

Rotifera from Korean Inland Waters IV. *Brachionus* and *Platyas* of Brachionidae (Rotifera: Monogononta)

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韓國 淡水産 輪形動物 IV. Brachionidae의 2屬 *Brachionus*와 *Platyas* (Rotifera: Monogononta)

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적 요

韓國 淡水産 輪蟲類의 分類學的 研究를 위하여 1990年 3月부터 1992년 2月까지 全國 일대에 散在해 있는 댐, 호수, 저수지, 연못, 논, 웅덩이 등을 대상으로 總 205개 지점에서 採集을 實施하여 調査한바, Brachionidae科의 *Brachionus*屬에 9亞種 2變種 6型이, 그리고 *Platyas*屬에는 1種이 밝혀졌는데, 그중 *Brachionus*屬의 1亞種 4型: *Brachionus urceolaris bennini*, *B. angularis* f. *bidens*, *B. quadridentatus* f. *rhenanus*, *B. forficula* f. *minor*, *B. forficula* f. *angularis*가 韓國 未記錄으로 판명되어 記載와 함께 도판을 作成하였고, 本 研究에서 確認된 *Brachionus*와 *Platyas*屬내의 種들에 대해서는 물론, 연차적인 발표를 목적으로 韓國産 輪形動物에 대한 전체적인 檢索表를 만들었다. 따라서 지금까지 記錄된 韓國産 輪蟲類는 總 2綱 4目 14科 40屬 134種, 15亞種, 9變種, 9型이 된다.

Key words: freshwater Rotifera, taxonomy, Korea.

INTRODUCTION

Rotifers are a single major taxonomic category that is majority being confined to freshwater habitat.

The most characteristic feature of a rotifer are the peculiar jaws (Trophe) (Fig. 2), the like of which are not to be found anywhere else in the animal kingdom (Hollowday, 1945-50). In previous studies about 1,500 species (including 120 genera) have been described from the world (Donner, 1966). Up to now, many authors (Hada, 1936; Yamamoto, 1953; Turner, 1986; Chung *et al.*, 1990) recorded about 170 species (including limno-ecological investigation) in Korea, and the species were first listed by Song (1989), and their systematic studies partly reviewed by Song and Kim (1989). In this part of our series of the Korean Rotifera (Chung *et al.*, 1991a, 1991b, 1992), we deal with the Korean specimens of genera *Brachionus* and *Platyas* of the family Brachionidae. Also, we provide the key to the Korean Rotifera for the first time.

MATERIALS AND METHODS

This study was based on the materials collected, during the period from March 1990 to February 1992, at 205 sites in Korea (Chung *et al.*, 1991b). Collections were made with a conical plankton net (mouth diameter: 30 cm; length: 90 cm; mesh size: 55 μ m) by horizontal haul from surface. All samples were fixed with 5% neutral formalin right away after collecting.

We followed the mounting methods of Hanley (1949) and Stemberger (1979). Drawing and measuring were made with the aid of a camera lucida. All drawings and descriptions of this study were based on characters of the female because of parthenogenic reproduction of rotifers.

All specimens reported here are deposited in the Department of Biology Education, Chonnam National University.

The classification system was mainly based on Koste (1978) and Mizuno and Takahashi (1991).

SYSTEMATIC ACCOUNTS

Phylum Rotifera Cuvier, 1798 율형동물문

Key to the Classes, Orders and Families of Rotifera

1. Ovary single Class Monogononta 2
- Ovary paired Class Digononta Trophi ramate type (Fig. 2, 7); foot with 0-4 toes, and spurs Order Bdelloidea Stomach with tubular lumen, sometimes indistinct; corona retractible, large trochus discs (Fig. 1, 7) Philodinidae
- 2(1) Corona of Collothecidae-pattern (Fig. 1, 6), trophi uncinata type (Fig. 2, 6) Order Collothecacea Margin of corona furnished either with long, very fine setae, or in a few cases ciliated Collothecidae
- Corona of *Hexarthra*-pattern (Fig. 1, 5), trophi malleoramate type --- Order Flosculariacea --- 3
- Corona other than *Conochilus* or *Hexarthra*-pattern Order Ploima 5
- 3(2) Corona with double circumapical ring 4
- Corona with a single cilia line, corona longitudinally setigerous lobes; buccal field central Flosculariidae
- 4(3) Body with arm-like appendages, foot absent Hexarthridae
- Body without appendages, foot present or absent Testudinellidae

