

HOSTS.—*Cambarus* (*C.*) *bartonii*, *C.* (*C.*) sp. A, *C.* (*J.*) *asperimanus*, *C.* (*P.*) sp. C, and *Procambarus* (*O.*) *a. acutus*.

ENTOCYTHERID ASSOCIATES.—*Ankylocythere tiphophila*, *Dactylocythere daphnioides*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Entocythere harrisi*, *E. reddelli*, and *Ucinocythere simonds*.

### *Dactylocythere suteri* (Crawford)

FIGURE 20, MAP 10

*Entocythere suteri* Crawford, 1959:162-167, figs. 18-23.

*Dactylocythere suteri*.—Hart, 1962:131.—Hart and Hart, 1974: 47, 72-74, pl. 21: figs. 11-15; pl. 49.

DIAGNOSIS.—Shell length in mm (numbers in pa-

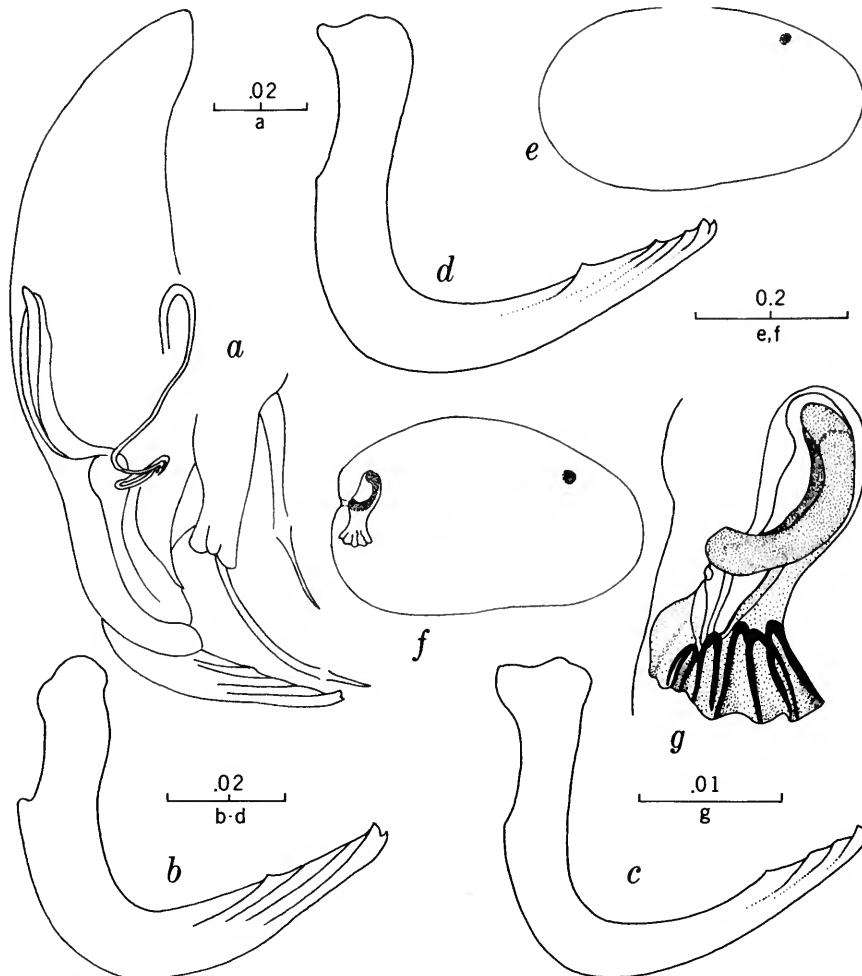


FIGURE 20.—*Dactylocythere suteri* (a,b,e,f, from Randolph County): a, copulatory complex of male; b, clasping apparatus of male; c, same, Wilkes County; d, same, Burke County; e, shell of male; f, shell of female; g, genitalia of female, Rowan County (scales in mm).

rentheses represent averages): ♂, 0.39–0.46 (0.43); ♀, 0.41–0.48 (0.45). Shell height: ♂, 0.24–0.28 (0.25); ♀, 0.27–0.32 (0.29). Shell (Figure 20e,f) without posteroventral prominence. Sternal spine absent. Ventral extremity of peniferum (Figure 20a) rounded and width of extremity of peniferal groove only slightly less than least diameter of vertical ramus of clasping apparatus. Accessory groove complex and extending dorsally approximately to level of dorsal margin of spermatic loop. Finger

guard heavy, its posterior margin not convex, and distal extremity trilobed with anterior lobe extending farther distally than others. Clasping apparatus (Figure 20b–d) with angular or rounded prominence on postaxial margin of vertical ramus; junction of rami not thickened, and posteroventral margin rounded; preaxial border of horizontal ramus bearing 3 or 4 elevations, or small teeth, on distal third set off basally by oblique lines on mesial surface of ramus, elevations progressively



lower distally; apex of ramus with 2 denticles. Female genitalia (Figure 20f,g) consisting of bowed rod and narrow amiculum.

**TYPE-LOCALITY.**—Twenty-five Mile Creek, 4.5 miles (7.2 km) east of Blythewood, Richland County, South Carolina; hosts: *Cambarus (D.) latimanus* and *C. (P.) acuminatus*.

**RANGE.**—From northern Georgia and McMinn County, Tennessee, northeastward to York County, Pennsylvania (see Hart and Hart, 1974:73).

**NORTH CAROLINA RECORDS.**—Fifty-one localities in the Mountain, Piedmont, and Inner Coastal Plain segments of the French Broad, Catawba, Pee Dee, Cape Fear, Neuse, Pamlico, and Roanoke basins. Hart and Hart (1974:73) cited six localities from the State.

**HOSTS.**—*Cambarus (C.) bartonii*, *C. (C.)* sp. A, *C. (D.) latimanus*, *C. (D.) reduncus*, *C. (H.) longulus*, *C. (J.) asperimanus*, *C. (L.) d. diogenes*, *C. (P.)* sp. C, and *Fallicambarus (C.) uhleri*.

**ENTOCYTERID ASSOCIATES.**—*Ankylocythere ancyra*, *An. telmoecia*, *An. tiphophila*, *Dactylocythere daphnioides*, *Dt. megadactylus*, *Dt. peedeensis*, *Dt. runki*, *Dt. striophylax*, *Donnaldsoncythere donnaldsonensis*, *Dn. leptodrilus*, *Entocythere harrisi*, *E. internotalus*, *E. reddelli*, *Okriocythere cheia*, and *Uncinocythere simondsii*.

### Genus *Donnaldsoncythere* Rioja, 1942

*Donnaldsoncythere* Rioja, 1942b:686.

**DIAGNOSIS.**—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum variously shaped, usually with acute, broadly rounded, or truncate, heavily sclerotized projection; accessory groove lacking. Penis large and heavily sclerotized, its length at least as great as anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasp apparatus reaching to or beyond ventral margin of peniferum and never with horizontal and vertical rami clearly defined; teeth on preaxial border grouped toward distal end, never with more than 2 separated by interval from apical denticles; total number of teeth and denticles ranging from 5 to 10; postaxial border entire. Female without pectinate appendix at base of apical claws of second antenna; genital complex consisting of strongly sclerotized tubular papilla.

**TYPE-SPECIES.**—*Entocythere donnaldsonensis* Klie, 1931:334.

**RANGE.**—Maine and Indiana southward to northern Georgia.

### Key to North Carolina Species of Genus *Donnaldsoncythere*

1. Anteroventral extremity of peniferum rounded and not produced in acute extension; diameter of distal half of penis distinctly more than half greatest diameter of proximal half ..... *donnaldsonensis*
- 1'. Anteroventral extremity of peniferum produced in acute extension; diameter of distal half of penis less than half that of greatest diameter of proximal half ..... *leptodrilus*

### *Donnaldsoncythere donnaldsonensis* (Klie)

#### FIGURE 21, MAP 4

*Entocythere donnaldsonensis* Klie, 1931:334–341, figs. 1–9.

*Entocythere donnaldsoni* Wolf, 1934–1938, 2:489 [erroneous spelling].

*Entocythere donnaldsonensis* Dobbin, 1941:185 [erroneous spelling].

*Entocythere (Cytherites) donnaldsonensis*.—Hoff, 1942:66, 69.

*Entocythere (Donnaldsoncythere) donnaldsonensis*.—Rioja, 1942b:688.

*Entocythere donaldsonensis* Rioja, 1943:568 [erroneous spelling].

*Entocythere (Cytherites) humesi* Hoff, 1943:282–285, fig. 2a–h. [Type-locality, stream near Boston, Erie County, New York. Host: *Cambarus (P.) robustus*.]

*Entocythere humesi*.—Hoff, 1944:331.—Hobbs, 1955:332.—Hart and Hart, 1974:78–80, pl. 23: figs. 11–14; pl. 50.

*Entocythere donnaldsonensis* Tressler, 1947:705 [erroneous spelling].

*Entocythere pennsylvanica* Hart, 1960:1–4, figs. 1–7. [Type-locality, Ridley Creek, 3/4 mile (1.2 km) SW of Goshenville, Delaware County, Pennsylvania; host: *Cambarus (C.) bartonii*.]

*Entocythere hiwasseeensis* Hobbs and Walton, 1961:381–384, figs. 1, 4–6. [Type-locality, stream 2.5 miles (4.0 km) E of Brasstown Bald, Towns County, Georgia. Hosts: *Cambarus (C.) bartonii* and *C. (Puncticambarus)* sp. D.]

*Entocythere tuberosa* Hart and Hobbs, 1961:182–184, figs. 29–32. [Type-locality, Upper Parrott Cave, 10 miles (16.1 km) NW of Livingston, Overton County, Tennessee. Host: *Cambarus (E.) tenebrosus* Hay, 1902:232.]

*Entocythere tuberculata* Hart and Hobbs, 1961:174 [erroneous spelling of *Entocythere tuberosa*].

*Donnaldsoncythere donnaldsonensis*.—Hart, 1962:131-132.—Hart and Hart, 1974:78-79, pl. 23: fig. 6; pl. 50.

*Donnaldsoncythere humesi*.—Hart, 1962:132.—Hart and Hart, 1974:79-80, pl. 23: figs. 11-14; pl. 50.

*Donnaldsoncythere pennsylvanica*.—Hart, 1962:132.—Hart and Hart, 1974:80-81, pl. 24: figs. 6-7; pl. 50.

*Donnaldsoncythere tuberosa*.—Hart, 1962:132.—Hart and Hart, 1974:77, 82, pl. 25: figs. 1, 2; pl. 50.

*Donnaldsoncythere hiwasseeensis*.—Hart, 1962:132.—Hart and Hart, 1974:77, 79, pl. 23: figs. 7-10; pl. 50.

*Donnaldsoncythere scalis* Hobbs and Walton, 1963:364-366, figs. 1-5, 25 [type-locality, Little Stony Creek, 2.8 miles (4.5 km) N of Mountain Lake Biological Station on State Route 613, Giles County, Virginia. Host: *Cambarus* (*C.*) *bartonii*].—Hart and Hart, 1974:77, 81, pl. 24: figs. 8-12; pl. 50.

*Donnaldsoncythere ileata* Hobbs and Walton, 1963:364, 366, figs. 11-15, 23 [type-locality, Greenbriar Branch at Newport, Giles County, Virginia. Host: *Cambarus* (*C.*) *bartonii*].—Hart and Hart, 1974:77, 80, pl. 24: figs. 1-5; pl. 50.

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.36-0.43 (0.40); ♀, 0.39-0.43 (0.41). Shell height: ♂, 0.21-0.25 (0.22); ♀, 0.23-0.26 (0.24). Anteroventral extremity

of peniferum produced in rounded or truncate lobe; penis massive, not tapering distally.

**TYPE-LOCALITY.**—Donaldson's Cave, Lawrence County, Indiana. Hosts unknown but probably *Orconectes inermis inermis* Cope (1872:419) and/or *Cambarus* (*Erebicambarus*) *tenebrosus* Hay (1902:232).

**RANGE.**—From northern Georgia to Indiana and Maine.

**NORTH CAROLINA RECORDS.**—Forty-six localities in the Mountain and Piedmont provinces in the following drainage systems: Hiwassee, Little Tennessee, French Broad, Nolichucky, Watauga, New, Savannah, Catawba, Pee Dee, and Roanoke.

**HOSTS.**—*Cambarus* (*C.*) *bartonii*, *C.* (*C.*) sp. A, *C.* (*D.*) *reduncus*, *C.* (*H.*) *chasmodactylus*, *C.* (*H.*) *longirostris*, *C.* (*J.*) *asperimanus*, *C.* (*J.*) *dubius*, *C.* (*P.*) *reburus*, *C.* (*P.*) *robustus*, *C.* (*P.*) sp. C, and *Procambarus* (*O.*) *a. acutus*.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancylla*, *Aphelocythere acuta*, *Cymocythere clavata*, *Dactylocythere chelomata*, *Dt. daphnioides*, *Dt. falcata*, *Dt. leptophylax*, *Dt. megadactylus*, *Dt. prinsi*,

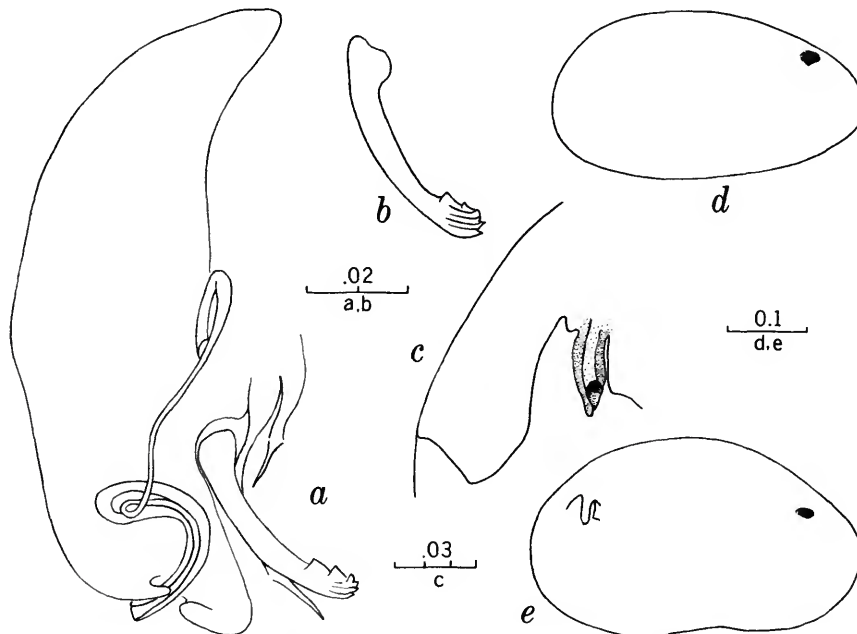


FIGURE 21.—*Donnaldsoncythere donnaldsonensis* from Clay County: a, copulatory complex of male; b, clasping apparatus of male; c, female genitalia; d, shell of male; e, shell of female (scales in mm).

*Dt. runki*, *Dt. striophylax*, *Dt. suteri*, *Entocythere dentata*, *E. harrisi*, *E. reddelli*, *Harpagocythere baileyi*, *Litocythere lucileae*, and *Urcinocythere simondsi*.

REMARKS.—With the acquisition of hundreds of locality records for members of the genus *Donnaldsoncythere*, it has become increasingly apparent that most of the species described since Klie named his *Entocythere donnaldsonensis* represent local variants of a single wide-spread species. At least part of the confusion surrounding the identity of Klie's species arose from the lack of detail in his description and illustrations as well as the apparent loss of his types. A broad range of local variations, including the absence of pigment in the eyes of at least some members of populations occurring in subterranean waters, added to our lack of understanding of this comparatively widely dispersed species. Upon comparisons of the several species here relegated to the synonymy of *Dn. donnaldsonensis* with specimens collected from a stream flowing from Donaldson's Cave and with numerous specimens from many localities within the range of the species, we are unable to distinguish between them. One of us (Peters, 1975:30) has already been convinced that whereas populations of this ostracod in the Mountain Lake area of Virginia assigned to *Dn. scalis* by Hobbs, Holt, and Walton (1967:39) seem to be distinct from *Dn. ileata*, elsewhere in the James River basin there exists a complete series of intermediate forms. Consequently, the former was relegated to synonymy with the latter. Here, the two, together with *Dn. humesi*, *Dn. pennsylvanica*, *Dn. hiwasseeensis*, and *Dn. tuberosa*, are considered to be conspecific with *Donnaldsoncythere donnaldsonensis*.

#### *Donnaldsoncythere leptodrilus*, new species

FIGURE 22, MAP 4

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.39–0.41 (0.39); ♀, 0.34–0.41 (0.39). Shell height: ♂, 0.20–0.24 (0.22); ♀, 0.21–0.25 (0.24). Anteroventral extremity of peniferum produced in acute projection; distal half of penis distinctly slender.

