FOUR GENERA OF OSTRACODS FROM TENNESSEE (*DARWINULA, LIMNOCYTHERE, ILYOCYPRIS,* AND *SCOTTIA*)

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ABSTRACT

Forty species of free-living fresh-water ostracods were found during a survey of twenty-four counties of central and western Tennessee. Among these species were the seven reported in this paper. Seven new species were previously reported (Cole 1965).

Original citations, synonomy, and a summary of previous descriptions are given, in addition to observations made during this study. Diagnosis, known range, and notes on ecology are included. One species of *Darwinula*, two species of *Limnocythere*, three species of *Ilyocypris*, and one species of *Scottia* are recorded in this paper. This is the first record of the genus *Scottia* for North America.

Darwinula stevensoni (Brady and Robertson, 1870) Sars, 1928

Figs. 1-6

Polycheles stevensoni Brady and Robertson, 1870, Ann. Mag. Natur. Hist., Ser. 4, 6:25, pl. 7, figs. 1-7, pl. 10, figs. 4-14.

Argilloecia aurea Brady and Robertson, 1870, Ann. Mag. Natur. Hist., Ser. 4, 6:16, pl. 8, figs. 4, 5.

Darwinella stevensoni Brady and Robertson, 1872, Ann. Mag. Natur. Hist., Ser. 4, 9:50.

Darwinula stevensoni Brady and Norman, 1889, Trans. Roy. Dublin Soc., Ser. 2, 4:122, 123.

Darwinula improvisa Turner, 1895, Geol. Natur. Hist. Surv. Minn. Zool. Ser. 2, Entomostraca of Minn. Pt. III:336, pl. 81, figs. 1-3, 13.

Darwinula aurea Muller, 1912, Das Tierreich 31:240.

Darwinula stevensoni (Brady and Robertson, 1870) Sars, 1928, Crustacea of Norway 9:145-146, pl. 67.

Description of female. Seen in dorsal view, the anterior end of the shell is pointed, and the posterior end is rounded. The greatest width lies in the posterior one-third of the shell and exceeds one-third of the length. In lateral view, the oblong valve is characterized by a broadly rounded posterior end, a narrowly rounded anterior end, a flatly arched dorsal margin, and a straight ventral margin. The adductor muscle scars, usually nine to twelve in number, are arranged in a rosette slightly antero-dorsal to the middle of the valve. The valves are granular, pearly-white, and sparsely hairy (Fig. 1). Females from Tennessee have a right valve that averages 0.71 mm in length and 0.27 mm in height, a left valve that averages 0.69 mm in length and 0.26 mm in height, and a shell that averages 0.28 mm in width. The first antenna is very short, six-segmented, strongly armed with short, stout setae. The second antenna is short, without swimming setae (Fig. 2). The masticatory processes of the maxilla bear some rounded sensory receptors among the marginal setae (Fig. 3).

The first thoracic leg also bears some rounded sensory receptors among the setae at the margin of the masticatory structure (Fig. 4). The second and third legs each terminate in a long claw and two setae. The claw of the third leg is longer. The abdomen terminates in a knobby cone (Fig. 5). The furca consists of a short basal portion and a terminal seta of moderate length (Fig. 6). Developing larvae can be seen in the posterior part of the shell cavity of the mature female.

Description of Male. No male of this species was collected, and males are inadequately described in the literature. The copulatory complex was figured by Brady and Robertson (1870, pl. 10, fig. 13). Turner reported males of *Darwinula improvisa*, but did not illustrate any special male structures. The shell of the male is somewhat more compressed than that of the female, with the greatest width near the middle, according to Brady and Norman (1889, p. 122).

Diagnosis. The abdomen of the female terminates in a knobby conical process; the furca is greatly reduced and is composed of a short base and a simple terminal seta. The above combination of characters separates this species from other described species of this genus.

Range. In addition to the type locality, this species is known in Europe, North Africa, Asia Minor, North America, West Indies Islands, and Sunda Islands. It is also known as a Post-tertiary fossil. In North America, *D. stevensoni* has been reported from Massachusetts, Michigan, Illinois, Georgia, Kentucky, Texas, and Yucatan. The single Tennessee collection was from the Cedar Glades area of Rutherford County, near Sewart Air Force Base.

Type Locality. Eastern Fen District of England.

Ecology. The depth of the pond from which *D. stevensoni* was collected was undetermined in the middle, but it was about one foot deep at the margin where the samples were taken. The pond was approximately fifteen feet in diameter. *Chara* was abundant, and the bottom was covered with a thick layer of black muck, especially decomposing *Chara*, in which the ostracods were crawling. The pH was 8, and the water temperature was 28 C, on October 2, 1959. Late instar larvae were present in abundance. Mature specimens were obtained by maintaining some of them in laboratory cultures until the following May. The first gravid female was observed during the first week in January.

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Limnocythere ornata Furtos, 1933

Figs. 7-15

Limnocythere ornata Furtos, 1933, Ohio Biol. Surv. Bull. 29:423, pl. 16, figs. 12-17.

Description of Female. The shell in dorsal view tapers to a blunt point anteriorly and is more rounded posteriorly; the left valve extends beyond the right posteriorly. Two shallow, dorso-lateral grooves constrict the shell just posterior to the ocular region; a sharply pointed protuberance occurs lateral to the eye and anterior to these grooves. A deeper groove constricts the shell in the mid-region above the ventro-lateral protuberances, and a pointed protuberance lies posterior to the constriction. These protuberances vary in degree of development in different individuals (Fig. 7). The width is about equal to the height. The valve is subrectangular, and the height is slightly less than one-half the length. The dorsal margin is almost straight or slightly curved; there is a median concavity in the ventral margin. The anterior margin is broadly rounded, while the posterior margin is a little more narrow. The marginal zone, which is wide anteriorly, disappears from view in the mid-ventral region, reappears, and continues as a narrow band in the posterior region. Narrow pore canals terminate in long hairs; between these long hairs are numerous small marginal hairs. The surface of each valve is covered with shallow polygonal depressions which give it a reticulate appearance under magnification. Tiny muscle scars are located subcentrally in a compact group. The valves are practically colorless, granular, and thin and fragile (Fig. 8). In females from Tennessee, the average length of the right valve is 0.63 mm and of the left valve 0.65 mm; the average height of the shell is 0.29 mm, and the average width is 0.28 mm. The first antenna is five-segmented; the length of the terminal segment is about six times its least width, with the terminal setae fused for about one-half the length of the longer seta of the pair (Fig. 9). The exopodite of the second antenna is bi-articulate and extends about to the middle of the terminal claws (Fig. 10). The claw of the first leg equals one and one-fifth times the length of the two terminal segments of the leg (Fig. 11). The claw of the second leg is approximately one and one-third times the length of the last two segments. The claw of the third leg is slightly more than the sum of the lengths of the three distal segments of the leg. The proximal segment of the first leg bears two spine-like setae distally at the "knee," while the second and third legs have one such seta. The furca is a short cone, or it may be blunt at the tip. It is armed with two setae, one sub-terminal, the other near the base (Fig. 12). The genital lobe is pear-shaped, with a finger-like process at the narrower, distal end; it does not appear to vary with the species (Fig. 13). The abdomen terminates in a short spine.