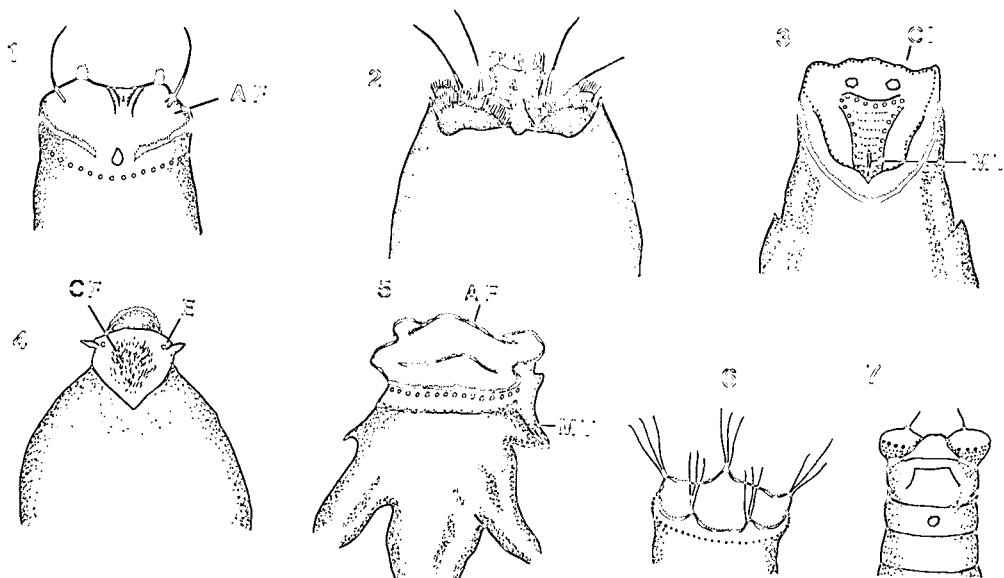


Fig. 1. Types of corona in plankton rotifers. 1, *Asplanchna*-pattern of wheel organ (ventral); 2, *Brachionus*-partly protruded head (ventral); 3, *Euchlanis*-pattern of wheel organ (ventral); 4, *Lepadella*-anterior end (ventral); 5, *Hexarthra*-pattern of wheel organ (oblique from above); 6, Collothecidae-pattern of wheel organ (ventral); 7, *Macrotrachela*-partly protruded head (dorsal). (After Donner, 1966). (AF, apical field; CL, cloaca; MT, mouth).

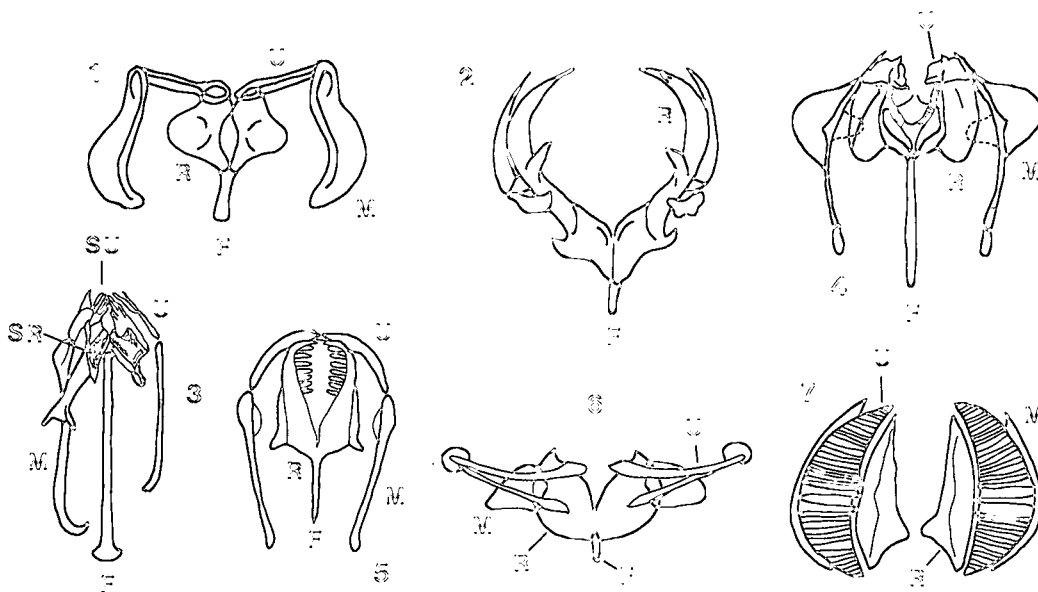


Fig. 2. Typical trophi of plankton rotifers. 1, Malleate type (*Brachionus*); 2, Incudate type (*Asplanchna*); 3, Virgate type (*Trichocerca* & *Synchaeta*); 4, Forcipate type (*Dicranophorus*); 5, Uncinate type (Collothecaceae); 6, Ramate type (*Digononta*); 7, Ramate type (*Digononta*). (1,2, After Pontin, 1978; 3,4, After Koste, 1978; 5-7, After Stemmerger, 1979). (F, fulcrum; M, Manubrium; R, ramus; SR, subramus; SU, subuncus; U, uncus)

- 5(2) Trophi forcipate type (Fig. 2, 5); creeping, littoral forms Dicranophoridae
 Trophi not forcipate type 6
- 6(5) Trophi incudate type (Fig. 2, 2); corona *Asplanchna*-pattern (Fig. 1, 1). Trunk transparent, illoricate
 Asplanchnidae
 Trophi not incudate type 7
- 7(6) Trophi malleate type (Fig. 2, 1) 8
 Trophi virgate type (Fig. 2, 3) 10
- 8(7) Lorica without sulci; only trunk loricate (except *Brachionus patulus*); corona of *Brachionus* - *Euchlanis*-
 pattern (Fig. 1, 2-3) Brachionidae
 Lorica with sulci 9
- 9(8) Lorica usually with medial ventral furrow; corona with broad lateral lamella or shield which is not
 retractible (Fig. 1, 4); foot joints with needle-like paired toes, seldom single or asymmetric
 Colurellidae
 Lorica without medial ventral furrow; dorsal and ventral plates of lorica connected by more or less
 simple sulci; first foot-segment united with ventral plate; one or two toes; corona very weak
 Lecanidae
- 10(7) Trunk, toes and trophi asymmetrical; trunk usually cylindrical, often arched and with asymmetrical
 dorsal crest; foot short with bristle-like toes; eye on brain Trichocercidae
 Trunk, toes symmetrical 11
- 11(10) Creeping, in littoral, only some species planktonic. Trunk symmetrical; corona ventral Notommatidae
 Free-swimming and planktonic 12
- 12(11) Stomach with 1-4 dark spots (blind sacs); foot small or lacking; cuticle approaching loricate condi-
 tion Gastropodidae
 Stomach without dark spots. Trophi virgate type (Fig. 2, 4); with complex V-shaped strong paired
 hypopharynx muscles; one cerebral eye; corona *Asplanchna*-pattern (Fig. 1, 1) with auricles or
 sword-shaped appendages Synchaetidae

Class Monogononta Plate, 1889 단성강
 Order Ploima Hudson & Gosse, 1886 유영목
 Family Brachionidae Wesenberg-Lund, 1899

Lorica box-like, open at each end, generally armed with anterior and posterior spines; foot long, ex-
 cessively flexible, wholly retractile within body, wrinkled, ending in two toes.