MALE.—Eye situated approximately one-fifth shell length from anterior margin. Shell (Figure 22f) subovate with greatest height near midlength;

ventral margin gently curved; submarginal setae present from level of eye anteriorly around ventral margin of shell and dorsally along posterior margin but not reaching quite so high as anteriorly.

Copulatory complex (Figure 22a–c,g) with clasping apparatus extending ventrally slightly beyond level of peniferum. Peniferum produced anteroventrally in complex prominence with acute extremity. Penis tapering rapidly from base and slender along distal two-thirds; least diameter of distal half of penis less than half that of greatest diameter of proximal half. Ventral finger varying from almost straight to gently curved. Clasping apparatus virtually straight along proximal three-fourths; distal fourth suddenly curved anteriorly, flared, and bearing 5 or 6 denticles.

FEMALE.—Eye situated as in male. Shell (Figure 22e) with greatest height near midlength; ventral margin slightly rounded. Submarginal setae distributed as in male. Genital apparatus (Figure 22d,e) consisting of sclerotized, tubular papilla.

TYPE-LOCALITY.—Middle Little River (Catawba Basin), 8.9 miles (14.3 km) east of Lenoir (junction of State routes 18 and 90) on Route 90, Caldwell County, North Carolina; hosts: *Cambarus* (C.) sp. A and C. (P.) sp. C; entocytherid associates include *Ankylocythere ancyla*, *Dactylocythere megadactylus*, and an unidentified member of the genus *Entocythere*.

TYPES.—The holotypic male and allotypic female are deposited in the National Museum of Natural History, Smithsonian Institution, numbers 155330 and 155331, respectively. Paratypes are in the British Museum, Smithsonian Institution, and in the collections of H. H. Hobbs III and the junior author.

RANGE.—Confined to the Piedmont Province of North Carolina where it occurs in the Catawba, Pee Dee, and Cape Fear drainage systems.

NORTH CAROLINA RECORDS.—CATAWBA BASIN. BURKE COUNTY: (1) tributary to Upper Creek, 14.9 mi (24 km) N Oak Hill on St Rte 181 (host: *C. (C.) bartonii*; associates: *Dt. daphnioides*, *Dt. runki*); (2) creek at E city limits of Valdese on U.S. Hwy 64 (hosts: *C. (C.)* sp. A, C. (P.) sp. C; associates: *Dt. suteri*, *U. simondsi*); (3) creek 6.4 mi (10.3 km) W of Catawba Co line on U.S. Hwy 64 (hosts: *C. (C.)* sp. A, C. (P.) sp. C; associates: *Dt. suteri*, *U. simondsi*); CALDWELL COUNTY: (4) Type-locality; (5) tributary to Mulberry Creek, 8.8 mi (14.2 km) S Watauga Co line on U.S. Hwy 321 (hosts: *C. (H.) longulus*, C. (P.) sp. C; associates: *An. ancyla*, *Dt. daphnioides*, *Dt. runki*, *E. internotalus*); CATAWBA COUNTY: (6) tributary to Catawba River at Alexander Co line on St

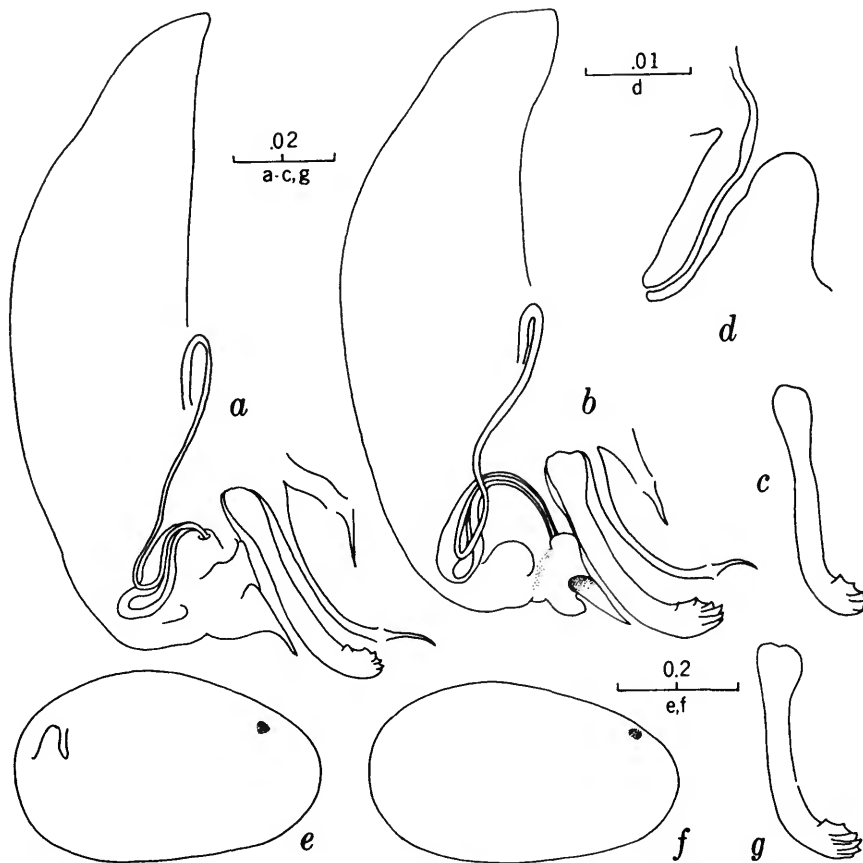


FIGURE 22.—*Donaldsoncythere leptodrilus*, new species (a,c-f, from Caldwell County; b,g, from Alexander County): a, copulatory complex of holotype; b, same of paratypic male; c, clasp apparatus of holotype; d, female genitalia of allotype; e, shell of same; f, shell of holotype; g, clasp apparatus of paratypic male (scales in mm).

Rte 16 (host: *C. (C.) bartonii*; no associate). CAPE FEAR BASIN. CHATHAM COUNTY: (7) Rocky River, 3 mi (4.8 km) N Lee Co line on U.S. Hwy 501 (hosts: *C. (D.) reduncus*, *C. (P.)* sp. C, *F. (C.) uhleri*; associates: *An. ancyla*, *An. tiphophila*, *Dt. suteri*). PEE DEE BASIN. IREDELL COUNTY: (8) Three Forks Creek, 4 mi (6.4 km) W Statesville on U.S. Hwy 64 (host: *C. (P.)* sp. C; associates: *An. ancyla*, *Dt. daphnioides*, *Dt. megadactylus*).

HOSTS.—*Cambarus (C.) bartonii*, *C. (C.)* sp. A, *C. (D.) reduncus*, *C. (H.) longulus*, *C. (P.)* sp. C, and *Fallicambarus (C.) uhleri*.

ENTOCYTHERID ASSOCIATES.—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere daphnioides*,

*Dt. megadactylus*, *Dt. runki*, *Dt. suteri*, *Entocythere internotalus*, and *Uncinocythere simondsi*.

RELATIONSHIPS.—*Donaldsoncythere leptodrilus* differs from the other members of the genus in possessing a slender penis, and, except in exhibiting an acute anteroventral prominence on the peniferum resembling that of *Dn. ardis* Hobbs and Walton (1963:366), it appears to be no more closely allied to that species than to any other of its congeners.

ETYMOLOGY.—This name is derived from leptos (Greek, = thin) + drilos (Greek, = penis), so named because of the unique slender penis.

**Genus *Entocythere* Marshall, 1903**

*Entocythere* Marshall, 1903:120.

**DIAGNOSIS.**—Terminal tooth of mandible simple, with lateral denticles, occasionally pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum subtruncate and often with heavily sclerotized areas; accessory groove lacking. Penis small, length less than anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasp ing apparatus extending ventrally beyond ventral margin of peniferum; usually L-shaped, and often with posterior junction of rami produced in heel-

like fashion; preaxial border of horizontal ramus with 5 teeth, postaxial border entire, and apex with 3 denticles (teeth on preaxial border and apical denticles sometimes forming continuous series). Female with pectinate appendix or spine at base of apical claws of second antenna. Genital apparatus of female consisting of long or short sclerotized tubercle or tube, usually associated with amorphous mass and caudally or ventrally protruding prominences.

**TYPE-SPECIES.**—*Entocythere cambaria* Marshall, 1903:120.

**RANGE.**—From Virginia to Wisconsin and Idaho southward to Veracruz, Mexico, Cuba, and Florida.

**Key to North Carolina Species of Genus *Entocythere***

- 1. Male .....2
- 1'. Female (triunguis) .....6
- 2.(1) Clasp ing apparatus with flange on mesial surface at junction of horizontal and vertical rami .....3
- 2'. Clasp ing apparatus without flange on mesial surface at junction of horizontal and vertical rami .....4
- 3.(2) Clasp ing apparatus with flange reaching level distinctly dorsal to tip of proximalmost tooth on preaxial border of horizontal ramus .....*reddelli*
- 3'. Clasp ing apparatus with flange never reaching level distinctly dorsal to tip of proximalmost tooth on preaxial border of horizontal ramus .....*internotalus*
- 4.(2') One or more teeth on preaxial border of horizontal ramus of clasp ing apparatus produced in ridges extending obliquely across mesial surface of ramus .....*costata*
- 4'. Teeth on preaxial border of horizontal ramus of clasp ing apparatus never produced in ridges extending obliquely across mesial surface of ramus .....5
- 5.(4') Clasp ing apparatus distinctly thickened at junction of horizontal and vertical rami .....*harrisi*
- 5'. Clasp ing apparatus little, if at all, thickened at junction of horizontal and vertical rami .....*dentata*
- 6.(1') Genital complex consisting of simple slender tube; base of apical claws of antenna with 2 pectinate prominences .....*harrisi*
- 6'. Genital complex of female consisting of complex combination of sclerotized and hyaline units, never of a pendant tube; base of apical claws of antenna with 1 pectinate prominence .....7
- 7.(6') Pectinate prominences at base of apical claws of antenna with more than 4 teeth .....*reddelli*
- 7'. Pectinate prominence at base of apical claws of antenna with no more than 4 teeth .....8
- 8.(7') Length of shell more than 0.5 mm .....*internotalus*
- 8'. Length of shell less than 0.5 mm .....9
- 9.(8') Pectinate prominence at base of apical claws of antenna with 4 teeth; genital complex with 2 acute projections .....*costata*
- 9'. Pectinate prominence at base of apical claws of antenna with 2 teeth; genital complex with 1 acute projection .....*dentata*

***Entocythere costata*, new species**

FIGURE 23, MAP 7

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.44–0.48 (0.46);

♀, 0.44–0.47 (0.46). Shell height: ♂, 0.24–0.27 (0.26); ♀, 0.25–0.26 (0.25). Distal tooth of mandible subpectinate. Clasp ing apparatus with postaxial border weakly bowed at junction of horizontal and vertical rami (not produced into heellike exten-

sion), junction little thickened and lacking flange on mesial surface; horizontal ramus with 1 or more oblique ridges on mesial surface extending from teeth on preaxial border to, or almost to, postaxial border; ridges not elevated into platelike extensions as in *E. claytonhoffi* Rioja (1942a:201). Female with genital apparatus consisting of complex coil embedded in amorphous mass and 2 acute projections: one extending posteriorly, other ventrally; second antenna with pectinate appendix at base of terminal claws bearing 4 denticles.

MALE.—Eye situated approximately one-fourth shell length from anterior margin. Shell (Figure 23g) subovate with greatest height slightly posterior to midlength; ventral margin almost linear, cephaloventral margin rounded; submarginal setae present except dorsally. Distal tooth of mandible subjectinate, cusps short and heavy but forming transverse row.

Copulatory complex (Figure 23a-f) with clasping apparatus extending much beyond ventral margin of peniferum. Peniferum with ventral extremity

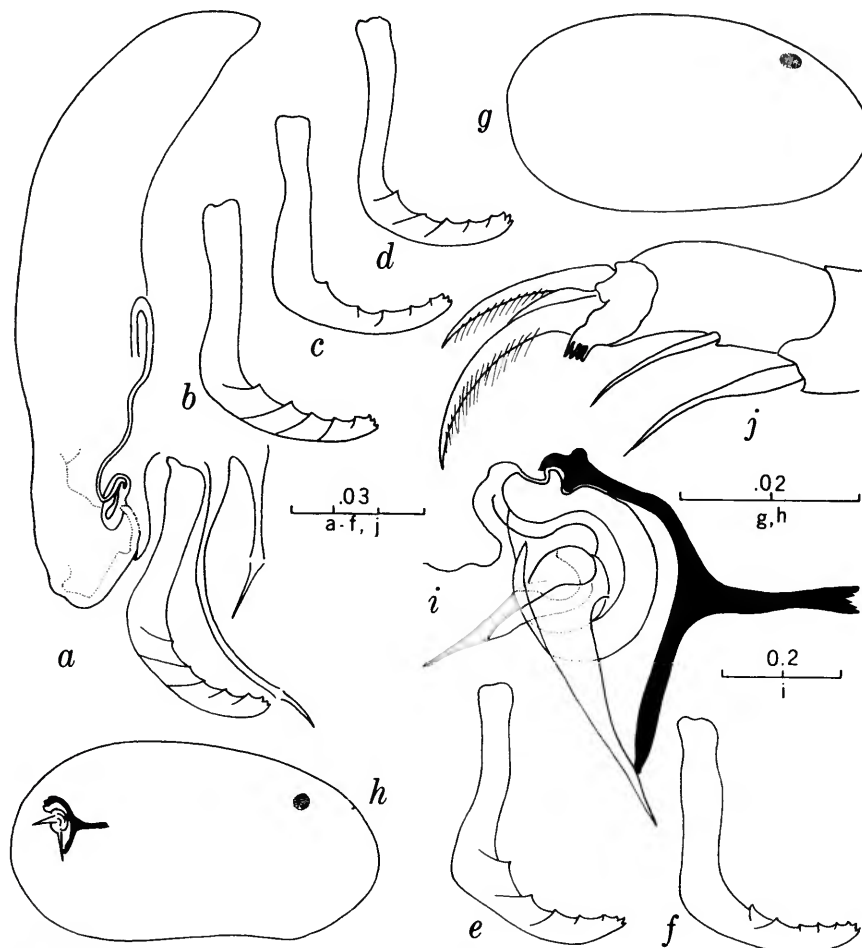


FIGURE 23.—*Entocythere costata*, new species (a-g-i, from Duplin County; c,d,j, from Bladen County); a, copulatory complex of holotype; b, clasping apparatus of paratypic male, Carteret County; c,d, same; e,f, same, Beaufort County; g, shell of holotype; h, shell of allotype; i, genitalia of allotype; j, distal part of antenna of female (scales in mm).

heavily sclerotized and bearing somewhat mesially directed penis situated about one-third distance between ventral extremity and apex of spermatic loop. Dorsal and ventral fingers slender and both terminating in simple setiform tip. Clasping apparatus with horizontal and vertical rami joining at angle greater than 90 degrees. Preaxial border of horizontal ramus with 5 teeth, distal 4 equally spaced, proximal 2 more widely separated; each tooth supported by ridge on mesial surface, and ridge of 1 or more extending obliquely ventrally to postaxial border of ramus; apex of horizontal ramus with row of 3 dorsally directed denticles.

FEMALE.—Eye situated as in male. Shell (Figure 23*h*) more highly vaulted than in male; ventral margin with broad shallow concavity near mid-length, in area of greatest height of shell. Submarginal setae also disposed as in male. Genital apparatus (Figure 23*i*) and distal part of second antenna (Figure 23*j*) as illustrated and described in "Diagnosis."

TYPE-LOCALITY.—Drainage ditch, 4 miles (6.4 km) east of Kenansville on State Route 24, Duplin County, North Carolina; hosts: *Fallicambarus* (*C.*) *uhleri* and *Procambarus* (*O.*) *plumimanus*; associates: *An. ancyla* and *An. tiphophila*.

TYPES.—The holotypic male and allotypic female are deposited in the National Museum of Natural History, Smithsonian Institution, numbers 155334 and 155335, respectively. Paratypes are in the collection of H. H. Hobbs III, the Smithsonian Institution, and the junior author.

RANGE.—Known from only six localities, all in the coastal plain segments of the Pee Dee, Cape Fear, Newport, and Pamlico drainage systems in North Carolina.