Description of male. In dorsal view, the shell of the male is relatively longer and more slender, and the protuberances are not as well developed as in the female. In lateral view, the posterior height relative to the anterior height is greater than in the female. In males from Tennessee, the average length of the right valve is 0.73 mm and of the left valve 0.75 mm; the average height of the shell is 0.32 mm. The male cephalic and thoracic appendages are essentially like those of the female, with the exception of the third leg. The claw of this leg is long and splender, about as long as the sum of the lengths of all segments of the leg. A "brush form" sense organ occurs between the bases of the legs. The furca is an elongate cone which bears two setae; one seta is located at approximately one-third the length of the furca from the base, the other about two-thirds of the length of the furca from the base (Fig. 14). The furca is usually directed anteriorly; and the terminal portion lies medial to the boot-shaped process of the penis, the two setae projecting ventrally. However, it appears quite probable that the furca can be projected posteriorly from the basal joint. As in other species of this genus, the penis is composed of a pair of semicircular plates with complex muscle bands, these plates covering the posterior part of the animal's body. A spine often can be seen projecting from the posterior end of the abdomen. Of the several appendages attached to the ventro-lateral part of each plate, the largest is shaped like a boot with the toe directed posteriorly and with an elongated sub-triangular flap extending anteriorly from the proximal end (Fig. 15).

Diagnosis. This species is differentiated from closely related species by the presence of pointed lateral protuberances on the shell, the short, cone-shaped female furca, the longer, cone-shaped male furca, and the posteriorly directed, boot-shaped penis appendage.

Range. In addition to the type locality, the species is known only from Tennessee. Tennessee populations were collected from the following localities: Fall Creek and Sugar Creek in Bedford County; Puckett Creek and Dixon Creek in Smith County; Lytle Creek and Fountain Creek in Maury County; Spring Creek in Wilson County; Big Rock Creek and Dry Creek in Marshall County; Eatons Creek, Otter Creek, Seven Mile Creek, South Harpeth River, South Harpeth Overflow Pond, and Marrowbone Lake in Davidson County.

Type Locality. Lake Erie at East Harbor or Chippewa Lake in Ohio. Furtos failed to indicate which of these two areas is the type locality.

Ecology. Furtos found this species in lakes in July and in November and indicated that it was rare. In Tennessee, the species was almost entirely restricted to running water, where it was found creeping on the bottom. The largest population (more than one hundred individuals) was collected from very shallow water in August. Others were collected in February, March, April, June, July, November, and December.

Discussion. Furtos apparently made several errors in her description of this species. She said that the endopodite of the second antenna is biarticulate, when she obviously referred to the exopodite. She failed to illustrate the female furca, and the description rather closely resembles the illustration of the male furca. Since the female furca usually is small and difficult to see, this may have been an erroneous description. The

female furca of Tennessee specimens does not terminate in a strong spine, and the male furca terminates in a blunt point rather than in a sharp spine. Furtos said the terminal abdominal seta was absent. However, in examining her paratype slide #67892 at the United States National Museum, I could see a spine only slightly hidden by debris. Tennessee specimens are smaller than those reported by Furtos. She gives the length of females as 0.88 mm and the height as 0.43 mm. Size is often variable in ostracods, and the proportions and other features are about the same. Of the Tennessee populations assigned to this species, eight contained males; the penis is quite distinctive and closely resembles that figured by Furtos. Therefore, I am of the opinion that they must be the same species. Danforth (1948) described *L. iowensis* from Iowa; this species closely resembles *L. ornata*. He listed the chief differences as the female furca and the antennal exopodite. He did not describe and illustrate his species completely. The size of Iowa specimens is intermediate between those of Tennessee and those of Ohio. Further collecting throughout this range is needed to determine the extent of variation. A more complete description of specimens from the type locality of the species should help determine whether Tennessee specimens belong to the same species, or should be considered a new species.

Limnocythere reticulata Sharpe, 1897, Hoff, 1942
Figs. 16-23

Limnicythere reticulata Sharpe, 1897, Bull. Ill. Lab. Natur. Hist. 4:423-425, pl. 39, figs. 1-7.

Limnocythere reticulata Sharpe, 1897, Hoff, 1942, Ill. Biol. Monog. 19:163-165, pl. 9, figs. 136-141.

Description of female. The valve in lateral view is subrectangular. The dorsal margin is approximately straight, while the ventral margin has a median concavity. The anterior and posterior margins are rounded, the anterior being a little broader. The four elongate muscle scars are arranged in a vertical row near the center of the valve. The valve bulges except in the rather wide marginal zone and in the antero-dorsal area ventral to the anterior hinge tooth, with two more prominent bulges posterior to this depression. The bulging portions are covered with honeycomb-like reticulations. The marginal zone is a little wider anteriorly than posteriorly and is constricted ventrally in the region of the concavity. In this marginal zone there are long, narrow pore canals; there are marginal hairs, but not prominent tubercles. The valves are fragile and creamy-white in color (Fig. 16). The body parts, which are golden brown, are visible through the translucent valves. In dorsal view the shell is elliptical, pointed anteriorly, and narrowly rounded posteriorly. The average length is 0.65 mm, and the average height is 0.34 mm. The terminal segment of the first antenna is about six times as long as wide and bears two terminal and two subterminal setae. The two terminal setae are fused proximally, the free portion of the shorter seta being about one-half as long as the free portion of the other (Fig. 17). The second antenna terminates in three plain claws. The exopodite (flagellum) is two-segmented and reaches at least to the middle of the terminal claws (Fig. 18). The thoracic legs are graduated in length, the first being the shortest. The length of the claw of the first leg equals about one and one-half times the length of the last two segments. The claw of the second leg is a little longer than the claw of the first leg and equals about one and one-fourth times the length of the last two segments of the second leg. The claw of the third leg is very long, about one and one-half times the length of the last three segments of that leg. The proximal segment of the first leg bears two spines distally at the "knee," while the second and third legs each have one spine in this position. The relatively short, cylindrical furca is thick and blunt and bears a short dorsal seta near the proximal end and another short seta distally (Fig. 19). The genital lobes lie lateral to the furcae. The abdomen terminates in a short spine.