Key to the genera of Brachionidae

- 1 Foot absent 2
 Foot present 4
- 2(1) Lorica strong, with spines and pointed processes 3
 Lorica thin, without spines. Lorica oval to boat-shaped with median ridge.
 Eye very large in proportion to animal, shaped like a droplet; it is attached to a cuticular organ,
 which can be extruded and used to clasp it ventrally to the body *Anuraeopsis*

- 3(2) Lorica forming a dorsal and ventral plate; dorsal plate strong, with distinct facets and 6 spines on anterior margin; ventral plate delicate, faintly granulated ----- *Keratella*
 Lorica divided into dorsal and ventral plate as *Keratella*, but less well developed, faint stripes instead of facets, short, pointed spines on anterior margin ----- *Notholca*
- 4(1) Body laterally compressed ----- 5
 Body dorso-ventrally flattened ----- 6
- 5(4) Lorica thin or rigid with dorsal sulcus and double keel, lorica unornamented; toes long --- *Mytilina*
 Lorica without dorsal sulcus, one strong keel; lorica ornamented with distinct pattern and cavities; toes short ----- *Lophocaris*
- 6(4) Foot annulated, completely retractile, with small to minute toes; lorica distinct, mostly with strong spines on the anterior margin, sometimes at the caudal corners and at the foot opening ----- *Brachionus*
 Foot not annulated and not retractile ----- 7
- 7(6) Foot segmented, not completely retractile; lorica similar to *Brachionus* ----- *Platyas*
 Lorica unlike *Brachionus*; toes of normal size. Especially, dorsal plate without spines ----- 8
- 8(7) Lorica strong, not transparent, granulated; first segment of foot loricate, usually with 2 strong spines; toes long and slender ----- *Trichotria*
 Lorica thin, somewhat transparent; corona without shield ----- 9
- 9(8) Dorsal plate of lorica arched, concave, narrower than arched ventral plate ----- *Dipleuchlanis*
 Dorsal plate of lorica domed to centrally ridged, deeply indented posteriorly, ventral plate flat; the two plates connected by a deep fold; foot short, toes sword-shaped ----- *Euchlanis*

Genus: *Brachionus* (Pallas, 1776)

Key to the species of *Brachionus*

- 1 In dorsal anterior margin, 6 spines well developed ----- 2
 In dorsal anterior margin, spines less than six ----- 9
- 2(1) Anterior lateral 2 spines longest ----- 3
 Ventral anterior margin with 4 conspicuous spines ----- *B. patulus patulus*
- 3(2) Anterior intermediate spines longest ----- *B. falcatus falcatus*
 Anterior median spines longest ----- 4
- 4(3) Anterior median 2 spines straight ----- 5
 Anterior median 2 spines highly curved outward ----- 6
- 5(4) Anterior lateral 2 spines somewhat curved outward, foot-opening short *B. urceolaris* var. *rubens*
 Anterior lateral 2 spines more or less curved inward, foot-opening long --- *B. urceolaris bennini*
- 6(4) Posterolateral 2 spines wanting ----- *B. leydigi* var. *rotundus*
 Posterolateral 2 spines present ----- 7
- 7(6) Posterolateral 2 spines about 1/3 of total length ----- *B. quadridentatus quadridentatus*
 Posterolateral 2 spines shorter than 1/3 of total length ----- 8
- 8(7) Posterolateral 2 spines similar to anterior median spines ----- *B. quadridentatus* f. *brevispinus*
 Posterolateral 2 spines much shorter than anterior median spines; in dorsal view, right one somewhat

- longer than the left *B. quadridentatus* f. *rhenanus*
- 9(1) Two small anteromedian spines; anterointermediate and anterolateral spines absent or highly reduced.
 Foot opening spines short, posterior spines wanting 10
 In dorsal anterior margin, 4 spines well developed 11
- 10(9) Anterior region rounded, body oval form *B. angularis angularis*
 Anterior region straight, body square form *B. angularis* f. *bidens*
- 11(9) Lorica not separated into definite dorsal and ventral plates. Anterior spines broad-based, medians longer. Lorica thin 12
 Lorica definitely separated into dorsal and ventral plates 13
- 12(11) Posterolateral two spines absent *B. calyciflorus calyciflorus*
 Posterolateral two spines about 1/3 of total length *B. calyciflorus* f. *amphiceros*
- 13(11) Laterals much longer than medians 14
 Anterior medians longer than laterals. Lorica without caudal spines; both anterior medians and laterals well developed *B. budapestinensis budapestinensis*
- 14(13) Posterior spines close together at their point of origin, and lacking knee-like swellings on inner side near base *B. diversicornis diversicornis*
 Posterior spines wide apart at base 15
- 15(14) Posterolateral two spines about 1/2 of total length, with knee-like swellings on inner side *B. forficula forficula*
 Posterolateral two spines much smaller than *B. forficula forficula* 16
- 16(15) Posterolateral two spines same; about 1/4 of total length *B. forficula* f. *minor*
 Posterolateral two spines different; in dorsal view, the left smaller than the right *B. forficula* f. *angularis*

1. *Brachionus urceolaris* var. *rubens* (Ehrenberg, 1838)

(Pl. I, Fig. 1)

Brachionus rubens Ehrenberg, 1838 (p. 513, pl. 63, fig. 4; cited from Ahlstrom, 1940); Hudson and Gosse, 1886 (vol. 2, p. 119, pl. 27, fig. 5; pl. A); Rousselet, 1907 (p. 151, pl. 12; figs. 9-11); Ahlstrom, 1940 (pp. 170-171, pl. 15, figs. 1-9); Tafall, 1942 (p. 58, pl. 4; figs. 42, pl. 9; figs. 95, 98); Yamamoto, 1949a (p. 94, fig. 13); Mizuno, 1964 (p. 54, pl. 17; fig. 5); Chengalath *et al.*, 1973 (p. 40, fig. 35); Ruttner-Kolisko, 1974 (p. 65, fig. 32b; 9c); Pontin, 1978 (p. 58, fig. 46); Koste and Shiel, 1987 (p. 985, fig. 19; 2a-f); Mizuno and Takahashi, 1991 (p. 210, fig. 35).