NORTH CAROLINA RECORDS.—CAPE FEAR BASIN. DUPLIN COUNTY: (1) Type-locality; (2) 1.8 mi (2.9 km) N Tin City on St Rte 11 (host: *F. (C.) uhleri*; associate: *An. tiphophila*); SAMPSON COUNTY: (3) 6.7 mi (10.8 km) S Newton Grove on U.S. Hwy 13 (host: *F. (C.) uhleri*; associates: *An. ancyla*, *An. tiphophila*). NEWPORT BASIN. CARTERET COUNTY: (4) roadside ditch, 3.5 mi (5.6 km) E Newport on St Rte 101 (host: *P. (O.) a. acutus*; no associate). PAMLICO BASIN. BEAUFORT COUNTY: (5) roadside ditch 3.9 mi (6.3 km) N U.S. Hwy 264 on St Rte 32 (host: *F. (C.) uhleri*; associates: *An. ancyla*, *An. tiphophila*). PEE DEE BASIN. BLADEN COUNTY: (6) roadside ditch, 3.4 mi (5.5 km) N Clarkton on U.S. Hwy 701 (hosts: *F. (C.) uhleri*, *P. (O.) pearsei*; associates: *An. ancyla*, *An. tiphophila*).

HOSTS.—*Fallicambarus* (*C.*) *uhleri*, *Procambarus*

(*O.*) *a. acutus*, *P. (O.) pearsei*, and *P. (O.) plumimanus*.

ENTOCYTHERID ASSOCIATES.—*Ankylocythere ancyla* and *An. tiphophila*.

RELATIONSHIPS.—*Entocythere costata* has its closest affinities with *E. dentata* from which it differs in possessing a clasping apparatus the vertical ramus of which is longer than the horizontal, and the oblique ridges extend ventrally from the teeth on the preaxial border toward the postaxial border; at least one of the ridges extends to the latter border.

ETYMOLOGY.—This name is derived from *costa* (Latin, = rib), so named because of the subparallel oblique ridges on the horizontal ramus of the clasping apparatus of the male.

### *Entocythere dentata* Crawford

FIGURE 24, MAP 7

*Entocythere dentata* Crawford, 1965:151-154, figs. 10-16.—Hart and Hart, 1974:86, pl. 25: figs. 8-12, pl. 51.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.42-0.46 (0.44); ♀, 0.46-0.52 (0.48). Shell height: ♂, 0.22-0.25 (0.23); ♀, 0.25-0.29 (0.27). Distal tooth of mandible multicuspid but not pectinate. Clasping apparatus (Figure 24*b*) of male with postaxial border at junction of horizontal and vertical rami rather evenly curved, not produced in heellike prominence, and junction not thickened; mesial surface of area of junction without flange; horizontal ramus without ridges extending across mesial surface. Female with genital apparatus (Figure 24*d,e*) composed of complex coil embedded in amorphous mass and 1 anteroventrally directed acute projection; second antenna (Figure 24*f*) with appendix at base of terminal claws bearing 2 teeth.

TYPE-LOCALITY.—Burrows in lawn at East Whittington Street, Greensboro, Guilford County, North Carolina; host: *Cambarus* (*D.*) *catagius*; associate: *Ankylocythere ancyla*.

RANGE.—According to Hart and Hart (1974:86), the northern and southern limits of the known range of this ostracod are Crawford County, Pennsylvania, and Cook County, Georgia. They also cited a new locality record in Orange County, North Carolina. We have examined their specimens and are of the opinion that those from the

two Georgia localities are members of the closely allied *Entocythere dorsorotunda* Hoff (1944:341). Their single specimen from Pennsylvania is a male that had recently molted, but it appears to be a typical specimen of *E. dentata*. Thus the range appears to be disjunct, one segment occurring in the northern part of North Carolina and the other in northwestern Pennsylvania.

**NORTH CAROLINA RECORDS.**—Confined to the Mountain and Piedmont provinces. **CAPE FEAR BASIN, GUILFORD COUNTY:** (1) Type-locality; **ORANGE COUNTY:** (2) 5 mi (8.1 km) E Chapel Hill (host: *C. (D.) reduncus*; associate: *An. ancyla* (Hart and Hart, 1974:86)). **CATAWBA BASIN, AVERY COUNTY:** (3) 0.5

mi (0.8 km) N Linville on Co Rd 1349 (host: *C. (J.) dubius*; associates: *As. cosmeta*, *U. simondsi*). **NEW BASIN, ALLEGHANY COUNTY:** (4) 1 mi (1.6 km) SE Blue Ridge Parkway on St Rte 18 (hosts: *C. (H.) chasmodactylus*, *C. (P.) robustus*; associates: *Dt. daphnioides*, *Dn. donaldsonensis*).

**HOSTS.**—*Cambarus (D.) catagius*, *C. (D.) reduncus*, *C. (H.) chasmodactylus*, *C. (J.) dubius*, and *C. (P.) robustus*.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *Ascetocythere cosmeta*, *Dactylocythere daphnioides*, *Donaldsoncythere donaldsonensis*, and *Uncinocythere simondsi*.

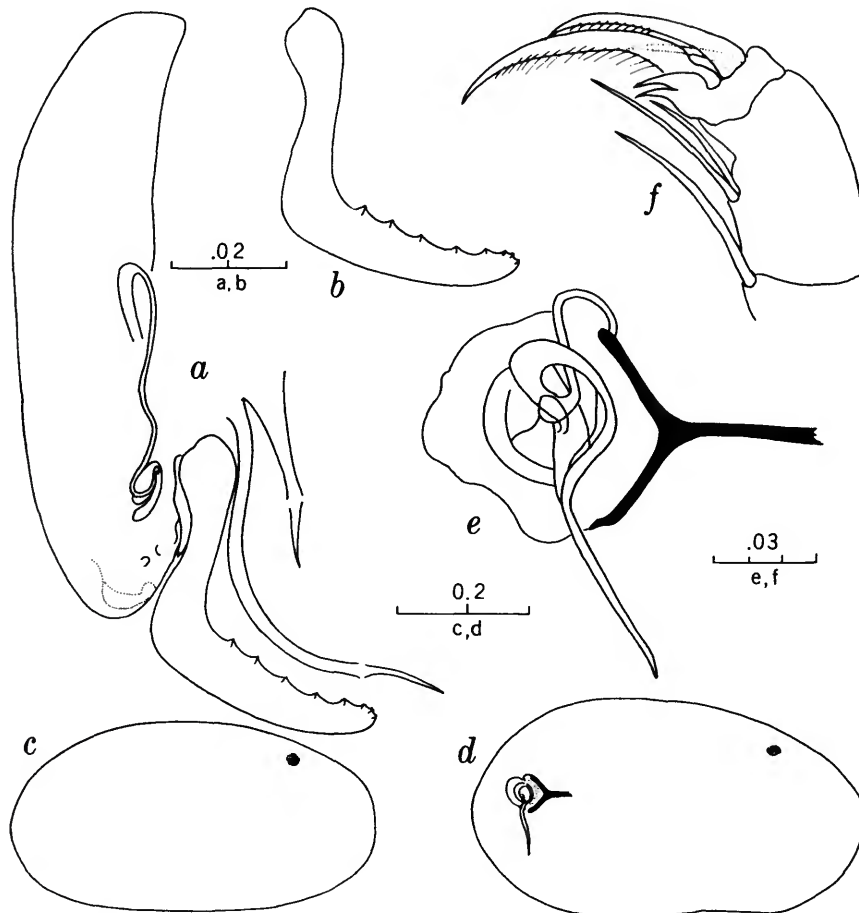


FIGURE 24.—*Entocythere dentata* from Guilford County (topotypes): a, copulatory complex of male; b, clasper of male; c, shell of male; d, shell of female; e, female genitalia; f, distal part of antenna of female (scales in mm).



*Entocythere harrisi* Peters

FIGURE 25, MAP 11

*Entocythere harrisi* Peters, 1975:32-33, figs. 5a, 6e,f, 7a.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): no males available from North Carolina; ♀, 0.60–0.71 (0.66). Shell height: ♀, 0.34–0.41 (0.37). Distal tooth of mandible simple. Clasping apparatus of male (Figure 25b) with postaxial border bowed into heellike prominence at junction of horizontal and vertical rami, junction thickened; mesial surface of area of junc-

tion without flange; horizontal ramus without oblique ridges on mesial surface. Female genital apparatus (Figure 25e,f) composed of simple tubular projection extending posteroventrally, lacking complex coil situated in amorphous mass; second antenna (Figure 25d) with pectinate appendix at base of terminal claws bearing 3 or 4 denticles.

TYPE-LOCALITY.—Rocky Creek, 4.3 miles (6.9 km) east of junction of U.S. Highway 60 and U.S. Highway 29 on former, Amherst County, Virginia; hosts: *Cambarus* (*C.*) *bartonii*, *C.* (*H.*) *longulus*, and *C.* (*P.*) sp. C.

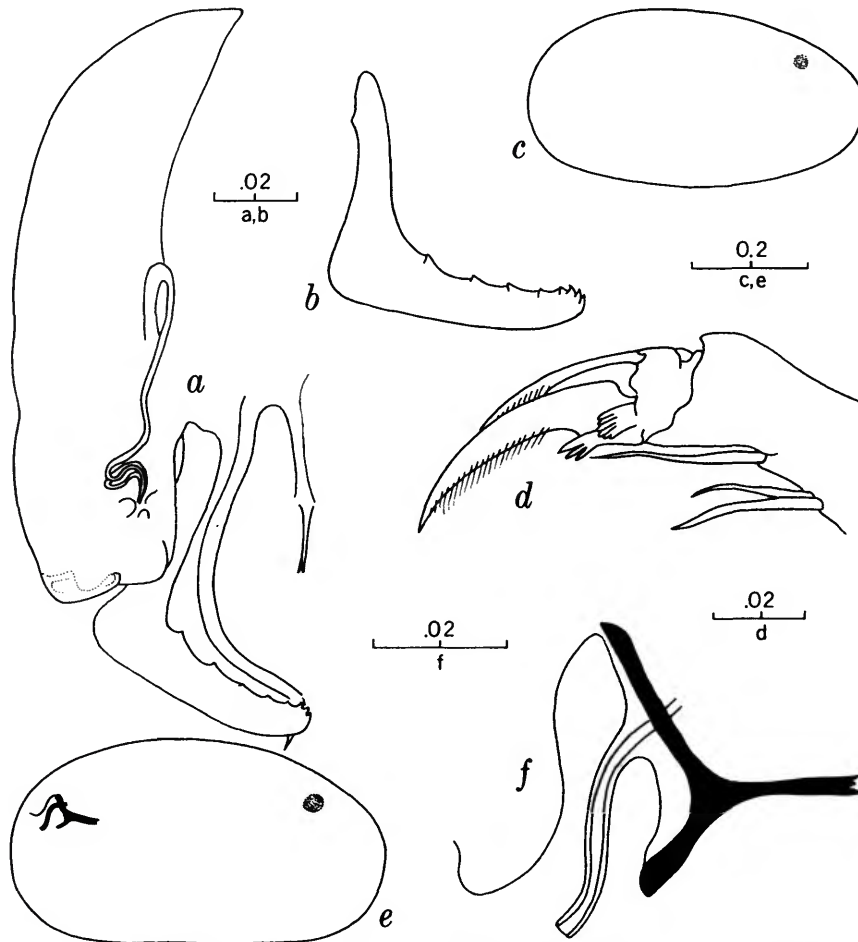


FIGURE 25.—*Entocythere harrisi* (a-c, from Amherst County, Virginia; d-f, from Surry County, North Carolina): a, copulatory complex of male; b, clasping apparatus of male; c, shell of male; d, distal part of antenna of female; e, shell of female; f, female genitalia (scales in mm).

**RANGE.**—Previously known only from the James, Potomac, and York basins in Virginia (Peters, 1975: 32); here reported from as far south as the Broad River (Catawba Basin) in North Carolina.

**NORTH CAROLINA RECORDS.**—Occurring in the Piedmont, Inner Coastal Plain and Tidewater regions. **CATAWBA BASIN.** BURKE COUNTY: (1) Irish Creek, 4.5 mi (7.2 km) N Oak Hill on St Rte 181 (hosts: *C. (C.)* sp. A, *C. (P.)* sp. C; associates: *An. ancyla*, *Dt. megadactylus*, *Dt. suteri*, *Dn. donnaldsonensis*, *E. internotalus*, *U. simondsi*); **CLEVELAND COUNTY:** (2) tributary to Buffalo Creek, 5 mi (8.1 km) S Cherryville on Co Rd 2002 (hosts: *C. (C.)* sp. A, *C. (P.)* sp. C; associates: *An. tiphophila*, *Dt. striophylax*, *Dt. suteri*); **MCDOWELL COUNTY:** (3) Sugar Creek, 0.5 mi (0.8 km) S Marion (host: *C. (C.) bartonii*, *C. (P.)* sp. C; associates: *Dt. suteri*, *Dn. donnaldsonensis*, *E. reddelli*); (4) creek, 1.7 mi (2.7 km) N Sugar Hill (hosts: *C. (C.) bartonii*, *C. (P.)* sp. C; associates: *Dt. suteri*, *Dn. donnaldsonensis*). **CAPE FEAR BASIN.** HARNETT COUNTY: (5) tributary to Neal's Creek, 4 mi (6.4 km) N Lillington on U.S. Hwy 15A (hosts: *C. (D.) latimanus*, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. megadactylus*); **HOKE COUNTY:** (6) Rockfish Creek, 8.5 mi (13.7 km) W Cumberland Co line on U.S. Hwy 401 by-pass (host: *C. (P.)* sp. C; associates: *An. ancyla*, *E. internotalus*). **CHOWAN BASIN.** HERTFORD COUNTY: (7) creek, 1.1 mi (1.8 km) S Virginia line on U.S. Hwy 258 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. jeanae*, *E. internotalus*, *Ok. cheia*). **PAMLICO BASIN.** BEAUFORT COUNTY: (8) 3.9 mi (6.3 km) N St Rte 264 on St Rte 32 (host: *C. (L.) d. diogenes*; associates: *An. tiphophila*, *Dt. jeanae*). **PEE DEE BASIN.** SURRY COUNTY: (9) 5 mi (8.1 km) NE Elkin on St Rte 268 (host: *C. (P.)* sp. C; associates: *Dt. daphnioides*, *Dt. megadactylus*, *Dt. suteri*, *Dn. donnaldsonensis*, *U. simondsi*).

**HOSTS.**—*Cambarus (C.) bartonii*, *C. (C.)* sp. A, *C. (D.) latimanus*, *C. (L.) d. diogenes*, *C. (P.)* sp. C, and *Procambarus (O.) a. acutus*.

**ENTOCYATHERID ASSOCIATES.**—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere daphnioides*, *Dt. jeanae*, *Dt. megadactylus*, *Dt. striophylax*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Entocythere internotalus*, *E. reddelli*, *Okriocythere cheia*, and *Uncinocythere simondsi*.

### *Entocythere internotalus* Crawford

FIGURE 26, MAP 12

*Entocythere internotalus* Crawford, 1959:152–157, figs. 1–9.—Hart and Hart, 1974:90–91, pl. 26: figs. 3–7; pl. 52.

*Entocythere internotalis* Hobbs, Holt, and Walton, 1967:35 [erroneous spelling].

*E(ntocythere) internotalus* Peters, 1975:10 [erroneous spelling].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.55–0.62 (0.57);

♀, 0.66–0.73 (0.69). Shell height: ♂, 0.27–0.31 (0.28); ♀, 0.36–0.40 (0.38). Distal tooth of mandible multicuspide but not pectinate. Clasping apparatus (Figure 26*b*) of male with postaxial border at junction of horizontal and vertical rami produced in heellike prominence and junction thickened; mesial surface of area of junction with angular margined pouch, apex of angle not reaching level of proximal tooth on preaxial margin of horizontal ramus; horizontal ramus without ridges extending across mesial surface. Female genital apparatus (Figure 26*d,e*) composed of anteroventrally directed spiculi-form projection arising from multipartite base, latter embedded in amorphous mass; second antenna (Figure 26*f*) with appendix at base of terminal claws bearing 3 teeth.

**TYPE-LOCALITY.**—Colonel's Creek, 14.6 miles (23.5 km) east of city limits of Columbia, Richland County, South Carolina, on State Route 262; host: *Cambarus (P.) acuminatus*.

**RANGE.**—According to Hart and Hart (1974:90–91), this species ranges in the Piedmont and Coastal Plain provinces from the Pamlico Basin in North Carolina south and southwestward to the Colorado Basin in Texas and as far north along the Mississippi Basin as Hickman County, Kentucky. Peters (1975:34) reported its occurrence in the James River drainage in Virginia.