Description of male. The valve is longer and relatively not as high as in the female. The average length is 0.75 mm, and the average height is 0.35 mm. The terminal segment of the first antenna is approximately seven times the least width and is slightly longer and more slender than in the female. Other cephalic and thoracic appendages are essentially like those of the female with the exception of the third leg. The claw of the third leg is slightly pectinate and longer than the sum of all segments of this leg (Fig. 20). A "brush form" sense organ occurs between the bases of the legs (Fig. 21). The furca is short and blunt, directed anteriorly, and partly obscured by the falciform process of the penis. There is a short, ventrally-directed seta near the proximal end and a short terminal seta near the rounded distal end (Fig. 22). The penis is composed of a large semicircular plate with complex muscle bands. A pair of these plates cover the postero-dorsal part of the animal's body. Several appendages are attached to the ventro-lateral part of each plate; the largest appendage is falciform and directed anteriorly (Fig. 23).

Diagnosis. L. reticulata is differentiated from other closely related species by the absence of well-developed protuberances on the shell, by the short, cylindrical, blunt-tipped furcae of both male and female, and the anteriorly directed, falciform penis appendage.

Range. In addition to the type locality, this species was reported from twenty-five counties in Illinois by Hoff. Tennessee specimens are from Davidson County.

Type locality. Urbana, Illinois.

Ecology. Sharpe (1897) reported this species from a pond and reared a population from mud taken from the bottom of the pond. Hoff (1942) found *L. reticulata* in running water, seldom in permanent lakes. Tennessee specimens were taken from a creek in November.

Discussion. Sharpe's original description did not mention the structure of males. Hoff (1942) described the male and gave a clear illustration of the penis. However, he said that the falciform process extends posteriorly from the base; apparently it extends anteriorly,

and the furca projects anteriorly and terminates medial to the base of this process. Wise (1962) reported *L. reticulata* from Texas, but the illustration of the penis (Fig. 12) indicates that he did not have this species.

Ilyocypris bradyi Sars, 1890

Figs. 24-30

Ilyocypris bradyi Sars, 1890, Forh. Videns.-Selsk. Christiana 1:59, 60.

Ilyocypris bradyi Sars, 1890, Muller, 1912, Das Tierreich 31:154 (*Monoculus bistrigatus* Jurine, 1820 is in part *I. bradyi*).

Description of female. In dorsal view the shell is semi-oval, more pointed anteriorly and rounded posteriorly, with two prominent furrows posterior to the eyes but lacking lateral protuberances (Fig. 24). The valve is subrectangular, with an almost straight dorsal margin and sinuate ventral margin. The anterior and posterior margins are rounded, the anterior margin being broader than the posterior. There are tubercles, spines and hairs at the margin, often more or less obscured by detritus clinging to the hairs. The surface appears reticulate or pitted. The muscle scars lie near the center of the valve, and the ovary forms a narrow, curved band in the posterior one-half of the valve (Fig. 25). The color resembles the sand on which the animals creep. In females from Tennessee, the average length of the right valve is 0.97 mm, and its average height is 0.48 mm; the average length of the left valve is 1.00 mm, and its average height is 0.49 mm. The width of the shell is approximately 0.50 mm. The natatory setae of the first antenna are relatively short and claw-like. The natatory setae of the second antenna are rudimentary and do not extend beyond the end of the penultimate segment (Fig. 26). The mandible has short, well-developed teeth, and there is a cluster of five plain setae on the medial surface of the antepenultimate segment of the palp. The masticatory lobes of the maxilla are short and wide, and the terminal segment of the palp is as wide as long. The endopodite of the first thoracic leg is three-segmented and leg-like, and the respiratory plate bears six setae (Fig. 27). The second thoracic leg is five-segmented as a result of the division of the penultimate segment (Fig. 28). The third leg bears two setae on the penultimate segment while the terminal segment bears three setae, one of which may be reflexed (Fig. 29). The furca is curved and bears hairs along the distal one-half of the dorsal margin. The ventral length of the furca is ten times the least width. The dorsal seta is plumose, bent in the distal one-third and separated from the subterminal claw by a distance equal to the length of the seta. The terminal seta is approximately twice the width of the ramus (Fig. 30).

Description of male. No males were collected in Tennessee, and I have found no record in the literature where males have been found.

Diagnosis. Ilyocypris bradyi may be distinguished from *I. gibba*, with which it is often associated, by the rudimentary nature in the former of the natatory setae of the second antenna. Also, there are five segments in the second thoracic leg of *I. bradyi*, as a result of the division of the penultimate segment, and its shell lacks the conspicuous lateral protruberances found in *I. gibba* and in *I. decipiens*.

Range. This species is widely distributed. In addition to the type locality, it has been reported from various parts of Europe, from north Africa, and from middle Asia. In the United States it has been reported from Illinois, Ohio, and Wisconsin. Tennessee collections were from Indian Creek, Eaton's Creek, Stoner Creek, and Seven Mile Creek in Davidson County.

Type locality. Norway.

Ecology. Furtos (1933) reported that she found this species inhabiting the bottoms of lakes in May and in November. Hoff (1942) stated that this species is usually found in running water. I found *I. bradyi* only in running water and in each instance it was associated with *I. gibba*. It was collected in April, October, November, and December. The largest population was found in April.

Ilyocypris decipiens Masi, 1906

Figs. 31-37

Ilyocypris decipiens Masi, 1906, Boll. Soc. Zool. Ital. 7:254.

Description of female. The shell is roughly elliptical in dorsal view with bluntly pointed anterior and posterior ends and with rounded lateral projections (Fig. 31). In lateral view the valve is subrectangular with a straight dorsal margin and a slightly sinuate ventral margin. The anterior and posterior margins are imperfectly rounded, the anterior broader than the posterior. The surface is granular and at the margin there are large sensory receptors terminating in long coarse hairs; between these are short hairs and spines to which detritus clings. There is a mid-dorsal depression, and there are anterior and posterior dorsal and ventral rounded projections. Muscle scars are near the center of the valve. The color resembles the sand found in its habitat (Fig. 32). In females from Tennessee, the average length of the right valve is 0.82 mm and of the left valve 0.79 mm; the average height of the shell is 0.39 mm, and its width is 0.38 mm. The swimming setae of both the first and second antennae are rather well developed. The longest swimming setae of the second antenna may extend beyond the tips of the terminal claws (Fig. 33). The mandible has coarse teeth, and there are four plain setae in the bundle on the medial surface of the antepenultimate segment of the palp (Fig. 34). The maxilla and the first thoracic leg are of the type characteristic of the genus. The second thoracic leg is five-segmented as a result of the division of the penultimate segment (Fig. 35). The penultimate segment of the third leg bears two well-developed setae (Fig. 36). The furca is curved and bears hairs along the distal one-half of the dorsal margin. The ventral length of the ramus is ten and one-half times the least width. The terminal and sub-terminal claws are long, slender and non-toothed; the terminal

claw length equals about two-thirds of the ventral length of the ramus. The terminal seta is approximately one-third as long as the terminal claw and the dorsal seta is one-half as long as the terminal claw. The genital lobe is in the form of a bluntly rounded cone (Fig. 37).