Brachionus urceolaris var. *rubens*: Collin *et al.*, 1912 (p. 209, fig. 410); Koste, 1978 (p. 79, T. 9: 2a-e; Abb. 32: d, e).

Material examined: 1 ind., st. 34, 28 IX 1990; 1 ind., st. 51, 8 VIII 1990; 2 inds., st. 71, 8 VIII 1990; 1 ind., st. 113, 26 IX 1990; 2 inds., st. 165, 29 VII 1990; 1 ind., st. 182, 15 IV 1990; 1 ind., st. 197, 24 VII 1990.

Diagnosis: Lorica smooth, transparent, rounded dorsally. Foot opening V-shaped in the ventral plate and M-shaped aperture dorsally. Mental edge undulate, markedly elevated toward the center. Posterior spines not present.

Description: Lorica divided into dorsal and ventral plate, very transparent, anterior dorsal margin with six conical spines, median two spines somewhat longer than others. Each anterior spine of lorica asymmetrical, with 'shoulder' on one side. Posterior spines not present. Size 150-200 μ , foot opening smooth, body oval, slightly compressed dorsoventrally.

Remarks: Body red-colored, commensal on *Daphnia* or free swimming. This species differs from *B.*

urceolaris urceolaris in that its intermediate and median spines' shape and the unornamented lorica.

Distribution: Cosmopolitan.

2. *Brachionus urceolaris bennini* (Leissling, 1924) (Pl. I, Fig. 3)

Brachionus urceus bennini Leissling, 1924 (p. 22; cited from Ahlstrom, 1940).

Brachionus bennini: Ahlstrom, 1940 (pp. 172-173, pl. 17; figs. 6-9); Tafall, 1942 (p. 44, pl. 8: figs. 84-85); Ruttner-Kolisko, 1974 (p. 66, fig. 32b, 10); Sharma, 1987 (p. 269, fig. 1); Koste and Shiel, 1987 (p. 987, fig. 19; 4).

Brachionus urceolaris f. *bennini*: Mizuno and Takahashi, 1991 (p. 208, fig. 34).

Brachionus urceolaris bennini: Koste, 1978 (p. 80, T. 9: 8a-e).

Material examined: 1 ind., st. 33, 25 IX 1990; 4 inds., st., 71, 7 VIII 1990; 2 inds., st. 116, 27 IX 1990; 3 inds., st. 118, 27 IX 1990.

Diagnosis: Foot-opening wide; V-shaped opening in ventral plate. Lorica surface more or less granulated.

Description: Body loricate. Lorica oval, divided into dorsal and ventral plate. Dorsal lorica anterior with six spines; medians longest, laterals somewhat curved inward. Mental margin rigid, elevated, undulate, with a V-shaped central notch. No posterior spines. In dorsal view, foot-opening with semi-square; in ventral view, large V-shaped. Length 160-180 μ , width 120-135 μ , anterior median spine 20-30 μ , ventral foot-opening 24-34 μ .

Remarks: This species resembles *B. urceolaris urceolaris* (Koste, 1978), but occipital spines shorter and having a somewhat different dorso-ventral shape.

Distribution: Cosmopolitan.

3. *Brachionus patulus patulus* O. F. Müller, 1786 (Pl. I, Fig. 2)

Brachionus patulus O.F. Müller, 1786 (p. 361, T. 47, figs. 14, 15); Haring, 1913 (p. 22); Gillard, 1967 (p. 6, fig. 4); Chengalath *et al.*, 1973 (p. 41, figs. 42-43, pl. C); Mamaril and Fernando, 1978 (p. 123, fig. 43); Sharma, 1983 (p. 37, fig. 9); Koste and Shiel, 1987 (p. 972, fig. 14: 1-5).

Brachionus militaris: Ehrenberg, 1834 (p. 199; cited from Haring, 1913); Hudson and Gosse, 1889 (p. 52, pl. 34, fig. 23).

Platylas patulus: Ahlstrom, 1940 (pp. 175-176, pl. 19; figs. 1-4); Tafall, 1942 (p. 59, pls. 11-12; figs. 109-110, 135); Yamamoto, 1949b (p. 142, fig. 22); Mizuno and Takahashi, 1991 (p. 214, fig. 52).

Brachionus patulus patulus: Koste, 1978 (p. 69, T. 8:1, 2a, 3, 6); Fernando and P-Zankai, 1981 (p. 207, figs. 4-5); Song and Kim, 1989 (pp. 143-144, fig. 4: A-E).

Material examined: 1 ind., st. 70, 7 VIII 1990; 2 inds., st. 71, 7 VIII 1990; 1 ind., st. 97, 14 X 1990; 9 inds., st. 196, 24 VII 1990.

Diagnosis: Lorica granulated, ventral anterior margin with four conspicuous spines; foot opening with asymmetrical spines; foot with 3 segments.

Description: Lorica pustulated, rigid, somewhat compressed dorso-ventrally. Anterior margin with ten spines; central two spines longest, curved over head ventrally. Intermediates on both margins and laterals about equal in length, two pectoral median spines shortest, straight. Two posterolateral spines present. Foot opening with 2 short spines, foot slender with 3 segments. Length 150-200 μ , width 100-140 μ .

Distribution: Cosmopolitan.