**NORTH CAROLINA RECORDS.**—Restricted to the Piedmont, Inner Coastal Plain, and Tidewater regions. **CATAWBA BASIN.** CALDWELL COUNTY: (1) Middle Little River, 8.9 mi (14.3 km) E Lenoir (host: *C. (P.)* sp. C; associates: *An. ancyla*, *Dt. megadactylus*, *Dt. suteri*, *Dn. leptodrilus*, *U. simondsi*). **CAPE FEAR BASIN.** BLADEN COUNTY: (2) 3.7 mi (6 km) S Dublin on St Rte 41 (host: *P. (O.) pearsei*; no associate); **HARNETT COUNTY:** (3) 2.8 mi (4.5 km) N Lillington on U.S. Hwy 15A (hosts: *C. (D.) latimanus*, *C. (P.)* sp. C, *P. (O.) a. acutus*; associate: *An. ancyla*); **HOKE COUNTY:** (4) Rockfish Creek, 8.5 mi (13.7 km) W Cumberland Co line on U.S. Hwy 401 by-pass (host: *C. (P.)* sp. C; associate: *An. ancyla*); **JONES COUNTY:** (5) roadside ditch, 1.3 mi (2.1 km) SE Hargetts on U.S. Hwy 258 (host: *P. (O.) a. acutus*; associate: *An. ancyla*); **PENDER COUNTY:** (6) 14.7 mi (23.7 km) N Rock Point on U.S. Hwy 117 (host: *P. (O.) a. acutus*; associate: *An. telmoecea*); **SAMPSON COUNTY:** (7) Ward Swamp Creek, 3.9 mi (6.3 km) S Newton Grove on U.S. Hwy 701 (host: *P. (O.) a. acutus*; associate: *An. sp.*). **CHOWAN BASIN.** GATES COUNTY: (8) 5 mi (8.1 km) NE Murfreesboro on U.S. Hwy 258 (host: *P. (O.) a. acutus*; associate: *An. tiphophila*); (9) roadside ditch 8.6 mi (13.8 km) NE Hertford Co line on U.S. Hwy 13 (host: *P. (O.) a. acutus*; associates: *An. ancyla*, *An. tiphophila*); **HERTFORD COUNTY:** (10) seepage area and creek, 1.1 mi (1.8 km) S Virginia line on U.S. Hwy 258 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. jeanae*, *E. harrisi*,

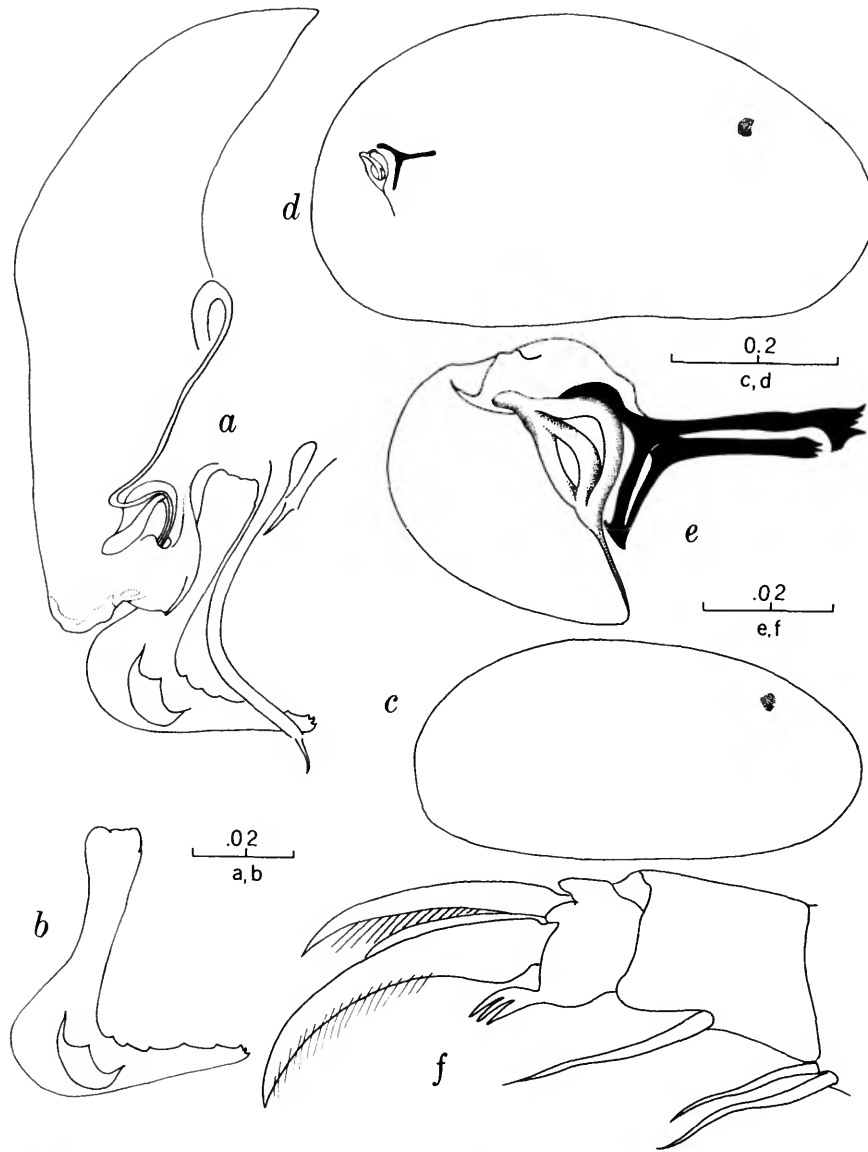


FIGURE 26.—*Entocythere internotalus* (a-e, from Gates County; f, from Northampton County): a, copulatory complex of male; b, clasping apparatus of male; c, shell of male; d, shell of female; e, female genitalia; f, distal part of antenna of female (scales in mm).

*Ok. cheia*); (11) roadside ditch 10.3 mi (16.6 km) N Bertie Co line on U.S. Hwy 13 (host: *F. (C.) uhleri*; associate: *An. tiphophila*); NORTHAMPTON COUNTY: (12) creek 8 mi (12.9 km) SE Garysburg on U.S. Hwy 301 (host: *P. (O.) a. acutus*; associate: *An. ancyla*); (13) tributary to Poticas Creek, 5 mi (8.1 km) S Hertford Co line on U.S. Hwy 258 (host: *P. (O.) a.*

*acutus*; associate: *An. ancyla*). NEUSE BASIN. CRAVEN COUNTY: (14) 2 mi (3.2 km) SE Havelock on U.S. Hwy 70 (host: *P. (O.) plumimanus*; associate: *An. ancyla*). NEW RIVER (EAST) BASIN. ONSLOW COUNTY: (15) 4.8 mi (7.7 km) SE Hargetts on U.S. Hwy 258 (host: *P. (O.) a. acutus*; associate: *An. ancyla*). PAMLICO BASIN. BEAUFORT COUNTY: (16) road-

side ditch 4 mi (6.4 km) W Pantego on U.S. Hwy 264 (host: *P. (O.) a. acutus* (Hart and Hart, 1974:90)). PEE DEE BASIN. BLADEN COUNTY: (17) 3.7 mi (6 km) S Dublin on St Rte 41 (host: *P. (O.) pearsei* (Hart and Hart, 1974:91)); COLUMBUS COUNTY: (18) 0.6 mi (1 km) E Hallsboro on U.S. Hwy 76 (host: *P. (O.) pearsei*; no associate); RANDOLPH COUNTY: (19) 2.8 mi (4.5 km) NE Davidson Co line on St Rte 49 (hosts: *C. (P.) sp. C.*, *P. (O.) a. acutus* (Hart and Hart, 1974:91)). ROANOKE BASIN. BERTIE COUNTY: (20) 6.5 mi (10.5 km) N Williamston on U.S. Hwy 17 (host: *P. (O.) a. acutus*; no associates).

HOSTS.—*Cambarus (D.) latimanus*, *C. (L.) d. diogenes*, *C. (P.) sp. C.*, *Fallicambarus (C.) uhleri*, *Procambarus (O.) a. acutus*, *P. (O.) pearsei*, *P. (O.) plumimanus*.

ENTOCYTHERID ASSOCIATES.—*Ankylocythere ancyla*, *An. telmoecea*, *An. tiphophila*, *Dactylocythere jeanae*, *Dt. megadactylus*, *Dt. suteri*, *Donnaldsoncythere leptodrilus*, *Entocythere harrisi*, *Okriocythere cheia*, *Uncinocythere simondsi*.

### *Entocythere reddelli* Hobbs and Walton

FIGURE 27, MAP 12

*Entocythere reddelli* Hobbs and Walton, 1968:243, 246, Fig. 2a-d.—Hart and Hart, 1974:92-93, pl. 27: figs. 11-15; pl. 52.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.54-0.60 (0.56);

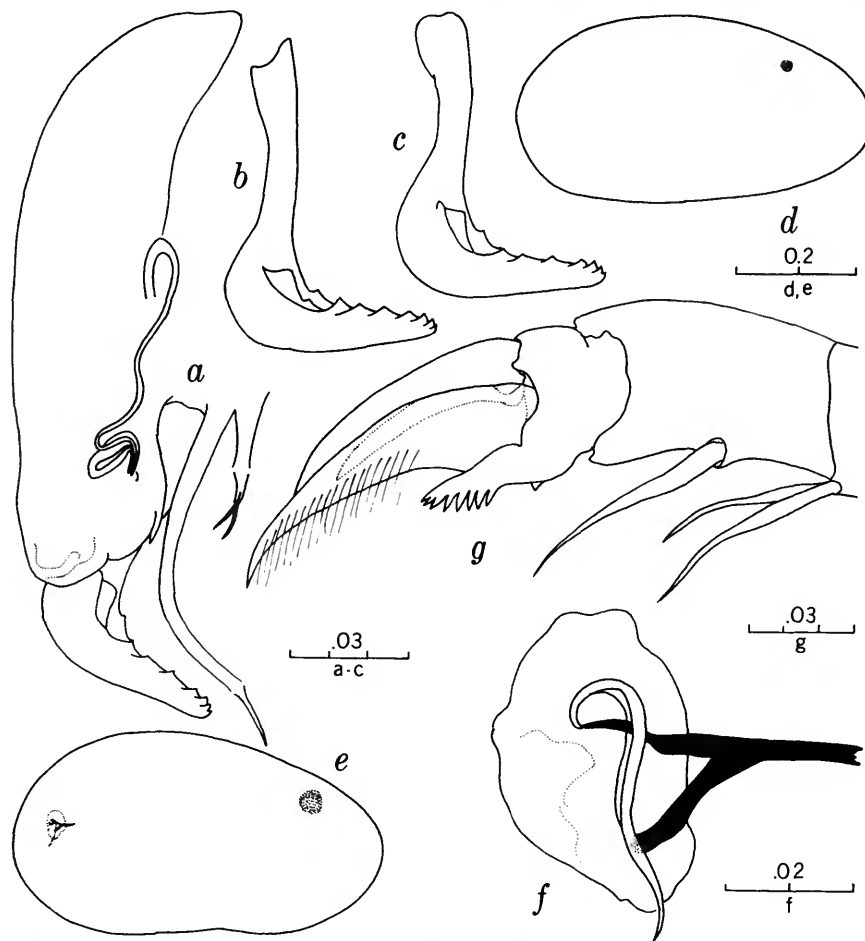


FIGURE 27.—*Entocythere reddelli* (a,c,d, from Haywood County; b, from McDowell County; e-g, from Burke County): a, copulatory complex of male; b,c, clasper apparatus of male; d, shell of male; e, shell of female; f, female genitalia; g, distal part of antenna of female (scales in mm).

♀, 0.60. Shell height: ♂, 0.29–0.32 (0.30); ♀, 0.36. Distal tooth of mandible acute, neither multi-dentate nor pectinate. Clasp apparatus (Figure 27*b,c*) of male with postaxial border at junction of horizontal and vertical rami produced in heellike prominence and junction thickened; mesial surface of area of junction with angular flange, apex of angle reaching level proximal to proximal tooth on preaxial margin of horizontal ramus; horizontal ramus lacking long oblique ridges extending across mesial surface. Female genital apparatus (Figure 27*e,f*) composed of ventrally directed subspiculi-form projection arising from bipartite base, latter embedded in amorphous mass; second antenna (Figure 27*g*) with appendix at base of terminal claws conspicuously enlarged, pectinate, with 8 denticles.

**TYPE-LOCALITY.**—Golden Fawn Cave, 8.0 miles (12.9 km) north-northeast of Boerne, Kendall County, Texas; host: *Procambarus* (*S.*) *clarkii* (Girard, 1852:91).

**RANGE.**—In addition to the type-locality, Hart and Hart (1974:93) recorded its presence in Greene County, Arkansas, and Sumner County, Kansas. Here it is reported from the Catawba, French Broad, and Hiwassee basins in North Carolina.

**NORTH CAROLINA RECORDS.**—In the Mountain and Piedmont provinces. **CATAWBA BASIN.** BURKE COUNTY: (1) creek 6.5 mi (10.5 km) NE McDowell Co line on U.S. Hwy 64 (hosts: *C. (C.) bartonii*, *C. (P.)* sp. C; associates: *Dt. suteri*, *Dn.* sp.); **MCDOWELL COUNTY:** (2) creek 4.7 mi (7.6 km) N Sugar Hill (hosts: *C. (C.) bartonii*, *C. (P.)* sp. C; associates: *Dt. suteri*, *Dn. donaldsonensis*, *E. harrisi*). **FRENCH BROAD BASIN.** HAYWOOD COUNTY: (3) tributary to East Fork of Pigeon River, 1.7 mi (2.7 km) E Canton on U.S. Hwy 19 (host: *C. (C.) bartonii*; no associate). **HIWASSEE BASIN.** CHEROKEE COUNTY: (4) Rose Creek, 1.0 mi (1.6 km) NW Ebenezer on Co Rd 1345 (host: *C. (C.) bartonii*; no associate).

**HOSTS.**—*Cambarus* (*C.*) *bartonii*, and *C. (P.)* sp. C.

**ENTOCYTHERID ASSOCIATES.**—*Dactylocythere daphnioides*, *Dt. megadactylus*, *Dt. striophylax*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, and *Entocythere harrisi*.

**REMARKS.**—The single female available from Burke County is only tentatively assigned to this species, for it differs from females taken from the type-locality in possessing an enlarged appendix (with 8 denticles) at the base of the apical claws of the second antenna. In topotypes, the appendix is smaller and bears no more than 6 denticles.

### Genus *Harpagocythere* Hobbs III, 1965

*Harpagocythere* Hobbs III, 1965:163.

**DIAGNOSIS.**—Terminal tooth of mandible pectinate. Copulatory complex of male with simple or excised finger guard. Ventral portion of peniferum sometimes tapering (never bulbous) and bearing small recurved terminal or barblike lateral prominence on anteroventral angle; accessory groove lacking. Penis size variable, shorter or longer than 1/3 anteroposterior diameter of peniferum at level of penis; spermatid and prostatic elements contiguous. Clasp apparatus C-shaped, almost or quite reaching ventral extremity of peniferum, with or without 2 teeth on preaxial border near apex; postaxial border entire, and apex with 4 or 6 terminal lobes or denticles. Female without pectinate appendix at base of terminal claws of second antenna; genital complex consisting of tubular papilla with acute apex.

**TYPE-SPECIES.**—*Harpagocythere georgiae* Hobbs III, 1965:163.

**RANGE.**—Southern Appalachians in North Carolina and South Carolina. Only one species is known to occur in North Carolina.

### *Harpagocythere baileyi*, new species

FIGURE 28, MAP 6

?*Harpagocythere tertius*.—Hobbs and Walton, 1968:247 [in part].—Hart and Hart, 1974:99, pl. 52 [in part].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.36–0.41 (0.39); ♀, 0.39–0.44 (0.41). Shell height: ♂, 0.21–0.23 (0.21); ♀, 0.22–0.25 (0.23). Ventral portion of peniferum not tapering and bearing mesially situated recurved barblike prominence on anteroventral extremity; length of penis subequal to anteroposterior diameter of peniferum at level of penis. Clasp apparatus without teeth on preaxial border; apex with 4 denticles. Genital complex of female indistinguishable from that of its congeners.

**MALE.**—Eye situated approximately one-fourth shell length from anterior margin. Shell (Figure 28*f*) subovate with greatest height slightly posterior to midlength; ventral margin gently curved; submarginal setae somewhat evenly spaced anteriorly, ventrally, and posteriorly, absent dorsally.