Description of male. No males were found in Tennessee collections. The shell of the male is said to resemble that of the female. According to Alm (1915), Klie (1938), and Bronstein (1947), the testis coils lie in the posterior one-half of the valve. The two prehensile palps are essentially alike. There is a rounded projection on the inner edge near the distal end, and the palp terminates in a feathered seta. The inner margin of the plate-like middle process of the penis is distinctly curved, and the inner process is considerably longer than the outer process. The ejaculatory apparatus bears about twenty whorls of spines surrounding the ejaculatory duct. Males are generally rare and may be entirely absent.

Diagnosis. I. decipiens resembles *I. gibba*, but the protuberances on the shell are rounded while those of *I. gibba* are pointed; the second thoracic leg is five-segmented in *I. decipiens*, four-segmented in *I. gibba*. If males are found, they may be distinguished by differences in the structure of the penis.

Range. In addition to the type locality, this species has been reported from Germany, Russia, and Sweden. The single Tennessee collection which contained *I. decipiens* was from Fall Creek in Bedford County.

Type locality. Southern Italy.

Ecology. According to Klie, *I. decipiens* is found in a habitat similar to that of *I. gibba*. In Tennessee, seventeen individuals were collected from shallow, flowing water in a creek with rock bottom. No other species of *Ilyocypris* was found here, but there was a very large population of *Limnocythere ornata*. The sample was taken in August.

Remarks. Although females of *I. decipiens* in Tennessee agree closely with the description of European representatives, they are considerably smaller. Tennessee specimens are about 0.8 mm long and European specimens are 1.10-1.15 mm. The study of males is needed to determine whether or not the Tennessee specimens belong to a new species.

Ilyocypris gibba (Ramdohr, 1808) Brady and Norman, 1889

Figs. 38-43

Cypris gibba Ramdohr, 1808, Mag. Ges. Fr. Berlin 2:41, pl. 3, figs. 13, 14, 17.

Ilyocypris gibba (Ramdohr, 1808) Brady and Norman, 1889, Trans. Roy. Dublin Soc., Ser. 2, 4:107, pl. 22, figs. 1-5.

Description of female. In dorsal view the shell is semi-oval, more rounded posteriorly and pointed anteriorly, with two prominent furrows posterior to the eye extending laterally from the hinge line. A pair of dorso-lateral projections lie anterior to the eye, a pair of prominent dorso-lateral projections are located posterior to the furrows, and there is a pair of small postero-ventral projections (Fig. 38). The valves are oblong, the height slightly less than one-half the length. The color is light tan, resembling the soil on which they crawl; the surface of the valves is covered with pits and granules. Tubercles, spines, and hairs occur especially around the free edge; the dorsal margin is almost straight, the anterior margin is more broadly rounded than the posterior, and the ventral margin is slightly concave (Fig. 39). In females from Tennessee, the average length of the right valve is 0.89 mm, and its average height is 0.44 mm; the average length of the left valve is 0.92 mm, and its average height is 0.45 mm. The average width of the shell, exclusive of protuberances, is 0.40 mm. The specific name refers to the protuberances. The swimming setae of both the first and the second antenna are well developed, extending beyond the tips of the terminal claws in the latter appendage (Fig. 40). The mandibles bear short teeth of moderate size, and there are four long, plain setae and one short, feathered seta clustered in a group on the antepenultimate segment of the palp. The masticatory lobes of the maxilla are short and broad, and the distal segment of the palp is wider than long. The endopodite of the first thoracic leg is composed of two or three segments and terminates in three setae; the respiratory plate is well developed and bears six setae. The penultimate segment of the second leg is undivided, the leg being composed of four segments (Fig. 41). The terminal segment of the third leg is approximately one-half as wide as long and bears three setae of unequal length; the shorter of the two terminal setae is about one-third as long as the other, and one-half as long as the outer seta (Fig. 42). The furca is curved and the ventral length of the ramus about seven times the least width. The furcal claws are long and slender and not toothed; the terminal claw equals about two-thirds the ventral length of the ramus. The dorsal seta is long and feathered, equaling four times the least width of the ramus; the terminal seta equals one-half the length of the subterminal claw. The distal one-half of the dorsal aspect of the furcal ramus bears numerous small setae (Fig. 43).

Description of male. No males were found in Tennessee collections. The shell is said to be much like that of the female in size and shape. The two prehensile palps are similar. The propodus is long and cylindrical, and the dactylus tapers to a sharp point. The penis bears three lobes, of which the middle lobe is longer, extending far beyond the main body of this structure. Males are seldom found, but they have been reported from northern Africa and southeastern Russia.

Diagnosis. I. gibba is separated from most closely related species by the presence of prominent lateral protuberances on the valve. It may be separated from *I. decipiens* since the latter has more rounded protuberances and a five-segmented second leg, while *I. gibba* has pointed protuberances and a four-segmented leg.

Range. In addition to the type locality, this species is known from other parts of Europe and from northern Africa. In North America it has been reported from Colorado, Ohio, and Illinois. This is the most common representative of the genus in Tennessee collections. It was collected from Indian Creek, Eaton's Creek, Ewing Creek, Stoner Creek, Seven Mile Creek, Hamilton Creek, and a pond formed by overflow from the South Harpeth River in Davidson County; from Fountain Creek, and from a tributary of Silver Creek in Maury County; from Puckett Creek and Dixon Creek in Smith County; from Stewart Creek in Rutherford County; and from Defeated Creek in Hickman County.

Type locality. Germany.

Ecology. I. gibba is a creeping form usually obtained by scraping the bottom in lotic habitats. The species was collected in each month from July to December, but not from January to June. In four collecting areas, this species was associated with *Ilyocypris bradyi.*

Genus *Scottia* Brady and Norman, 1889

The shell is reniform, firm, and densely hairy. The swimming setae of the second antenna are rudimentary, not reaching the terminal segment. The first thoracic leg bears a well-developed respiratory plate. The second thoracic leg has one long terminal seta and one long terminal claw. The furca is stout and bears very strong claws, a long, feathered dorsal seta, and a slender, claw-like terminal seta. The ejaculatory apparatus has numerous closely set wreaths of spines. There is only one species.