4. *Brachionus quadridentatus quadridentatus* Hermann, 1783 (Pl. I, Fig. 5)

Brachionus quadridentatus Hermann, 1783 (p. 47, pl. 2, fig. 9; cited from Ahlstrom, 1940); Ahlstrom, 1940 (pp. 165-167, pl. 11, fig. 9; pl. 12, figs. 1-9; pl. 13, fig. 3); Yamamoto, 1949a (p. 93, fig. 11a-f); Sudzuki, 1957 (p. 12, fig. 1, B); Mizuno, 1964 (p. 53, pl. 17; Fig. 1); Chengalath *et al.*, 1973 (p.40, figs. 33-34); Koste, 1974 (p. 51, T. 2, fig. 2a-c); Mamaril and Fernando, 1978 (pp. 123-124, fig. 45); Pontin, 1978 (p. 54, fig. 44); Sharma, 1983 (p. 36, fig. 57); Koste and Shiel, 1987 (p. 977, figs. 12, 16).

Brachionus quadridentatus var. *quadridentatus*: Mizuno and Takahashi, 1991 (p. 210, fig. 40).

Brachionus quadridentatus quadridentatus: Koste, 1978 (p. 73, T. 11: 4a-b; Abb. 32a); Song and Kim, 1989 (pp. 145-146, fig. 5: A-C).

Material examined: 2 inds., st. 26, 26 IX 1990; 5 inds., st. 33, 25 IX 1990; 1 ind., st. 49, 25 IX 1990; 18 inds., st. 50, 25 IX 1990; 16 inds., st. 71, 7 VIII 1990; 2 inds., st. 77, 13 X 1990; 11 inds., st. 83, 13 X 1990; 1 ind., st. 85, 15 X 1990; 4 inds., st. 86, 15 X 1990; 2 inds., st. 87, 15 X 1990; 4 inds., st. 90, 15 X 1990; 6 inds., st. 97, 14 X 1990; 1 ind., st. 99, 14 X 1990; 6 inds., st. 105, 25 IX 1990; 1 ind., st. 111, 26 IX 1990; 1 ind., st. 113, 26 IX 1990; 4 inds., st. 118, 27 IX 1990; 1 ind., st. 119, 27 IX 1990; 1 ind., st. 143, 10 VI 1990; 6 inds., st. 146, 26 V 1990; 6 inds., st. 152a, 26 VII 1990; 10 inds., st. 152b, 20 IX 1990; 2 inds., st. 152c, 1 XI 1990; 4 inds., st. 152d, 7 XI 1990; 7 inds., st. 152e, 21 XI 1990; 2 inds., st. 152f, 24 XII 1990; 1 ind., st. 165, 29 VII 1990; 1 ind., st. 167, 6 VIII 1990; 2 inds., st. 172, 3 X 1990; 1 ind., st. 196, 24 VII 1990.

Description: Anterior dorsal margin with six spines, of which median two spines longest and curved outward. Lateral spines longer than intermediates. Two posterolateral spines, parallel to body axis. Foot opening protruding tube and slightly segmented, with or without spines, toes lancet-shaped. Body more or less rectangular, posterior corners elongated into spines.

Remarks: Ahlstrom (1940) insisted that this species was very variable because of extensive synonymy. The character of the posterolateral spines was used in redescribing new forms or varietal names. Also, this species usually have long and seasonal variation in spine length occurs, especially long in Summer and Autumn.

Distribution: Cosmopolitan.

5. *Brachionus quadridentatus* f. *brevispinus* (Ehrenberg, 1832) (Pl. I, Fig. 6)

Brachionus brevispinus Ehrenberg, 1832 (p. 146; 1838, p. 513; pl. 63: fig. 6; cited from Ahlstrom, 1940); Hudson and Gosse, 1889 (p. 50, pl. 34: fig. 17).

Brachionus quadridentatus: Ahlstrom, 1940 (pp. 165-167, pl. 12: fig. 5).

Brachionus bakeri var. *brevispinus*: Collin *et al.*, 1912 (p. 206, fig. 402).

Brachionus quadridentatus var. *brevispinus*: Yamamoto, 1949a (p. 93, fig. 11c); Mizuno, 1964 (p. 53, pl. 17; fig. 2); Pontin, 1978 (p. 54, fig. 44c).

Brachionus quadridentatus f. *brevispinus*: Tafall, 1942 (p. 57, pl. 9; fig. 93); Koste, 1978 (p. 74, T. 11: 4c); Koste and Shiel, 1987 (p. 979, fig. 16: 1f-j); Mizuno and Takahashi, 1991 (p. 212, fig. 43).

Material examined: 2 inds., st. 71, 7 VIII 1990; 1 ind., st. 85, 15 X 1990; 1 ind., st. 105, 25 IX 1990; 2 inds., st. 134, 3 XI 1990; 2 ind., st. 195, 23 VII 1990.

Diagnosis: Body loricate. Anterodorsal margin with six spines; median longest, curve outward, laterals

longer than submedians. Ventro-posterior region of lorica prolonged, formed tubular; dorsal portion formed sub-square. Posterolateral spines $18-40\mu$, usually less than a fifth of lorica length; two spines commonly paralleled. Length $190-226\mu$, width $140-185\mu$.

Distribution: Cosmopolitan.

6. *Brachionus quadridentatus* f. *rhenanus* (Lauterborn, 1893) (Pl. II, Fig. 1)

Brachionus rhenanus Lauterborn, 1893 (p. 269; T. 11: fig. 3; cited from Koste, 1978).

Brachionus quadridentatus: Ahlstrom, 1940 (pp. 165-167, pl. 12: fig. 7); Mamaril and Femando, 1978 (pp. 123-124, fig. 44).

Brachionus bakeri var. *rhenanus*: Collin *et al.*, 1912 (p. 207, figs. 404, 407).

Brachionus quadridentatus var. *rhenanus*: Yamamoto, 1949a (p. 93, fig. 11e).