Copulatory complex (Figure 28*a–c*) with clasp

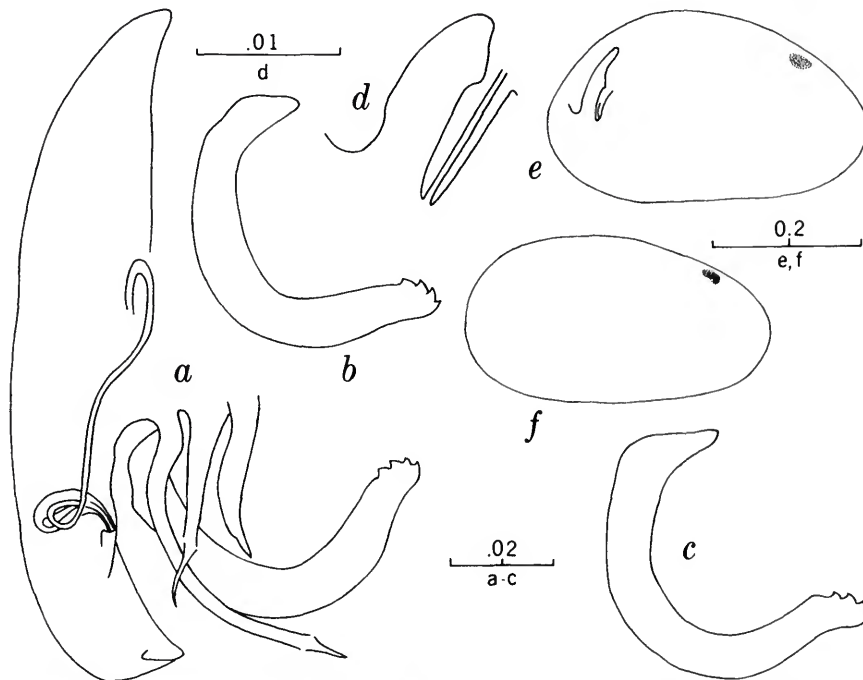


FIGURE 28.—*Harpagocythere baileyi*, new species (*a, b, d-f*, from Jackson County; *c*, from Macon County): *a*, copulatory complex of holotype; *b*, clasper of holotype; *c*, same of paratype male; *d*, genitalia of allotype; *e*, shell of same; *f*, shell of holotype (scales in mm).

apparatus extending ventrally about same level as peniferum. Peniferum with anterior and posterior margins of ventral portion subparallel and with lateral barblike prominence on anteroventral angle. Penis located at base of ventral third of peniferum, comparatively large, its length subequal to anteroposterior diameter of ventral part of peniferum. Finger guard slender, long, and with distal excision on posterior border. Ventral finger forming single broad continuous arc. Clasper apparatus C-shaped with pre- and postaxial borders entire and bearing four apical denticles.

**FEMALE.**—Eye situated as in male. Shell (Figure 28*e*) much more highly vaulted than in male, greatest height near midlength; ventral margin almost straight. Submarginal setae disposed as in male. Genital apparatus (Figure 28*d*) consisting of long tubular tapering papilla situated in posterodorsal region of body.

**TYPE-LOCALITY.**—Stream tributary to Whitewater River at State Route 107, 5.6 miles (9.0 km) south

of junction with U.S. Highway 64 at Cashiers, Jackson County, North Carolina; hosts: *Cambarus* (*C.*) *bartonii* and *C. (J.) asperimanus*; associates: *Dactyocythere leptophylax*, *Dt. prinsi*, and *Donaldsoncythere donnaldsonensis*.

**TYPES.**—The holotypic male and allotypic female are deposited in the National Museum of Natural History, Smithsonian Institution, numbers 155332 and 155333, respectively. Paratypes are in the Smithsonian Institution and in the collections of H. H. Hobbs III and the junior author.

**RANGE.**—Known from only six localities, all in the Mountain Province of North Carolina: headwaters of the Savannah River in Jackson County and in the Little Tennessee watershed in Jackson and Macon counties.

**NORTH CAROLINA RECORDS.**—LITTLE TENNESSEE BASIN. JACKSON COUNTY: (1) creek 0.6 mi (1.0 km) N of St Rte 107 on Cane Creek Road, 5.0 mi (8.1) km S of Sylva (hosts: *C. (C.) bartonii* and *C. (J.)* sp.; associate: *U. simondsi*); MACON COUNTY: (2) stream in Primeval Forest near Highlands (host: *C. (J.) asperimanus*; no associates); (3) stream flowing from

Lake Ravenel at Highlands (host: *C. (J.) asperimanus*; no associates). SAVANNAH BASIN. JACKSON COUNTY: (4) Type-locality; (5) tributary to lake at High Hampton golf course at Cashiers (host: *C. (J.) asperimanus*; no associates); (6) stream 3.5 mi (5.6 km) S U.S. Hwy 64 on St Rte 107 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *Dn. donaldsonensis*, *U. simondsi*).

HOSTS.—*Cambarus (C.) bartonii*, *C. (J.) asperimanus*, and *C. (J.)* sp.

ENTOCYThERID ASSOCIATES.—*Dactylocythere leptophylax*, *Dt. prinsi*, *Donnaldsoncythere donnaldsonensis*, and *Uncinocythere simondsi*.

RELATIONSHIPS.—*Harpagocythere baileyi* has its closest affinities with its congeners, *H. georgiae* Hobbs III (1965:163) and *H. tertius* Hobbs and Walton (1968:247), the latter a probable synonym of the former. It differs from them in lacking teeth on the preaxial border of the clasping apparatus and in the lateral position of the recurved prominence on the anteroventral extremity of the clasping apparatus.

ETYMOLOGY.—We are pleased to name this ostracod in honor of Joseph R. Bailey, Duke University, who has donated a large number of crayfishes (harboring entocytherids) from North Carolina to the Smithsonian Institution.

REMARKS.—In describing *Harpagocythere tertius*, Hobbs and Walton probably erred in reporting it from the Whitewater River (Savannah Basin), inasmuch as the type-locality of *H. baileyi* lies in a nearby headwater stream in the same drainage system. Unfortunately, the specimen on which their record was based has been misplaced. Subsequent collections made in the Whitewater watershed near State Route 107 contained no specimen of *H. tertius*.

### Genus *Litocythere* Hobbs and Walton, 1968

*Litocythere* Hobbs and Walton, 1968:247.

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male with finger guard. Ventral portion of peniferum flattened laterally, flared, and with concave ventral margin. Penis small, length less than anteroposterior diameter of peniferum at level of penis; spermatid and prostatic elements contiguous; accessory groove lacking. Clasping apparatus reaching ventrally to or beyond ventral margin of peniferum, not clearly

divisible into horizontal and vertical rami but much thickened in area of their junctions; preaxial border of horizontal ramus with single blunt tooth near base, and apex with cluster of six rounded denticles. Female without pectinate appendix at base of apical claws of second antenna; genital complex consisting of broad-based, acute cone.

TYPE-SPECIES.—*Litocythere lucileae* Hobbs and Walton, 1968:247.

RANGE.—A monotypic genus ranging in the Blue Ridge of North Carolina from Buncombe to Avery and Watauga counties.

### *Litocythere lucileae* Hobbs and Walton

FIGURE 29, MAP 11

*Litocythere lucileae* Hobbs and Walton, 1968:247, 250, fig. 3d-f.—Hart and Hart, 1974:102, pl. 30: figs. 1-3; pl. 53.

DIAGNOSIS.—Shell length in mm (numbers in parentheses represent averages): ♂, 0.36–0.39 (0.38); ♀, 0.34–0.37 (0.35). Shell height: ♂, 0.20–0.22 (0.21); ♀, 0.21–0.23 (0.21). See diagnosis of genus.

TYPE-LOCALITY.—Tributary to the Linville River (Catawba drainage system) near U.S. Highway 221, Linville, Avery County, North Carolina; host: *Cambarus (J.) asperimanus*; associate: *Ascetocythere cosmata*.

RANGE.—Headwater tributaries of the Catawba, French Broad, Nolichucky, and Pee Dee rivers in North Carolina.

NORTH CAROLINA RECORDS.—Restricted to the Mountain Province. CATAWBA BASIN. AVERY COUNTY: (1) Type-locality; BUNCOMBE COUNTY: (2) Hickory Nut Gorge, 1 mi (1.6 km) NW McDowell Co line on U.S. Hwy 74 (host unknown; associate: *U. simondsi*); BURKE COUNTY: (3) creek 12.8 mi (20.6 km) N Oak Hill on St Rte 181 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associate: *Dn. donnaldsonensis*). FRENCH BROAD BASIN. BUNCOMBE COUNTY: (4) Big Piney Creek at Montreat (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*; associates: *Dt. daphnioides*, *Dn. donnaldsonensis*, *U. simondsi*); (5) creek 3 mi (4.8 km) W Black Mountain (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*, *C. (P.) reburus*; associates: *Dt. megadactylus*, *Dn. donnaldsonensis*, *U. simondsi*); McDOWELL COUNTY: (6) creek 2.3 mi (3.7 km) E Buncombe Co line on U.S. Hwy 70 (hosts: *C. (C.) bartonii*, *C. (J.) asperimanus*, *C. (P.)* sp. C; associates: *Dt.* sp., *U. simondsi*). NOLICHUCKY BASIN. MITCHELL COUNTY: (7) tributary to Big Crabtree Creek, 2.5 mi (4.0 km) N jct St Rte 19 and Co Rd 1002 (host: *C. (J.) asperimanus*; no associate). PEE DEE BASIN. WATAUGA COUNTY: (8) creek at Deep Gap (host: *C. (J.) asperimanus*; associate: *Dn. donnaldsonensis*).

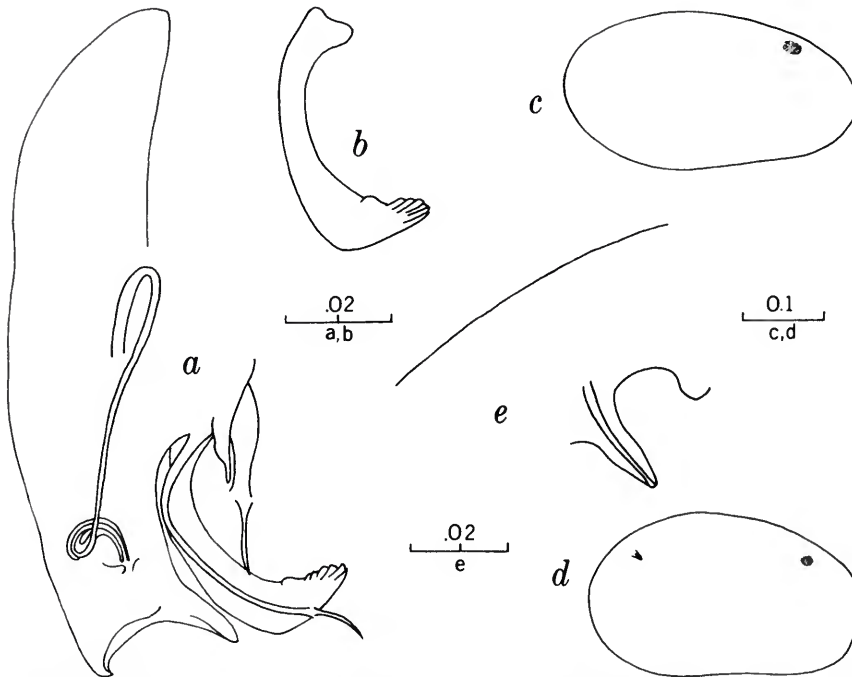


FIGURE 29.—*Litocythere lucileae* from Mitchell County: *a*, copulatory complex of male; *b*, clasp apparatus of male; *c*, shell of male; *d*, shell of female; *e*, genitalia of female (scales in mm).

HOSTS.—*Cambarus* (*C.*) *bartonii*, *C. (J.) asperimanus*, *C. (P.) reburrus*, and *C. (P.)* sp. *C.*

ENTOCYOTHERID ASSOCIATES.—*Cymocythere cosmata*, *Dactylocythere daphnioides*, *Dt. megadactylus*, *Donnaldsoncythere donnaldsonensis*, and *Uncinocythere simondsi*.

REMARKS.—Although Hart and Hart (1974:102) indicated that this ostracod is known only from the type-locality, three localities corresponding to ones cited herein are indicated on their distribution map (pl. 53, p. 229).

#### Genus *Lordocythere* Hobbs and Hobbs, 1970

*Lordocythere* Hobbs and Hobbs, 1970:15.

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum tapering to acute apex and with angular prominences on posterior margin at level of penis; accessory groove lacking. Penis small but its length at least as great

as anteroposterior diameter of tapering peniferum at level of penis, its tip directed posteroventrally; spermatic and prostatic elements contiguous. Clasp apparatus almost reaching ventral margin of peniferum, only slightly bent, tapering, and with 6 denticles grouped at apex, otherwise margins entire. Genital complex of female consisting of large, ventrally disposed acute projection.

TYPE-SPECIES.—*Lordocythere petersi* Hobbs and Hobbs III, 1970:16.

RANGE.—A monotypic genus known only from the Cumberland River drainage in Kentucky, and the Hiwassee River drainage in North Carolina.

#### *Lordocythere petersi* Hobbs and Hobbs

FIGURE 30

*Lordocythere petersi* Hobbs and Hobbs III, 1970:16, fig. 9.—Hart and Hart, 1974:103, pl. 30: figs. 4-7; pl. 53.

DIAGNOSIS.—Same as that for genus.

TYPE-LOCALITY.—Creek and burrows in seepage



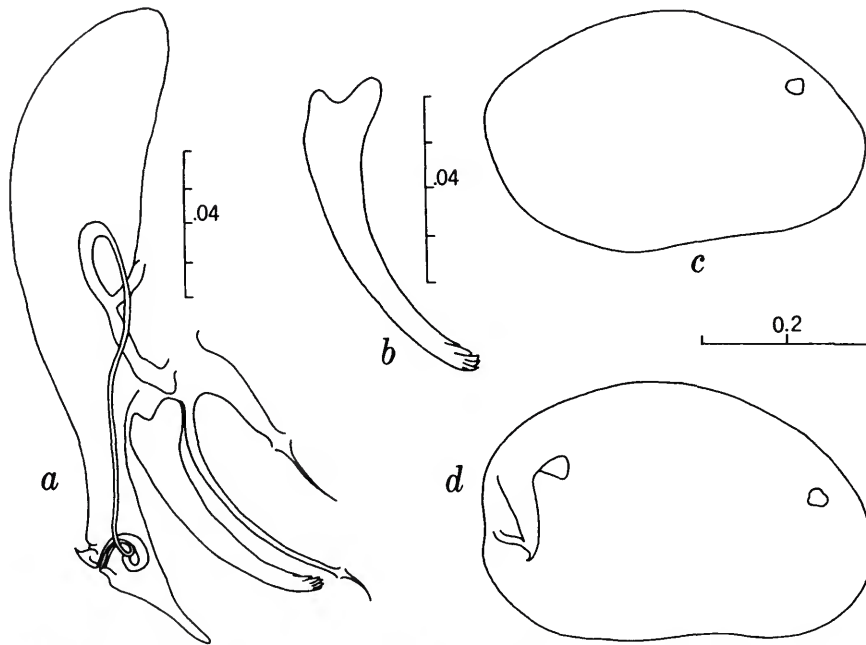


FIGURE 30.—*Lordocythere petersi* from Whitley County, Kentucky, type-locality: *a*, copulatory complex of male; *b*, clasping apparatus of male; *c*, shell of male; *d*, shell of female (from Hobbs and Hobbs, 1970; scales in mm).

area, 4.8 miles (7.7 km) southwest of junction of Interstate Hwy 75 and U.S. Highway 25W on latter, southwest of Corbin, Whitley County, Kentucky; hosts: *Cambarus (D.) sphenoides* Hobbs, 1968:262, and *C. (L.) diogenes* subsp.

RANGE.—Same as that for genus.

NORTH CAROLINA RECORDS.—As pointed out in the discussion of "Entocytherid Associates," our single record of the presence of this ostracod in North Carolina is based on a sketch of the genitalia of a male taken from *Cambarus (J.) nodosus* made by one of us (Hobbs) several years ago. The host was collected by Kenneth W. Simonds 1.6 miles (2.6 km) southwest of U.S. Highway 64 on State Route 60 (Hiwassee Basin), Cherokee County. The ostracod was in the collection of Dr. Simonds and is no longer available.

HOST.—*Cambarus (J.) nodosus*.

ENTOCYTHERID ASSOCIATES.—Unknown.

#### Genus *Okriocythere* Hart, 1964

*Okriocythere* Hart, 1964:243.

*Okricocythere* Peters, 1975:ii [erroneous spelling].

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum with prominent, ventrally directed, rounded lobe on anteroventral extremity; accessory groove lacking. Penis moderately large, longer than anteroposterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasping apparatus not reaching ventral margin of peniferum, flared and subtruncate ventrally with posteroventral angle subacute, ventral margin serrate and anteroventral extension annulate; apical denticles lacking. Female without pectinate appendix at base of terminal claws of second antenna; genital complex consisting of tapering sclerotized papilla bearing anterior and posterior barbs at base.

TYPE-SPECIES.—*Okriocythere cheia* Hart, 1964: 243.

RANGE.—The monotypic *Ok. cheia* ranges in the Coastal Plain Province from the Cape Fear Basin in North Carolina to the Potomac Basin in Maryland.

*Okriocythere cheia* Hart

FIGURE 31, MAP 9

*Okriocythere cheia* Hart, 1964:243-245, [2 figs.].—Hart and Hart, 1974:104, pl. 30: figs. 8-10; pl. 53.

*Okriocythere cheia*.—Peters, 1975:ii [erroneous spelling].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.44–0.50 (0.47); ♀, 0.48–0.50 (0.49). Shell height: ♂, 0.25–0.27 (0.26); ♀, 0.28–0.31 (0.30). See generic diagnosis.