Scottia browniana (Jones, 1850) Brady and Norman, 1889

Figs. 44-53

Cypris browniana Jones, 1850, Ann. Mag. Natur. Hist., Ser. 2, 6:25-28; pl. 3.

Scottia browniana (Jones, 1850) Brady and Norman, 1889, Trans. Roy. Dublin Soc., Ser. 2, 4:72; pl. 9, figs. 23, 24; pl. 11, figs. 19-25.

Description of female. In dorsal view the shell is oval, rounded at both ends. The valves are subreniform, strongly arched dorsally, but almost straight ventrally. They are brown in color, strongly calcified and hairy, especially at the margin. Three or four oval muscle scars are located near the center of each valve (Fig. 44). In females from Tennessee, the average length of the right valve is 0.67 mm, and its average height is 0.40 mm; the average length of the left valve is 0.70 mm, and its average height is 0.41 mm. The average width of the shell is 0.40 mm, or equal to the height. The height exceeds one-half the length. The first antenna is composed of seven segments, and most of the swimming setae are well developed, but a few are shortened and spine-like. The second antenna has rudimentary swimming setae which do not reach to the distal end of the penultimate segment. The terminal claws of this appendage are short and heavy (Fig. 45). The mandible does not show any very distinctive features. The masticatory lobes of the maxilla are long and slender and bear long, slender terminal setae; the terminal segment of the maxillary palp is short and expanded distally. The first thoracic leg bears a well-developed branchial lobe of six setae; oval sensory receptors are scattered among the terminal setae of the masticatory lobe (Fig. 46). The second thoracic leg is composed of five segments; the second segment bears four clusters of setae along the margin; there is a feathered seta at the antero-distal end of segments two, three, and four; the terminal segment bears, at its distal end, a long toothed claw and a feathered seta almost as long and heavy as the claw (Fig. 47). The terminal segment of the third leg is small and bears a claw-like seta and a reflexed seta (Fig. 48). The furca is stout, the ventral length nine and one-half times the least width; the dorsal seta is long and feathered, equal to the length of the subterminal claw, and is separated from it by little more than the width of the ramus. The terminal seta is spine-like, and its length equals twice the width of the ramus. Terminal and subterminal claws are heavy and blunt, and each has a patch of coarse setae near the middle of the dorsal surface; the subterminal claw equals five-sixths of the length of the terminal claw (Fig. 49).

Description of male. The valve of the male resembles the valve of the female in shape and size. The testis coils are conspicuous in the posterior one-third of the valve (Fig. 50). The average length of the right valve in males from Tennessee is 0.66 mm, its average height is 0.39 mm; the average length of the left valve is 0.68 mm, and its height is 0.40 mm. There are two sensory setae on the second antenna, but the appendage is not divided at the point of their origin. The two prehensile palps are similar in shape, with a sickle-shaped dactylus. The right palp is somewhat longer than the left (Fig. 51). The ejaculatory apparatus surrounding the ejaculatory duct is armed with 19-21 whorls of spines, exclusive of terminal crowns. The ejaculatory sac is three times as long as wide (Fig. 52). The penis is shaped like a triangle with rounded angles, or a flattened bird's head, with a conspicuous coil of tubes in the proximal portion, and with two blunt, hooked terminal processes (Fig. 53).

Diagnosis. S. *browniana* is readily separated from all described species of Cyprinae by the peculiar appearance of its second thoracic leg, which appears to terminate in two long claws.

Range. The only Tennessee collection was taken from a spring in the suburbs of Centerville, Hickman County, Tennessee, near the Duck River bridge. This is the first report of the species from the United States. In addition to the type locality, it is known from Denmark, Sweden, Germany, Switzerland, and Russia. Previous to the discovery of the recent form, this species was known as a Pleistocene fossil.

Type locality. The fossil form was first reported from the Pleistocene beds in Clackton, Essex. The recent form was first found on the Isle of Bute in Scotland.

Ecology. This interesting relict species was found associated with two new species of ostracods, *Cypridopsis arhiga* and *Cypridopsis herpestica*, in a cold-water spring. Moss lined the rock surface of the spring basin, and *Nostoc* also was present, as well as tardigrades, Collembola, and tipulid larvae. The flow of the water appeared to be rather constant, and so was the temperature. The water registered 19 C on September 9, 1959 and 20 C on April 4, 1960. On the latter date the air temperature was 32 C. No ostracods were collected from the drainage ditch flowing from the spring. *Scottia browniana* is classified as a cold water stenotherm, and this report lends support to the conclusion. The adults are not so sensitive that they cannot be carried to the laboratory and studied in the living condition, but it was not possible to successfully maintain a culture for any great length of time under normal laboratory conditions.

Discussion. Valves of these specimens have been compared with those of fossil forms which were kindly lent by Dr. R. H. Bate of the British Museum of Natural History. Tennessee collections have not been compared with the recent form from Europe, but they agree closely with the descriptions and illustrations of Alm (1915), of Klie (1938), and of Bronstein (1947). Chromosome studies of this species were made by Dietz (1955), and it would be of interest to make such a study on Tennessee specimens. This is apparently a very stable species.