Brachionus quadridentatus f. *rhenanus*: Tafall, 1942 (p. 57, pl. 9: fig. 92); Koste, 1978 (p. 74, T. 11: 4d); Sharma, 1983 (p. 37, fig. 61); Koste and Shiel, 1987 (p. 979, fig. 16: 1d, e); Mizuno and Takahashi, 1991 (p. 212, fig. 44).

Material examined: 1 ind., st. 1, 28 X 1990; 2 inds., st. 25, 26 IX 1990; 1 ind., st. 33, 25 IX 1990; 2 inds., st. 50, 25 IX 1990; 6 inds., st. 71, 7 VIII 1990; 1 ind., st. 77, 13 X 1990; 1 ind., st. 83, 13 X 1990; 1 ind., st. 90, 15 X 1990; 1 ind., st. 97, 14 X 1990; 1 ind., st. 105, 25 IX 1990; 3 inds., st. 120, 27 IX 1990; 1 ind., st. 134, 3 XI 1990.

Diagnosis: Posterolateral spines symmetrical or asymmetrical; usually right spine short than that of left (in dorsal view). Anterior dorsal margin and ventro-posterior region much similar to *B. quadridentatus* f. *brevispinus*. Length $180-250\mu$, width $140-200\mu$.

Distribution: Cosmopolitan.

7. *Brachionus leydigii* var. *rotundus* (Rousselet, 1907) (Pl. I, Fig. 4)

Brachionus quadratus var. *rotundus* Rousselet, 1907 (p. 149, pl. 12; figs. 6-8).

Brachionus leydigii: Ahlstrom, 1940 (pp. 173-174, pl. 17: 5).

Brachionus leydigii rotundus: Koste and Shiel, 1987 (p. 977, fig. 15: 1).

Brachionus leydigii var. *rotundus*: Pontin, 1978 (p. 56, fig. 45a); Koste, 1978 (p. 71, T. 11: 1; Abb. 25); Mizuno and Takahashi, 1991 (p. 210, fig. 38).

Material examined: 1 ind., st. 26, 26 IX 1990; 2 inds., st. 50, 25 IX 1990; 2 inds., st. 54, 8 VIII 1990; 2 inds., st. 71, 7 VIII 1990; 1 ind., st. 77, 13 X 1990; 1 ind., st. 113, 26 IX 1990; 1 ind., st. 118, 27 IX 1990; 1 ind., st. 123, 5 IV 1990; 16 inds., st. 124, 5 IV 1990; 4 inds., st. 146, 26 V 1990; 1 ind., st. 152a, 26 VII 1990; 1 ind., st. 152d, 7 XI 1990.

Diagnosis: Dorsal plate with six anterior spines, of which two median spines longest and highest, somewhat curved outside. Posterolateral spine wanting. Posterolateral portion of lorica rounded, shape of foot opening spines rounded projection, with shallow V-shaped aperture in dorsal plate and rather large oval aperture ventrally. Length $150-170\mu$, width $130-145\mu$, anterior median spine $20-25\mu$.

Remarks: This species differs from *B. quadridentatus* var. *cluniorbicularis* (Koste, 1978) in that the position of foot opening is deposited in outside of lorica. The Korean specimen is somewhat smaller than Ahlstrom (1940), but very similar to Koste and Shiel (1987).

Distribution: Australia, England, Sweden, India, China, Korea.

8. *Brachionus calyciflorus calyciflorus* Pallas, 1766

(Pl. III, Fig. 1)

Brachionus calyciflorus Pallas, 1766 (p. 93; cited from Ahlstrom, 1940); Haring, 1913 (p. 18); Rylov, 1935 (pp. 59-61, T. 6, figs. 48-49; T. 7, fig. 57: 11 V, 21 IX); Ahlstrom, 1940 (pp. 150-152, pl. 3, figs. 2, 4, 7; pl. 20, fig. 7); Tafall, 1942 (p. 45, pl. 8, fig. 83); Yamamoto, 1949a (p. 94, fig. 15a); Sudzuki, 1957 (p. 12, figs. 2B, 4A); Mizuno, 1964 (p. 52, pl. 16: fig. 1); Ruttner-Kolisko, 1974 (p. 67, pl. I: 8, fig. 32a: 1b); Mamaril and Fernando, 1978 (p. 122, fig. 40); Sharma, 1983 (p. 36, fig. 40).

Brachionus calyciflorus f. *calyciflorus*: Mizuno and Takahashi, 1991 (p. 204, fig. 19).

Brachionus calyciflorus calyciflorus: Koste, 1978 (pp. 87-88, T. 12: 1a, Abb. 33b: 1, 5); Koste and Shiel, 1987 (p. 990, fig. 21: 1c).

Material examined: 1 ind., st. 23, 26 IX 1990; 1 ind., st. 28, 26 IX 1990; 19 inds., st. 33, 25 IX 1990; 1 ind., st. 36, 27 IX 1990; 5 inds., st. 42, 24 IX 1990; 30 inds., st. 45, 25 IX 1990; 6 inds., st. 51, 8 VIII 1990; 6 inds., st. 57, 9 VIII 1990; 21 inds., st. 59, 9 VIII 1990; 1 ind., st. 60, 8 VIII 1990; 1 ind., st. 61, 9 VIII 1990; 4 inds., st. 71, 7 VIII 1990; 4 inds., st. 93, 15 X 1990; 5 inds., st. 94, 16 X 1990; 20 inds., st. 96, 16 X 1990; 5 inds., st. 106, 25 IX 1990; 7 inds., st. 108, 26 IX 1990; 1 ind., st. 113, 26 IX 1990; 1 ind., st. 117, 27 IX 1990; 1 ind., st. 121, 5 IV 1990; 3 inds., st. 124, 5 IV 1990; 30 inds., st. 128, 5 IV 1990; 1 ind., st. 149, 25 IV 1990; 1 ind., st. 154, 29 IV 1990; 8 inds., st. 173, 15 IV 1990; 7 inds., st. 174, 15 IV 1990; 6 inds., st. 176, 15 IV 1990; 11 inds., st. 177, 15 IV 1990; 2 inds., st. 178, 15 IV 1990; 1 ind., st. 180, 15 IV 1990; 1 ind., st. 181, 15 IV 1990; 2 inds., st. 186, 21 IV 1990.