**TYPE-LOCALITY.**—"Prince George's Co., Maryland"; host: *Cambarus (L.) d. diogenes*.

**RANGE.**—Same as that cited for genus.

**NORTH CAROLINA RECORDS.**—In all of the major drainage systems between Cape Fear and Perquimans drainage systems where occurring in the Piedmont, Inner Coastal Plain, and Tidewater regions. **ALLIGATOR BASIN. DARE COUNTY:** (1) roadside ditch 5.5 mi (8.9 km) W U.S. Hwy 264 on U.S. Hwy 64 (host: *C. (L.) d. diogenes*; associates: *Dt. jeanae*, *Or. waltonae*); **TYRRELL COUNTY:** (2) roadside ditch 5 mi (8.1 km) W Dare Co line on U.S. Hwy 64 (hosts: *C. (L.) d. diogenes*,

*F. (C.) uhleri*, *P. (O.) a. acutus*; associates: *An. tiphophila*, *Dt. jeanae*); **WASHINGTON COUNTY:** (3) roadside ditch 4 mi (6.4 km) E Plymouth on U.S. Hwy 64 (hosts: *C. (L.) d. diogenes*, *F. (C.) uhleri*, *P. (O.) a. acutus*; associates: *An. tiphophila*, *Dt. jeanae*). **CAPE FEAR BASIN. CUMBERLAND COUNTY:** (4) roadside ditch 1.8 mi (2.9 km) NE Wade on U.S. Hwy 301 (host: *C. (L.) d. diogenes*; associate: *An. ancyla*). **CHOWAN BASIN. BERTIE COUNTY:** (5) roadside ditch 8.8 mi (14.2 km) S Powellville on U.S. Hwy 13 (host: *C. (L.) d. diogenes*; associate: *Dt. jeanae*); **HEFRTFORD COUNTY:** (6) roadside ditch and creek 1.1 mi (1.8 km) S Virginia line on U.S. Hwy 258 (hosts: *C. (L.) d. diogenes*, *P. (O.) a. acutus*; associates: *An. ancyla*, *Dt. jeanae*, *E. harrisi*, *E. internotalus*); **NORTHAMPTON COUNTY:** (7) roadside ditch in Woodland (host: *C. (L.) d. diogenes*; associate: *Dt. jeanae*). **NEUSE BASIN. WAKE COUNTY:** (8) roadside ditch 1 mi (1.6 km) S Durham Co line on St Rte 55 (host: *C. (L.) d. diogenes*; no associate); **WAYNE COUNTY:** (9) roadside ditch 6.1 mi (9.8 km) S U.S. Hwy 117 on U.S. Hwy 13 (host: *C. (L.) d. diogenes*; associate: *An. ancyla*). **PAMLICO BASIN. BEAUFORT COUNTY:** (10) roadside ditch 3.9 mi (6.3 km) N St Rte 264 on St Rte 32 (hosts: *C. (L.) d. diogenes*, *F. (C.) uhleri*, *P. (O.) a. acutus*; associates: *An. ancyla*, *An. tiphophila*, *Dt. jeanae*); **EDGE-COMBE COUNTY:** (11) roadside ditch 2.2 mi (3.5 km) S St Rte 97 on U.S. Hwy 258 (host: *C. (L.) d. diogenes*; associate: *Dt.*

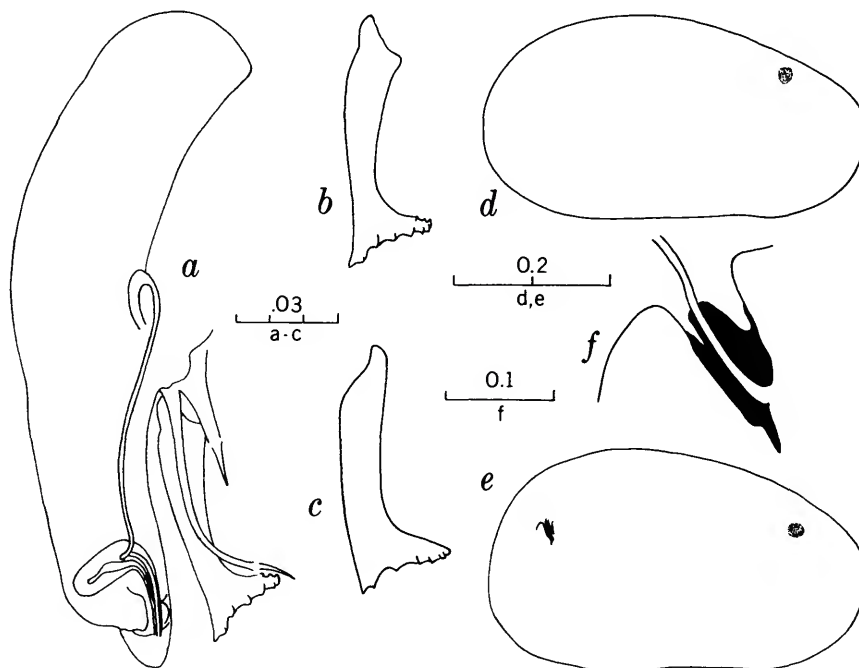


FIGURE 31.—*Okriocythere cheia* (a,b,d, from Hyde County; c, from Nash County; e,f, from Pasquotank County): a, copulatory complex of male; b,c, clasper apparatus of male; d, shell of male; e, shell of female; f, female genitalia (scales in mm).

*jeanae*); GREENE COUNTY: (12) 9.0 mi (14.5 km) E Saratoga (host: *C. (L.) d. diogenes*; no associate (Hart and Hart, 1974: 104, cited this locality as in Edgecombe County)); HYDE COUNTY: (13) roadside ditch in Fairfield (host: *C. (L.) d. diogenes*; associates: *An. tiphophila*, *Dt. jeanae*); NASH COUNTY: (14) roadside ditch 7 mi (11.3 km) NE Elm City on U.S. Hwy 301 (host: *C. (L.) d. diogenes*; associate: *Dt. suteri*); PASQUOTANK BASIN. PASQUOTANK COUNTY: (15) roadside ditch 2.9 mi (4.7 km) NE Perquimans Co line on Co Rd 1001 (host: *C. (L.) d. diogenes*; associates: *Dt. jeanae*, *Or. waltonae*); ROANOKE BASIN. CASWELL COUNTY: (16) Moon Creek about 12 mi (19 km) E Rockingham Co line at Co Rd 1306 (host: *C. (L.) d. diogenes*; no associate).

**HOSTS.**—*Cambarus (L.) d. diogenes*; questionable hosts include *Fallicambarus (C.) uhleri* and *Procambarus (O.) a. acutus*.

**ENTOCYTHERID ASSOCIATES.**—*Ankylocythere ancyla*, *An. tiphophila*, *Dactylocythere jeanae*, *Dt. suteri*, *Entocythere harrisi*, *E. internotalus*, and *Ornithocythere waltonae*.

**REMARKS.**—Worthy of note perhaps is the observation that the specimens from Hyde County are distinctly larger than those elsewhere in the State. The shells of the males range from 0.48 to 0.49 mm in length and are consistently 0.27 mm in height; the corresponding maxima elsewhere are 0.47 and 0.26 mm. The Hyde County females range from 0.50 to 0.51 mm in length and 0.29 to 0.31 mm in height, and the corresponding maxima in other North Carolina localities are 0.49 and only 0.29 mm (except for one female from Washington County which is 0.31 mm). Otherwise, few variations other than those of the clasping apparatus (cf. Figure 31*b,c*) have been noted.

### Genus *Ornithocythere* Hobbs, 1967

*Ornithocythere* Hobbs, 1967:2.

**DIAGNOSIS.**—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum resembling head of bird with beak projecting from anteroventral angle; accessory groove lacking. Penis moderately large, but its length less than antero-posterior diameter of peniferum at level of penis; spermatid and prostatic elements contiguous. Clasping apparatus never surpassing ventral margin of peniferum, well-developed, sometimes divisible into horizontal and vertical rami, with annulations, teeth, or rounded denticles on preaxial, postaxial, and/or mesial surfaces; apex with

3 to 5 denticles. Female without pectinate appendix at base of apical claws of second antenna; genital apparatus consisting of sclerotized genital papilla; campanula present or absent.

**TYPE-SPECIES.**—*Ornithocythere waltonae* Hobbs, 1967:2.

**RANGE.**—Discontinuous: Maryland to northeastern North Carolina, and Kentucky to Mississippi and Alabama. Only one species is known to occur in North Carolina.

### *Ornithocythere waltonae* Hobbs

FIGURE 32, MAP 10

*Ornithocythere waltonae* Hobbs, 1967:2-4, fig. 1*a-c*.—Hart and Hart, 1974:108-109, pl. 32: figs. 3-6; pl. 53.

*Ornithocythere Waltonae*.—Peters, 1975:44 [lapsus calami].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.45-0.48 (0.47); ♀, 0.51-0.53 (0.52). Shell height: ♂, 0.24-0.27 (0.25); ♀, 0.31-0.32 (0.31). Peniferum with prominent, corneous, dorsally curved beaklike projection on anteroventral extremity. Clasping apparatus (Figure 32*b*) almost reaching ventral margin of peniferum, with vertical and horizontal rami moderately well defined; vertical ramus, with both preaxial and postaxial borders entire, subequal in length to horizontal ramus; postaxial border of latter entire; preaxial border with 4 somewhat equally spaced serrations; apex bearing 4 terminal denticles. Female genital apparatus (Figure 32*d,e*) with campanula.

**TYPE-LOCALITY.**—Roadside ditch at Acerdale, 0.4 mile (0.6 km) from junction of Great Bridge and Indian River, Princess Anne County, Virginia; host: *Cambarus (L.) d. diogenes*. *Procambarus (O.) a. acutus* was cited as a host in the type-locality by Hobbs (1967:3) because the types were obtained from a collection containing both crayfishes mentioned. On the basis of subsequent observations of entocytherids on both crayfish species, we are convinced that *Or. waltonae* is restricted to *Cambarus (L.) d. diogenes*. *Dactylocythere jeanae* was the only entocytherid associate.

**RANGE.**—From Dare and Washington counties, North Carolina, northward to Anne Arundel County, Maryland.

**NORTH CAROLINA RECORDS.**—Known only from the Tidewater Region. ALLIGATOR BASIN. DARE COUNTY: (1) road-

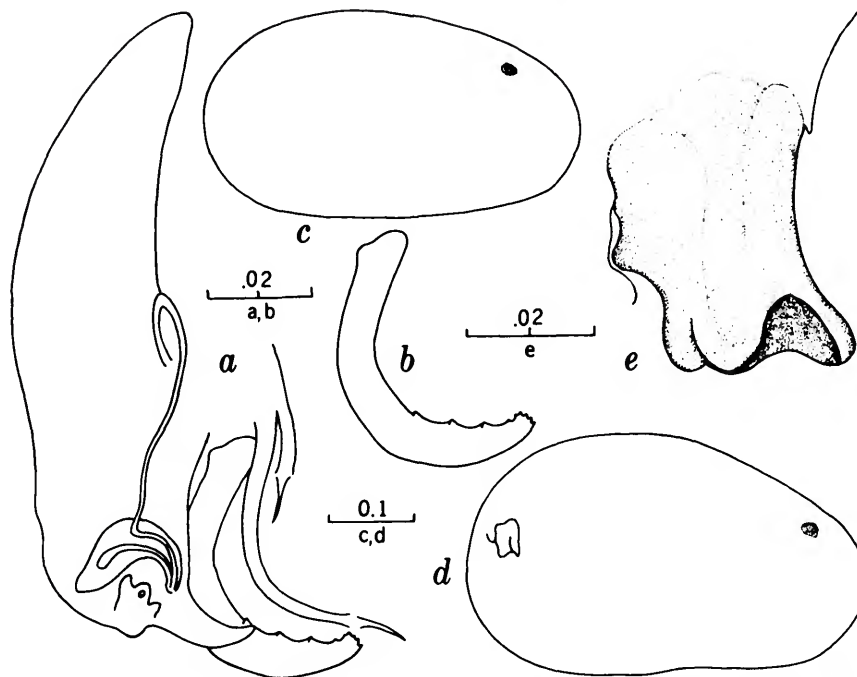


FIGURE 32.—*Ornithocythere waltonae* from Pasquotank County: a, copulatory complex of male; b, clasper of male; c, shell of male; d, shell of female; e, female genitalia (scales in mm).

side ditch 5.5 mi (8.9 km) W U.S. Hwy 264 on U.S. Hwy 64 (host: *C. (L.) d. diogenes*; associates: *Dt. jeanae*, *Ok. cheia*); WASHINGTON COUNTY: (2) roadside ditch 4 mi (6.4 km) E Plymouth on U.S. Hwy 64 (hosts: *C. (L.) d. diogenes*, *F. (C.) uhleri* (?), *P. (O.) a. acutus* (?); associate: *Dt. jeanae*). PASQUOTANK BASIN. PASQUOTANK COUNTY: (3) roadside ditch 2.9 mi (4.7 km) NE Perquimans Co line on Co Rd 1001 (host: *C. (L.) d. diogenes*; associates: *Dt. jeanae*, *Ok. cheia*).

HOSTS.—*Cambarus (L.) d. diogenes*; questionable hosts include *Fallicambarus (C.) uhleri* and *Procambarus (O.) a. acutus*.

ENTOCYTHERID ASSOCIATES.—*Dactylocythere jeanae* and *Okriocythere cheia*.

#### Genus *Uncinocythere* Hart, 1962

*Uncinocythere* Hart, 1962:136.

DIAGNOSIS.—Terminal tooth of mandible pectinate. Copulatory complex of male without finger guard. Ventral portion of peniferum never inflated, variously sculptured, often concave, frequently

bearing single anteroventral acute prominence, and sometimes with anterolateral fold; accessory groove lacking. Penis small, length less than antero-posterior diameter of peniferum at level of penis; spermatic and prostatic elements contiguous. Clasper extending to or beyond ventral margin of peniferum, L-, C-, or U-shaped, with preaxial border of horizontal ramus bearing 1 to 4 teeth, postaxial border entire, and apex with 2 to 4 denticles. Female without pectinate appendix at base of apical claws of second antenna. Genital complex of female consisting of small, weakly sclerotized, tubular papilla.

TYPE-SPECIES.—*Entocythere columbia* Dobbin, 1941:184.

RANGE.—In the Atlantic and Gulf basins, from Ontario to northern Florida and from Minnesota and South Dakota to Pueblo and Veracruz, Mexico; in the Pacific Basin from Utah and Washington to California. Only one species is known to occur in North Carolina.

*Uncinocythere simondsi* (Hobbs and Walton)

FIGURE 33, MAP 5

*Entocythere simondsi* Hobbs and Walton, 1960:17, 18, figs. 1-10.*Uncinocythere simondsi*.—Hart, 1962:138.—Hart and Hart, 1974:133-135, pl. 37: figs. 4-7; pl. 55.*Uncinocythere zancla*.—Hart and Hart, 1974:141 [in part].

**DIAGNOSIS.**—Shell length in mm (numbers in parentheses represent averages): ♂, 0.31-0.36 (0.32); ♀, 0.32-0.41 (0.36). Shell height: ♂, 0.18-0.24 (0.19); ♀, 0.20-0.25 (0.22). Peniferum shallowly or deeply cleft ventrally. Clasping apparatus (Figure 33*b,c*) well developed, extending ventrally approximately as far as peniferum, and clearly divisible into horizontal and vertical rami, latter with pre- and postaxial borders entire and subequal in length to horizontal ramus; horizontal ramus with 2 teeth on preaxial border; proximal tooth, situated near midlength of ramus, only slightly larger than more distal one, latter located slightly distal to midway between proximal tooth and proximalmost of 3

or 4 apical denticles; postaxial border of horizontal ramus entire. Female genital apparatus (Figure 33*d,f*) consisting of slender, tubular papilla.

**TYPE-LOCALITY.**—Dunn Creek, 1.9 miles (3.1 km) west of Fighting Town Creek on Hell's Hollow Road, Fannin County, Georgia; hosts: *Cambarus* (*C.*) *bartonii* and *Cambarus* (*D.*) *latimanus*.

**RANGE.**—According to Hart and Hart (1974:231), this ostracod ranges from Illinois and Kentucky to the panhandle of Florida and from Mississippi to Georgia and South Carolina. It is reported here from several localities in the mountain and piedmont sections of North Carolina.