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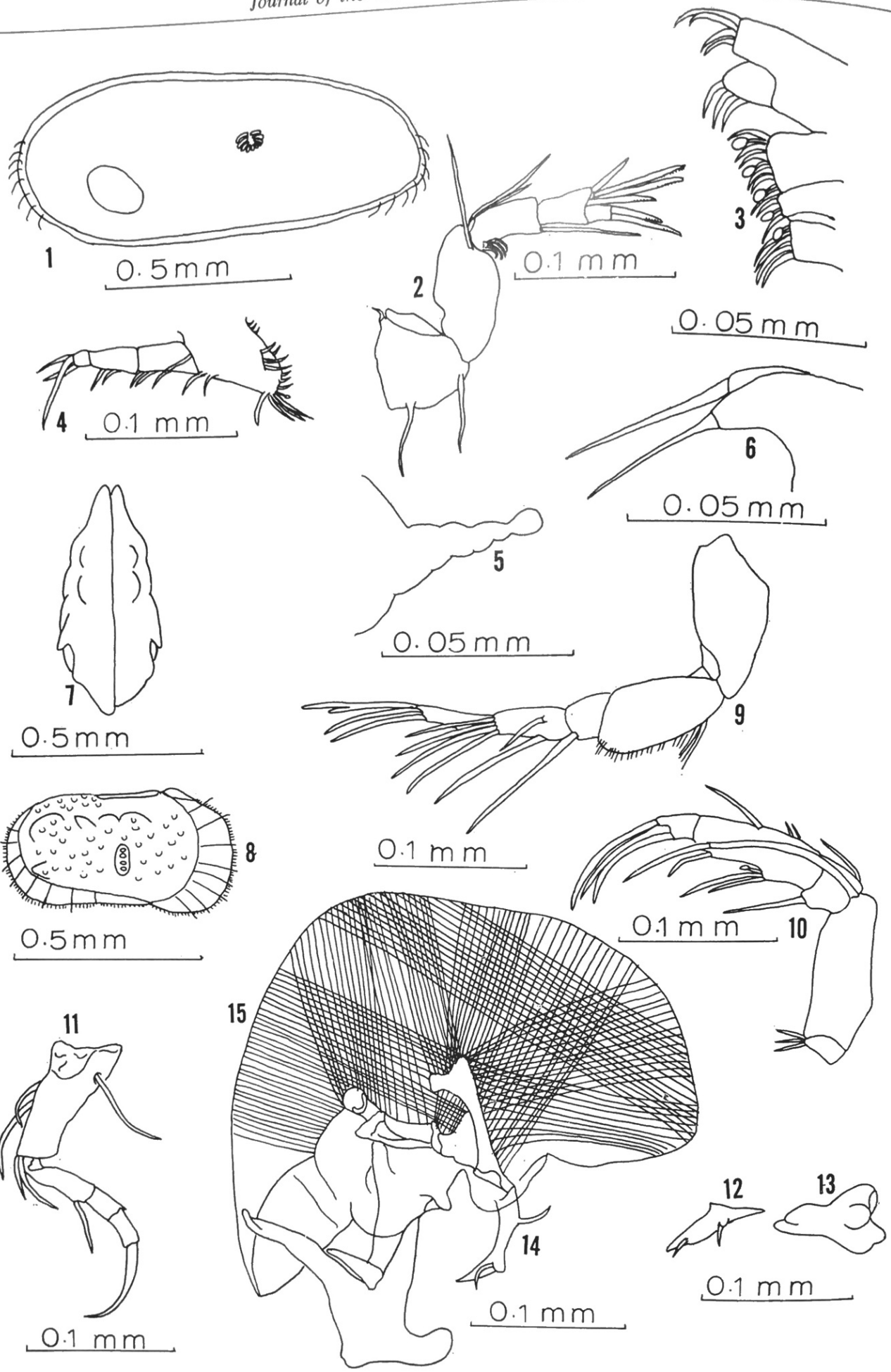


Fig. 1. Right valve of female
Fig. 2. Second antenna of female

Fig. 7. Dorsal view of shell of female
Fig. 8. Right valve of female
Fig. 9. First antenna of female

DARWINULA STEVENSONI

Fig. 3. Maxilla of female
Fig. 4. First thoracic leg of female

LIMNOCYTHERE ORNATA

Fig. 10. Second antenna of female
Fig. 11. First thoracic leg of female
Fig. 12. Furca of female

Fig. 5. Terminal process of abdomen
Fig. 6. Furca of female

Fig. 13. Genital lobe of female
Fig. 14. Furca of male
Fig. 15. Penis

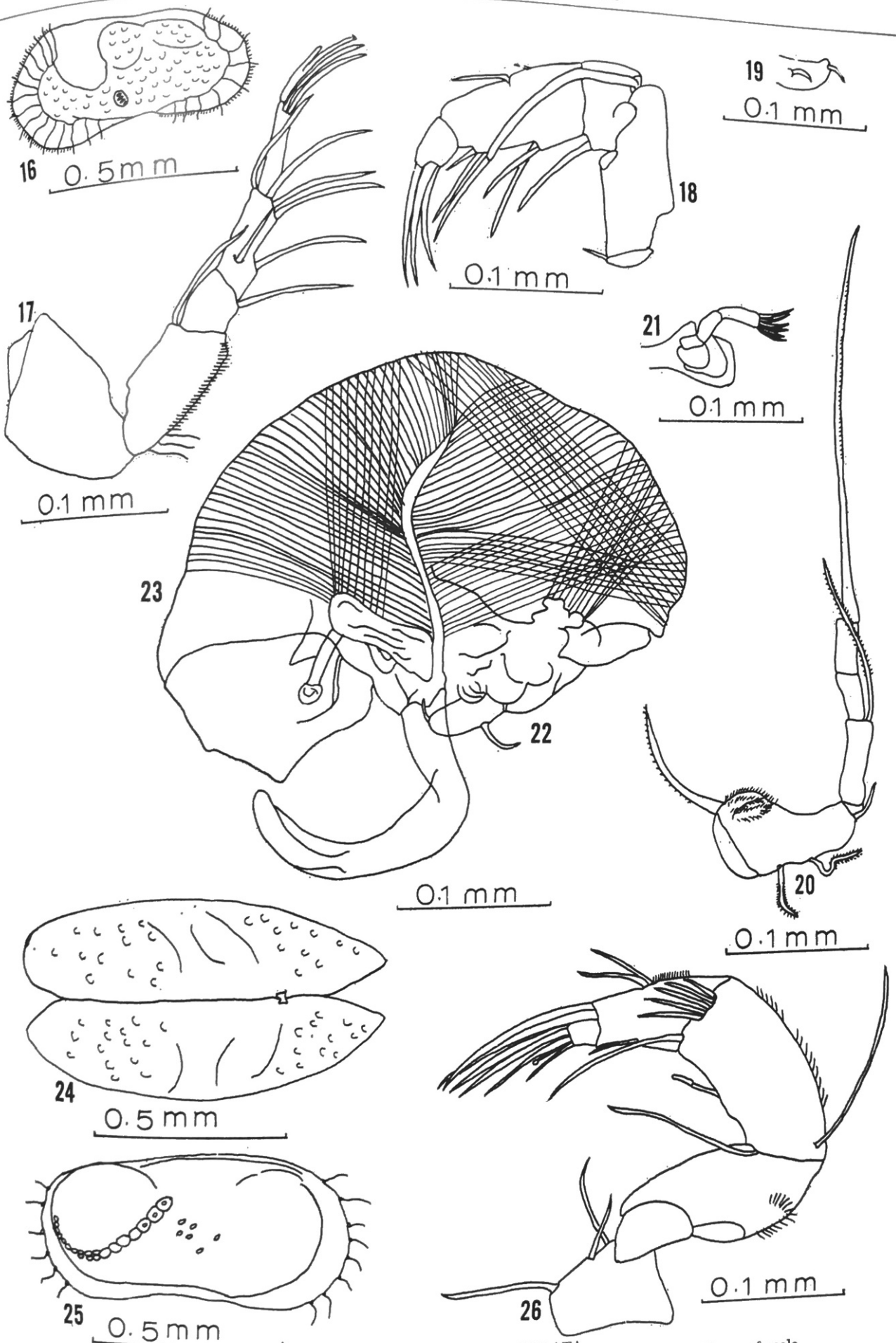


Fig. 16. Lateral view of left valve of female
Fig. 17. First antenna of female
Fig. 18. Second antenna of female