Description: Lorica very flexible and strong, not separated. Anterior dorsal spines four; long and pointed, with broad bases. Length equal or median two spines somewhat longer. Mental margin rather flexible, usually somewhat elevated with shallow V-or U-shaped. Foot opening with weakly developed 2 spines. Length 230-300 μ , width 150-190 μ , anterior median spines 45-65 μ . Posterior spine not present.

Distribution: Cosmopolitan.

9. *Brachionus calyciflorus* f. *amphiceros* (Ehrenberg, 1838)

(Pl. III, Fig. 2)

Brachionus amphiceros Ehrenberg, 1838 (p. 511, pl. 63, fig. 2; cited from Koste, 1978).

Brachionus calyciflorus: Rylov, 1935 (pp. 59-61, T. 6, fig. 46; T. 7, fig. 57, 29 IX); Ahlstrom, 1940 (pp. 150-152, pl. 3, fig. 1); Tafall, 1942 (p. 45, pl. 8, figs. 86-90); Chengalath *et al.*, 1973 (p. 36, fig. 16); Ruttner-Kolisko, 1974 (p. 67, fig. 32c: 21); Sharma, 1983 (p. 36, fig. 42).

Brachionus calyciflorus var. *amphiceros*: Mizuno, 1964 (p. 52, pl. 16: fig. 3).

Brachionus calyciflorus f. *amphiceros*: Yamamoto, 1949a (p. 95, fig. 15b); Pontin, 1978 (p. 52, fig. 43b); Koste, 1978 (p. 89, T. 12: 1d, Abb. 33b: 2); Koste and Shiel, 1987 (p. 990, fig. 21: 1d, 2b, c); Mizuno and Takahashi, 1991 (p. 204, fig. 22).

Material examined: 16 inds., st. 4, 29 X 1990; 13 inds., st. 33, 25 IX 1990; 1 ind., st. 37, 27 IX 1990; 1 ind., st. 38, 27 IX 1990; 2 inds., st. 42, 24 IX 1990; 9 inds., st. 46, 25 IX 1990; 1 ind., st. 48, 25 IX 1990; 6 inds., st. 51, 8 VIII 1990; 11 inds., st. 57, 9 VIII 1990; 15 inds., st. 58, 9 VIII 1990; 12 inds., st. 71, 7 VIII 1990; 1 ind., st. 77, 13 X 1990; 9 inds., st. 90, 15 X 1990; 8 inds., st. 93, 15 X 1990; 7 inds., st. 96, 16 X 1990; 7 inds., st. 98, 14 X 1990; 18 inds., st. 103, 25 IX 1990; 1 ind., st. 105, 25 IX 1990; 9 inds., st. 106, 25 IX 1990; 19 inds., st. 108, 26 IX 1990; 19 inds., st. 113, 26 IX 1990; 3 inds., st. 128, 5 IV 1990; 2 inds., st. 161, 27 VII 1990; 2 inds., st. 165, 29 VII 1990; 1 ind.,

st. 168, 28 IV 1990; 2 inds., st. 173, 15 IV 1990; 1 ind., st. 180, 15 IV 1990; 2 inds., st. 181, 15 IV 1990; 2 inds., st. 182, 15 IV 1990.

Description: Lorica oval, compressed dorso-ventrally. Anterior dorsal margin with 4 spines; the medians somewhat longer than the laterals. Mental margin soft, usually more or less elevated with a shallow V-shaped notch which is unflanked. Foot opening with weakly developed 2 spines. Posterior lateral spines present; the length variable. Length 250-350 μ , width 120-190 μ , anterior median spines 55-70 μ , posterolateral spines 50-120 μ .

Remarks: Usually found in the artificial pond.

Distribution: Cosmopolitan.

10. *Brachionus budapestinensis budapestinensis* (Daday, 1885) (Pl. II, Fig. 2)

Brachionus budapestinensis Daday, 1885 (pp. 131, 211, pl. 11, figs. 1-4, 9, 10; cited from Ahlstrom, 1940); Hudson and Gosse, 1889 (p. 51, pl. 34, fig. 25); Harring, 1913 (p. 18); Rylov, 1935 (p. 64, T. 7, fig. 65a-b); Ahlstrom, 1940 (pp. 152-153, pl. 4, figs. 6-9); Tafall, 1942 (p. 44, pl. 11, figs. 112, 114, 115); Yamamoto, 1949a (p. 95, fig. 18); Sudzuki, 1957 (p. 13, fig. 4B); Mizuno, 1964 (p. 52, pl. 16: fig. 6); Hauer, 1965 (p. 344, Abb. 2); Chengalath *et al.*, 1973 (p. 35, figs. 12-15); Ruttner-Kolisko, 1974 (p. 67, figs. 32a: 4, 32c: 23) Sharma, 1983 (p. 32, fig. 26); Koste and Shiel, 1987 (pp. 988-989, fig. 20: 4a-d); Mizuno and Takahashi, 1991 (p. 206, fig. 30).

Brachionus budapestinensis budapestinensis: Koste, 1978 (p. 91, T. 12: 4a-d).

Material examined: 2 inds., st. 15, 27 X 1990; 1 ind., st. 28, 26 IX 1990; 5 inds., st. 33, 25 IX 1990; 10 inds., st. 46, 25 IX 1990; 9 inds., st. 51, 8 VIII 1990; 6 inds., st. 71, 7 VIII 1990; 4 inds., st. 93, 15 X 1990; 3 inds., st. 102, 25 IX 1990; 7 inds., st. 106, 25 IX 1990; 2 inds., st. 116, 27 IX 1990; 6 inds., st. 161, 27 VII 1990; 23 inds., st. 165, 29 VII 1990.