**NORTH CAROLINA RECORDS.**—Twenty-five localities in the Mountain and Piedmont provinces, encompassing parts of the Little Tennessee, French Broad, Watauga, New, Catawba, Pee Dee, Neuse, and Roanoke basins. Most of these localities are in the mountains; however, it has become established in the upper Piedmont province. The report of the occurrence of *U. zancla* in North Carolina by Hart and Hart (1974:141) was based on misidentifica-

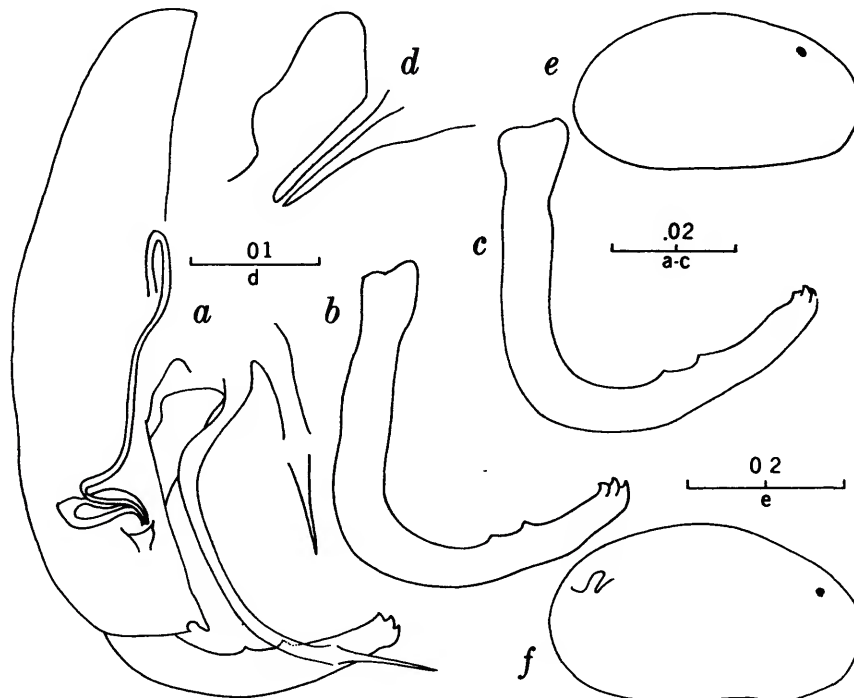


FIGURE 33.—*Uncinocythere simondsi* from Avery County: *a*, copulatory complex of male; *b,c*, clasping apparatus of male; *d*, female genitalia; *e*, shell of male; *f*, shell of female (scales in mm).

tions of *U. simondsi* collected in Alleghany, Durham, and Orange counties.

HOSTS.—*Cambarus* (*C.*) *bartonii*, *C.* (*C.*) sp. A, *C.* (*H.*) *chasmodactylus*, *C.* (*J.*) *asperimanus*, *C.* (*J.*) *dubius*, *C.* (*J.*) *nodosus*, *C.* (*P.*) *reburus*, *C.* (*P.*) *robustus*, and *C.* (*P.*) sp. C.

ENTOCYThERID ASSOCIATES.—*Ankylocythere an-*

*cyla*, *An. tiphophila*, *Aphelocythere acuta*, *Ascetocythere cosmeta*, *Cymocythere clavata*, *Dactylocythere daphnioides*, *Dt. megadactylus*, *Dt. striophylax*, *Dt. suteri*, *Donnaldsoncythere donnaldsonensis*, *Dn. leptodrilus*, *Entocythere dentata*, *E. harrisi*, *E. internotalus*, *Harpagocythere baileyi*, and *Litocythere lucileae*.

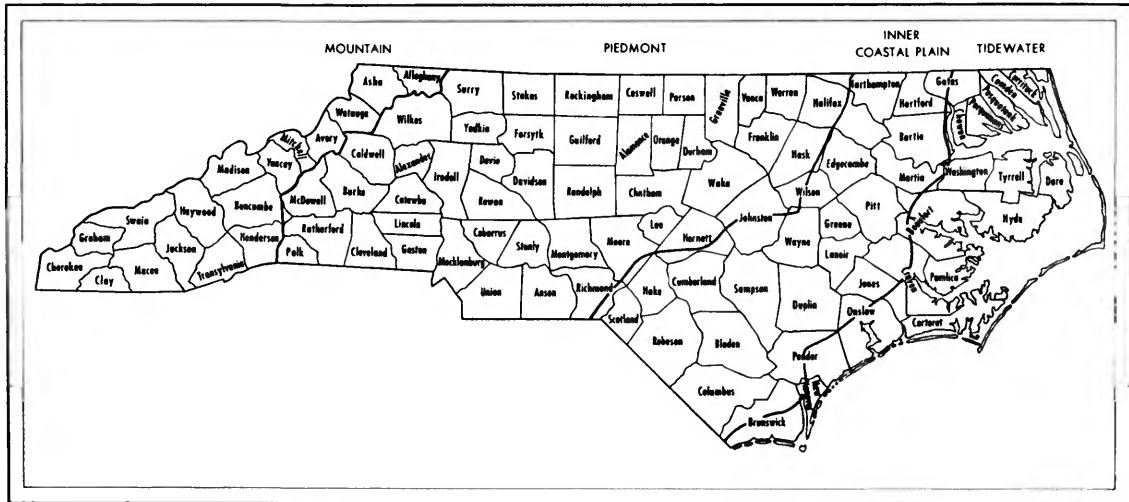
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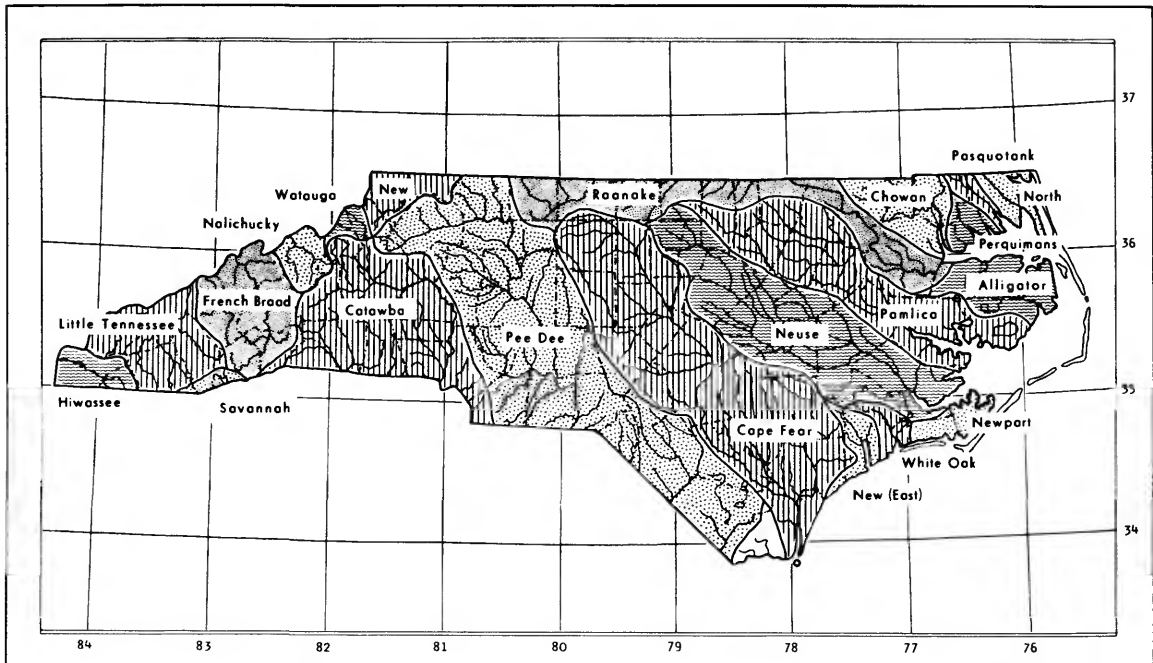
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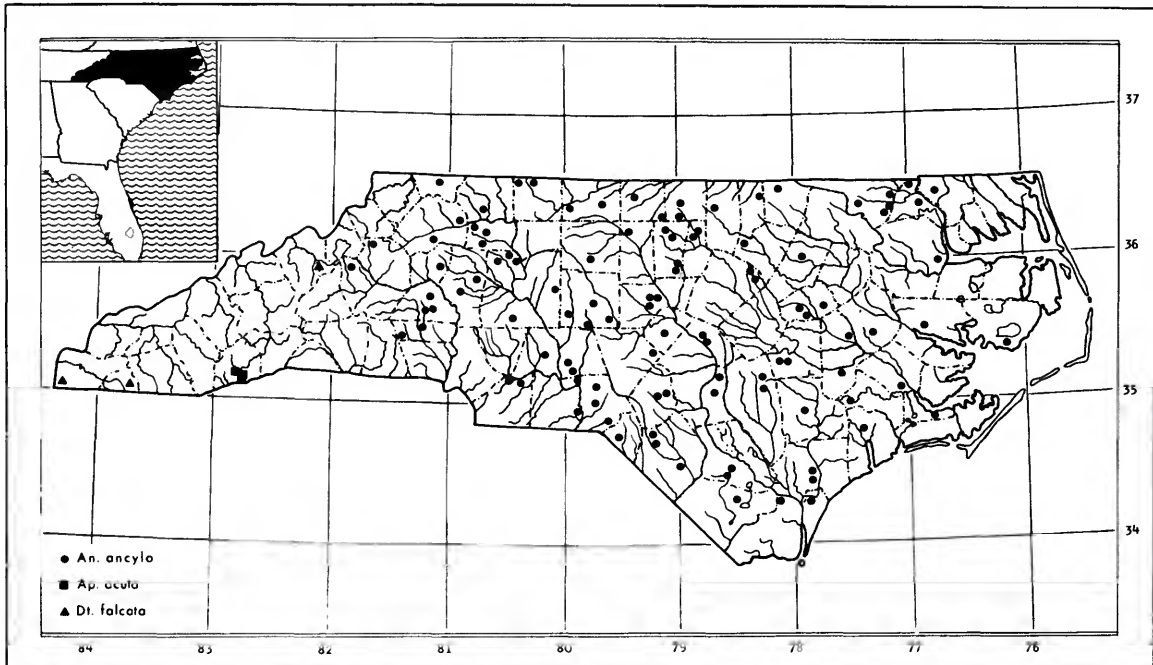
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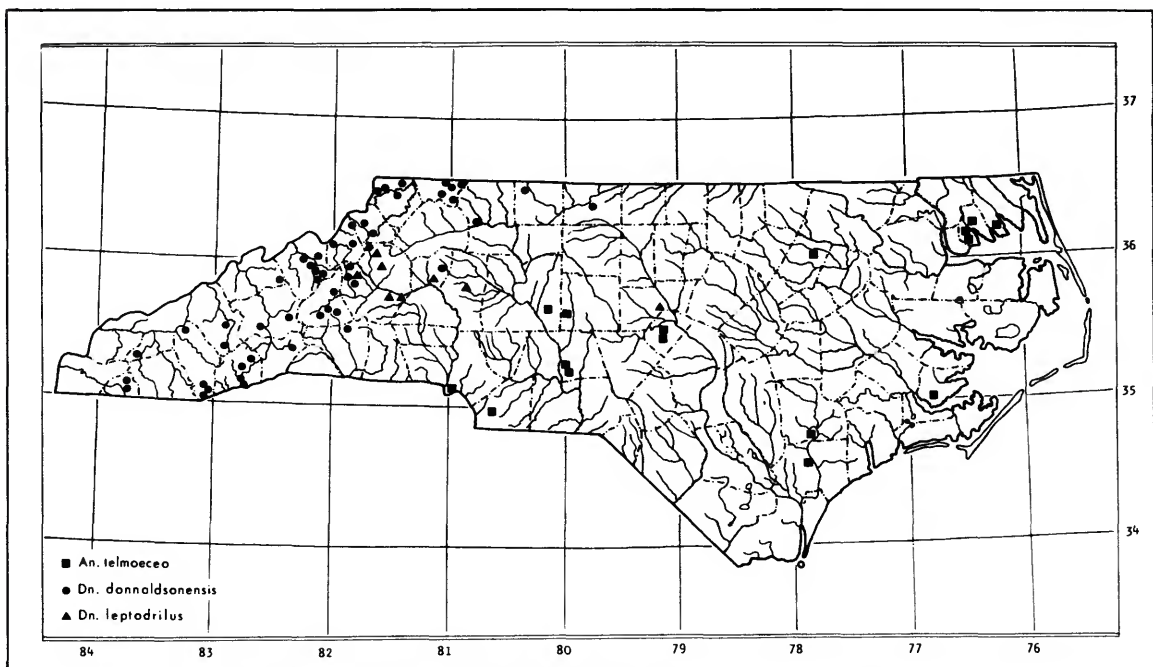
MAP 1.—The physiographic regions and counties of North Carolina.



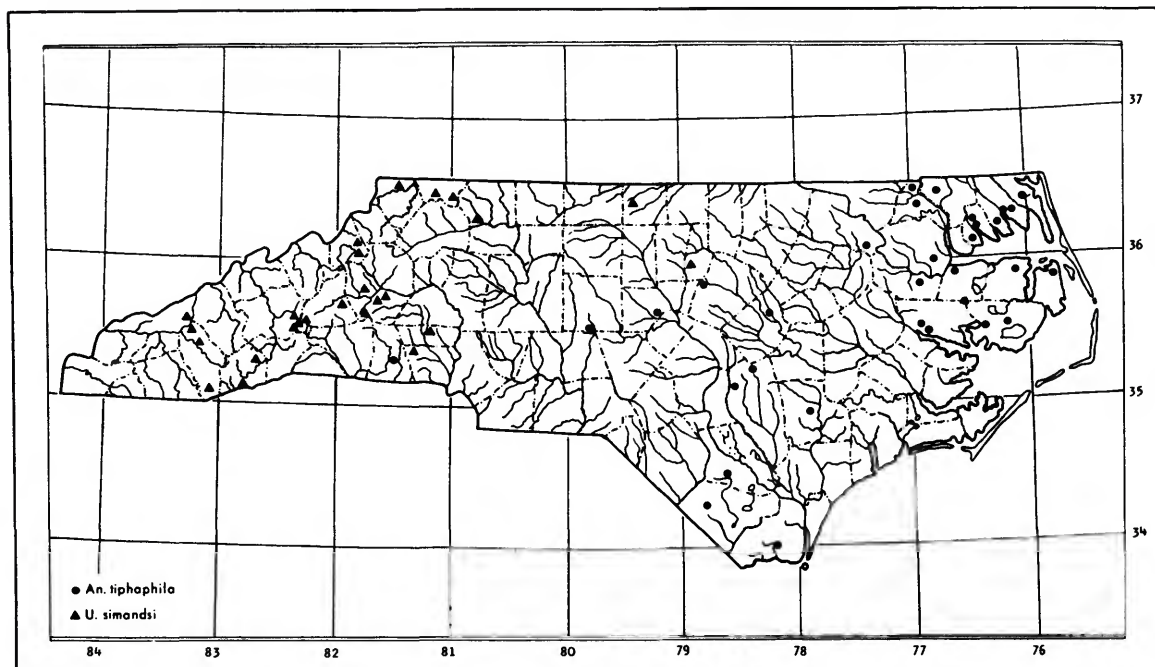
MAP 2.—The major drainage systems of North Carolina.



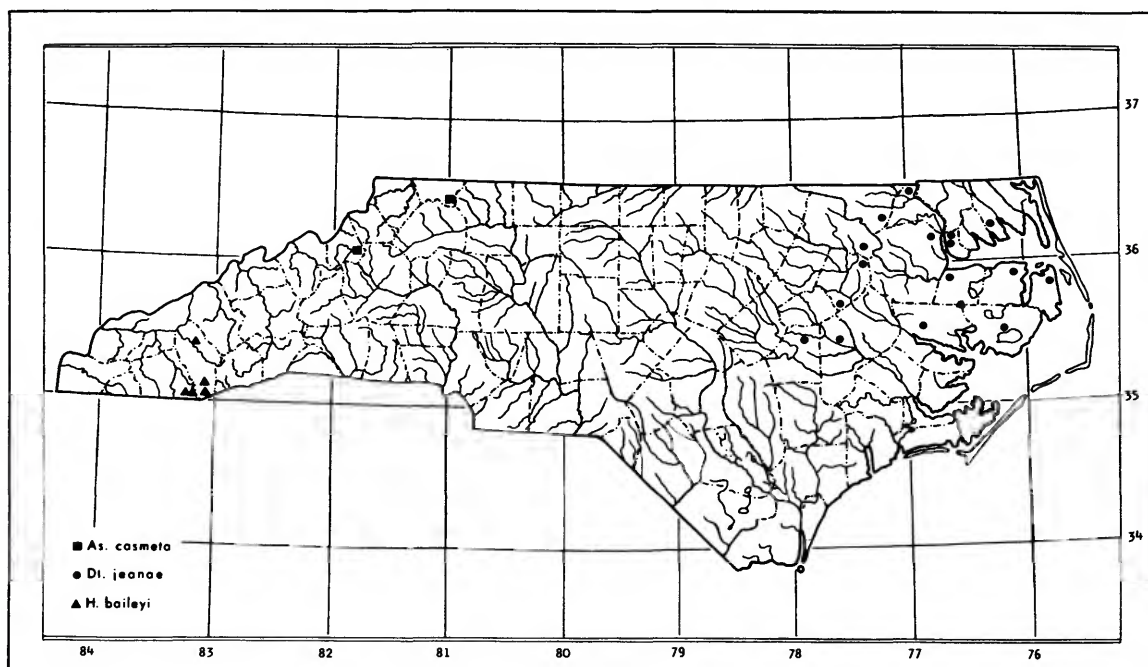
MAP 3.—Distribution of *Ankylocythere ancyla*, *Aphelocythere acuta*, and *Dactylocythere falcata*.