Fig. 24. Dorsal view of female

LIMNOCYTHERE RETICULATA

Fig. 19. Furca of female
Fig. 20. Third leg of male
Fig. 21. "Brush-form" sensory organ of male

ILYOCYPRIS BRADYI

Fig. 25. Right valve of female

Fig. 22. Furca of male
Fig. 23. Penis

Fig. 26. Second antenna of female

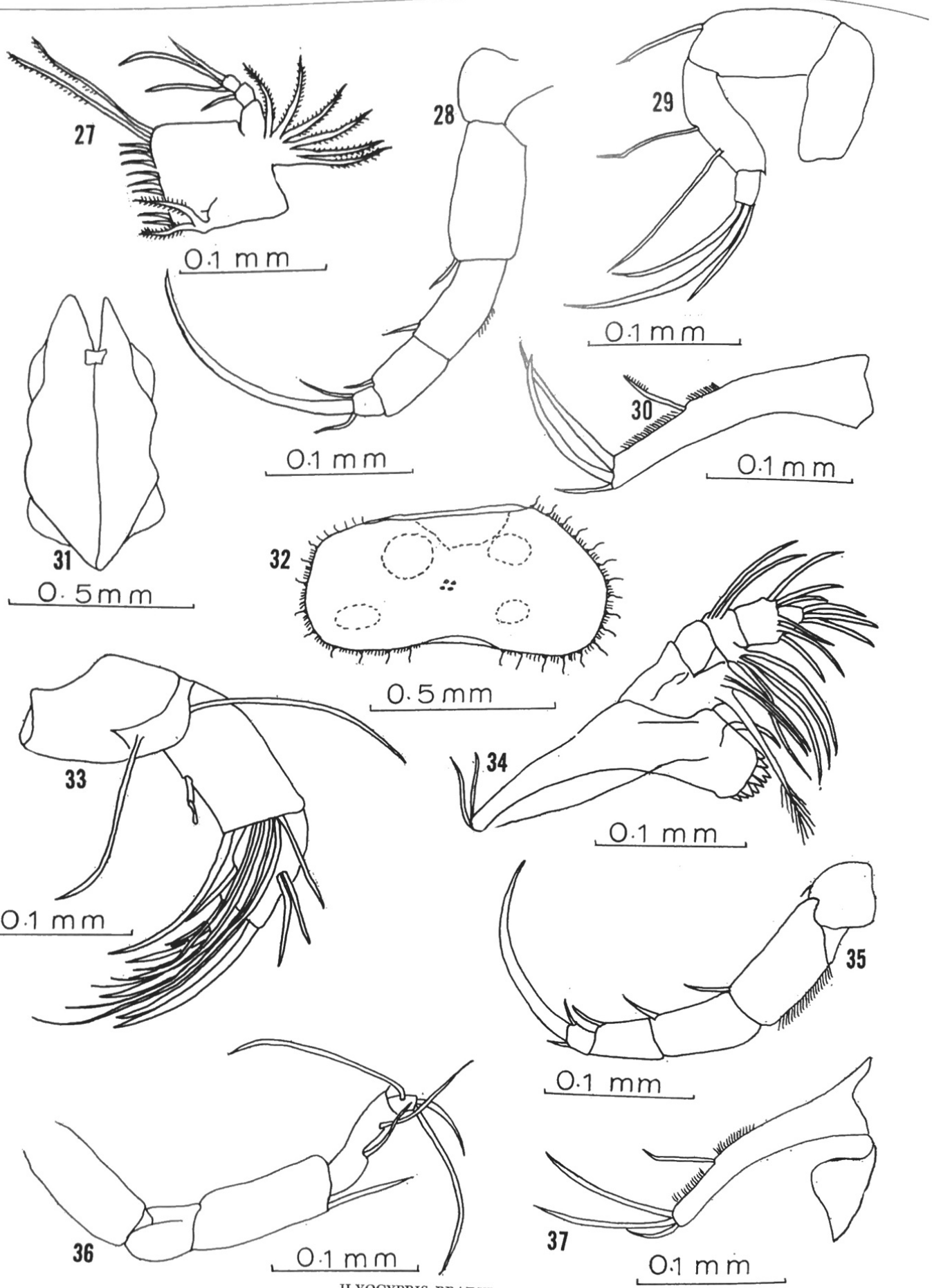


Fig. 27. First thoracic leg of female
Fig. 28. Second thoracic leg of female

ILYOCYPRIS BRADYI

Fig. 29. Third thoracic leg of female
Fig. 30. Furca of female

Fig. 31. Dorsal view of female
Fig. 32. Right valve of female
Fig. 33. Second antenna of female

ILYOCYPRIS DECIPIENS

Fig. 34. Mandible of female
Fig. 35. Second thoracic leg
Fig. 36. Third thoracic leg
Fig. 37. Furca and genital lobe

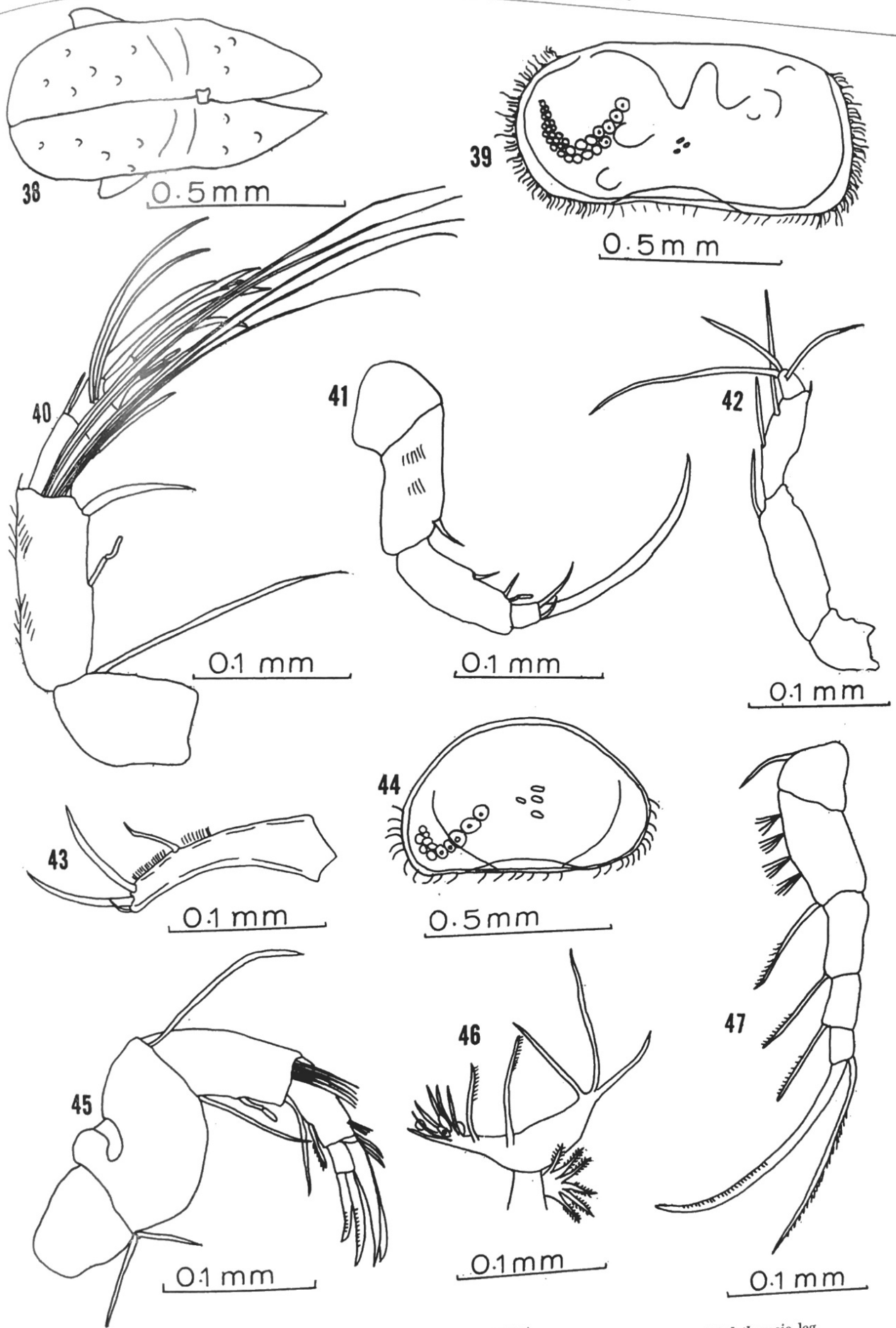


Fig. 38. Dorsal view of female
Fig. 39. Right valve of female

Fig. 44. Right valve of female
Fig. 45. Second antenna of female

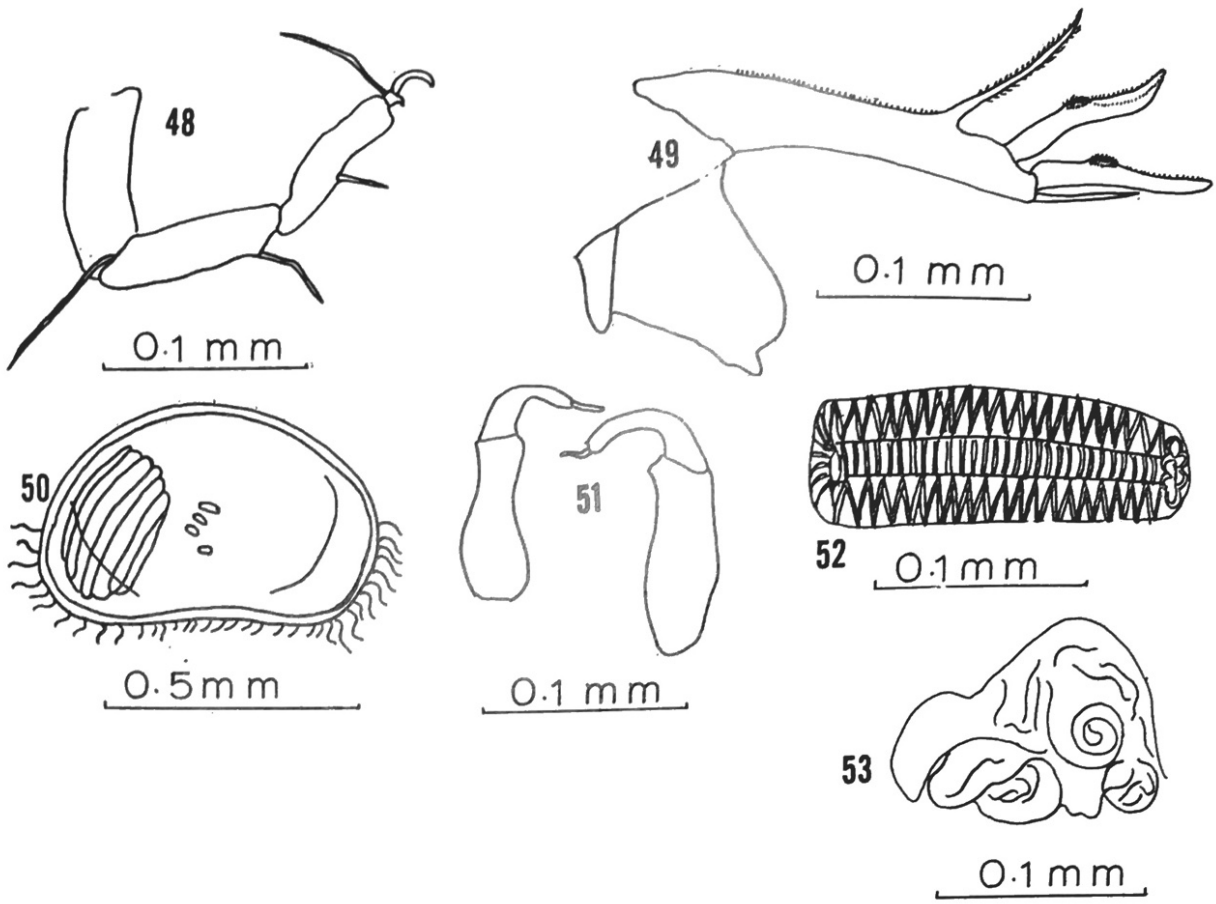
ILOCYPRIS GIBBA

Fig. 40. Second antenna of female
Fig. 41. Second thoracic leg

Fig. 42. Third thoracic leg
Fig. 43. Furca

SCOTTIA BROWNIANA

Fig. 46. First thoracic leg of female
Fig. 47. Second thoracic leg



SCOTTIA BROWNIANA

Fig. 48. Third thoracic leg of female
Fig. 49. Furca and genital lobe of female
Fig. 50. Right valve of male
Fig. 51. Prehensile palps of male
Fig. 52. Ejaculatory apparatus of male
Fig. 53. Penis