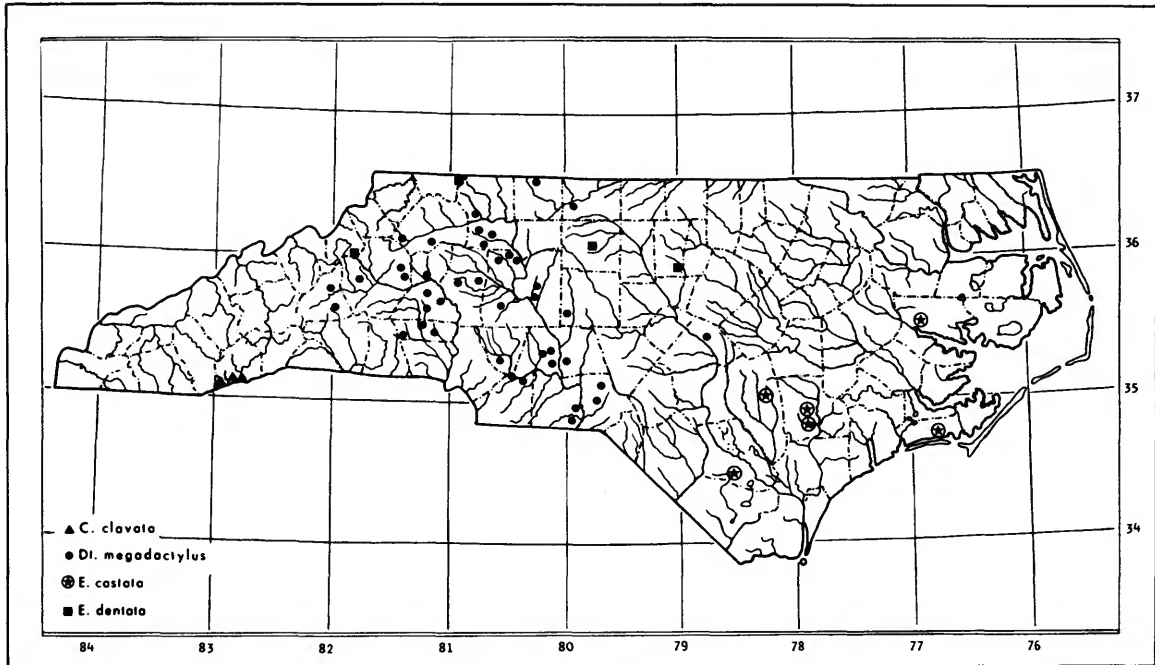
MAP 4.—Distribution of *Ankylocythere telmoecia*, *Donnalsoncythere donnaldsonensis*, and *Donnalsoncythere leptodrilus*.



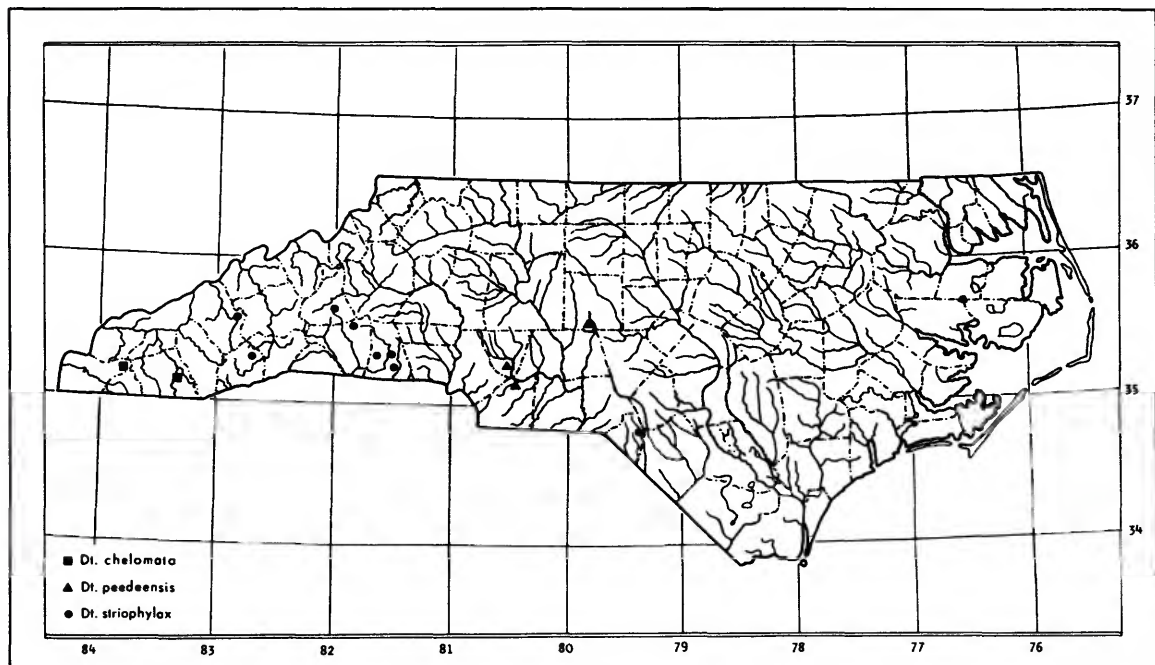
MAP 5.—Distribution of *Ankylocythere tiphophila* and *Uncinocythere simondsii*.



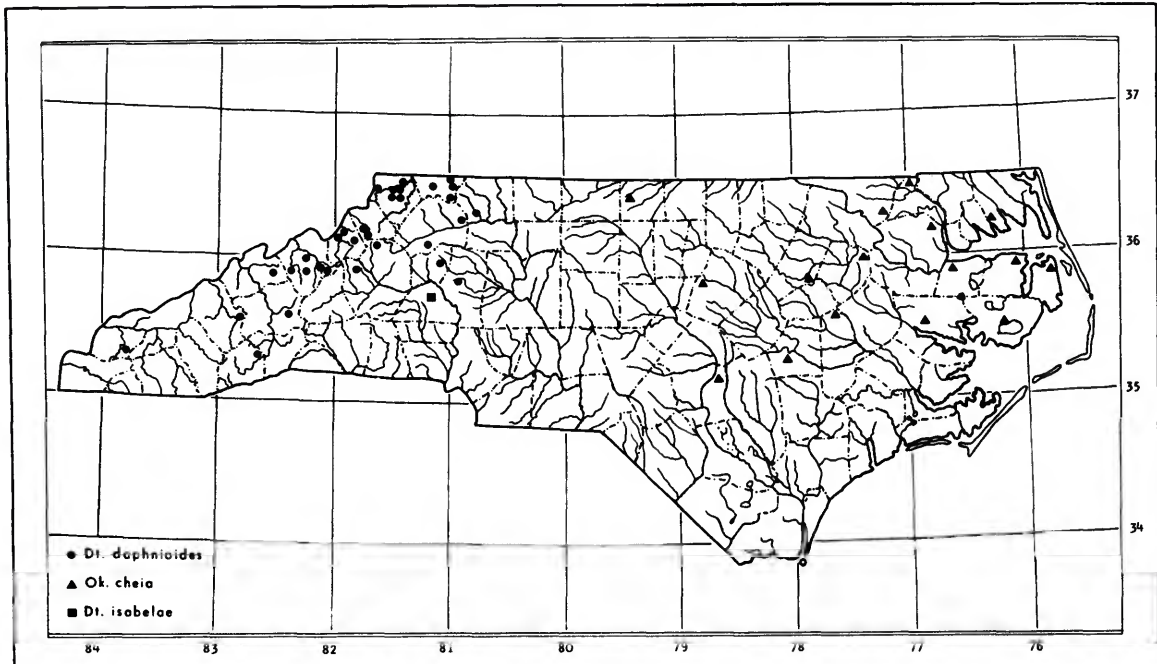
MAP 6.—Distribution of *Ascetocythere cosmata*, *Dactylocythere jeanae*, and *Harpagocythere baileyi*.



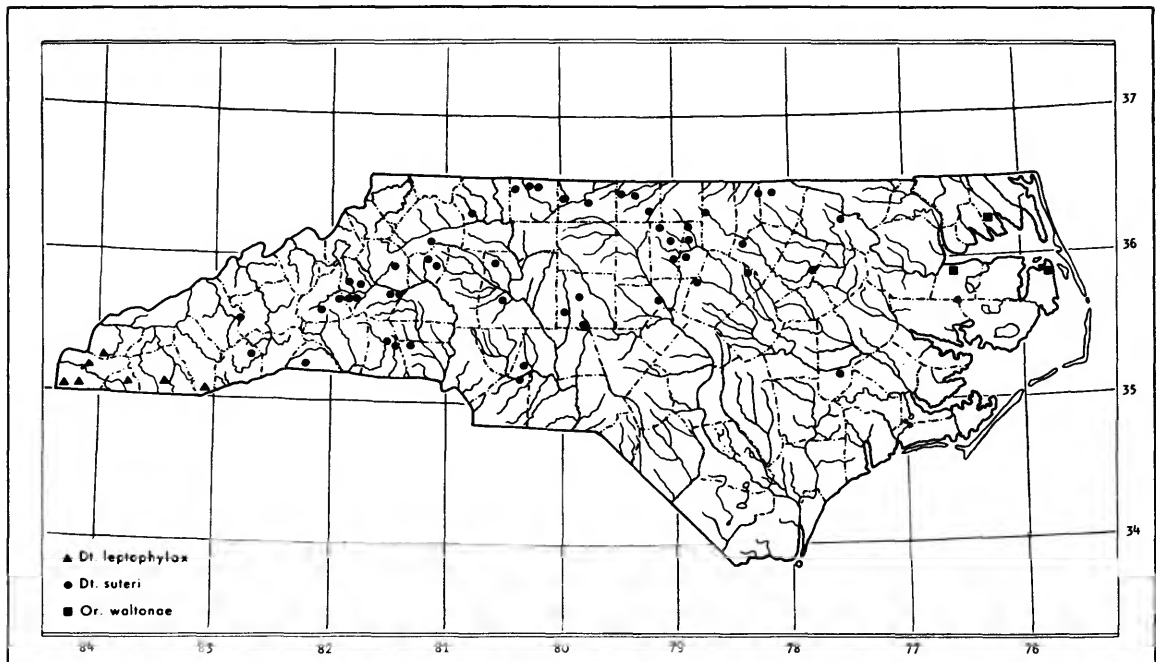
MAP 7.—Distribution of *Cymocythere clavata*, *Dactylocythere megadactylus*, *Entocythere costata*, and *Entocythere dentata*.



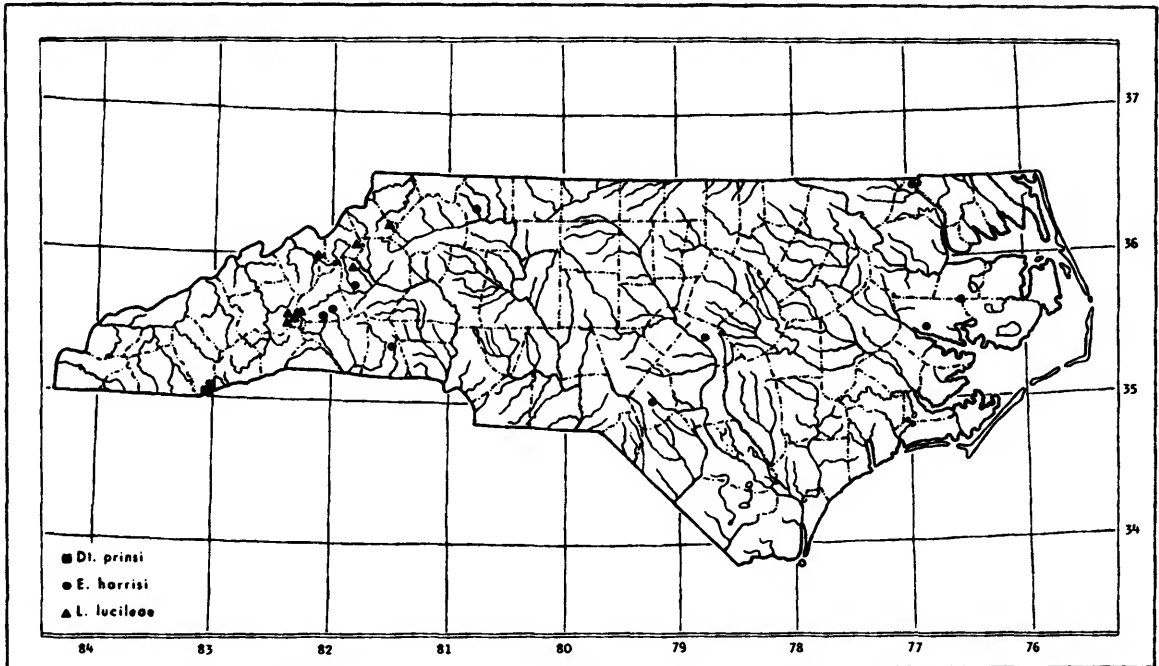
MAP 8.—Distribution of *Dactylocythere chelomata*, *Dactylocythere peedeensis*, and *Dactylocythere striophylax*.



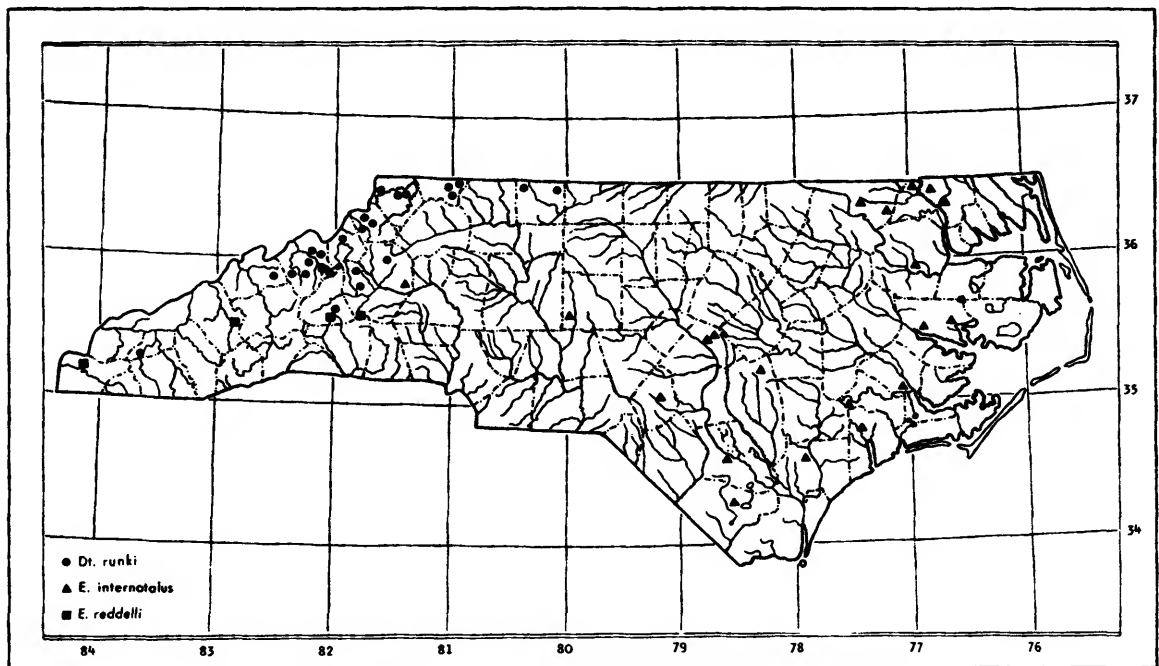
MAP 9.—Distribution of *Dactyloctenre daphnioides*, *Okriocythere cheia*, and *Dactyloctenre isabelae*.



MAP 10.—Distribution of *Dactyloctenre leptophylax*, *Dactyloctenre suteri*, and *Ormithocythere waltonae*.



MAP 11.—Distribution of *Dactyloctenre prinsi*, *Entocythere harrisi*, and *Litocythere lucileae*.



MAP 12.—Distribution of *Dactyloctenre runki*, *Entocythere internotalus*, and *Entocythere reddelli*.









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