Description: Lorica two plates (a dorsal + a ventral), rigid and oval form, and somewhat folded. Spines on anterior dorsal margin four, emerging from narrow base, crooked. Median two spines longer than laterals, and their ends curved ventrally. Outer two spines not quite lateral, posited somewhat inner side. Length 130-160 μ , width 75-95 μ , anterior median spines 30-40 μ .

Remarks: Usually found in Alkaline fresh waters. Surface of developing egg covered with much hair.

Distribution: Brazil, Mexico, Sweden, America, Korea.

11. *Brachionus angularis angularis* Gosse, 1851 (Pl. II, Fig. 3)

Brachionus angularis Gosse, 1851 (p. 203); Hudson and Gosse, 1886 (vol. 2, p. 120, pl. 27, fig. 4; pl. 30, fig. 9); Harring, 1913 (p. 18); Rylov, 1935 (p. 59, T.6, fig. 50a-b); Ahlstrom, 1940 (pp. 154-155, pl. 5, figs. 1-3, 6-7, 11); Tafall, 1942 (p. 42, pls. 1-2, figs. 1-19); Yamamoto, 1949a (p. 95, fig. 19a); Sudzuki, 1957 (p. 12, fig. 1, D-F); Chengalath *et al.*, 1973 (p. 35, fig. 11); Ruttner-Kolisko, 1974 (p. 68, fig. 32d: 26); Pontin, 1978 (p. 50, fig. 42a); Mamaril and Fernando, 1978 (p. 122, fig. 39); Sharma, 1983 (p. 32, figs. 10-13).

Brachionus angularis var. angularis: Mizuno and Takahashi, 1991 (p. 204, fig. 14).

Brachionus angularis angularis: Koste, 1978 (p. 92, T. 13: 1-6); Koste and Shiel, 1987 (p. 990, figs. 22: 1,2,3a-h).

Material examined: 3 inds., st. 4, 29 X 1990; 1 ind., st. 28, 26 IX 1990; 2 inds., st. 32, 25 IX 1990; 5 inds., st. 33, 25 IX 1990; 1 ind., st. 42, 24 IX 1990; 42 inds., st. 45, 25 IX 1990; 1 ind., st. 46, 25 IX 1990; 1 ind., st. 57, 9 VIII 1990; 6 inds., st. 61, 9 VIII 1990; 1 ind., st. 74, 5 IV 1990; 46 inds., st. 75, 5 IV 1990; 2 inds., st. 80, 14 X 1990; 3 inds., st. 83, 13 X 1990; 1 ind., st. 90, 15 X 1990; 10 inds.,

st. 93, 15 X 1990; 17 inds., st. 96, 16 X 1990; 1 ind., st. 102, 25 IX 1990; 26 inds., st. 106, 25 IX 1990; 13 inds., st. 108, 26 IX 1990; 2 inds., st. 116, 27 IX 1990; 3 inds., st. 123, 5 IV 1990; 3 inds., st. 124, 5 IV 1990; 7 inds., st. 125, 5 IV 1990; 9 inds., st. 128, 5 IV 1990; 1 ind., st. 129, 3 XI 1990; 8 inds., st. 130, 3 XI 1990; 1 ind., st. 131, 3 XI 1990; 3 inds., st. 152e, 21 XI 1990; 1 ind., st. 152f, 24 XII 1990; 38 inds., st. 170, 20 V 1990; 4 inds., st. 173, 15 IV 1990; 4 inds., st. 174, 15 IV 1990; 1 ind., st. 176, 15 IV 1990; 15 inds., st. 178, 15 IV 1990; 8 inds., st. 179, 23 XII 1990; 30 inds., st. 182, 15 IV 1990; 1 ind., st. 183, 5 V 1990; 1 ind., st. 187, 15 IV 1990; 7 inds., st. 198, 14 IV 1990; 16 inds., st. 199, 15 IV 1990; 29 inds., st. 200, 14 IV 1990; 2 inds., st. 203, 15 IV 1990.

Diagnosis: Lorica firm, oval; anterior margin rounded. Anterodorsal margin with V-shaped spines at center. Foot opening without both tubular projections and spines. No posterior spines.

Description: Lorica distinguished 2 plates (a dorsal + a ventral), moderately compressed dorso-ventrally, strong. All spines reduced except small median two spines; divided by V-shaped sinus. Lateral and median occipitals usually obliterate, or weakly developed. Intermediates more commonly developed than laterals. Mental margin firm, somewhat elevated. Foot opening rather larger aperture in ventral plate, flanked laterally by cuticular protuberances. Size 100-200 μ .

Distribution: Cosmopolitan.

12. *Brachionus angularis* f. *bidens* (Plate, 1886)

(Pl. II, Fig. 4)

Brachionus bidens Plate, 1886 (p. 72, pl. 3, fig. 30; cited from Haring, 1913).

Brachionus angularis: Ahlstrom, 1940 (pp. 154-155, pl. 5, figs. 4, 5).

Brachionus angularis bidens: Koste and Shiel, 1987 (p. 992, fig. 22: 3i).

Brachionus angularis var. *bidens*: Collin et al., 1912 (p. 202, fig. 397 a); Rylov, 1935 (p. 58, T. 6: fig. 50: b); Yamamoto, 1949a (p. 96, fig. 19b); Mizuno, 1964 (p. 53, pl. 16: fig. 10); Pontin, 1978 (P. 50, fig. 42b); Sharma, 1983 (p. 32, figs. 16, 19); Mizuno and Takahashi, 1991 (p. 204, fig. 17).

Brachionus angularis f. *bidens*: Koste, 1978 (p. 92, T. 13: 7).

Material examined: 1 ind., st. 33, 25 IX 1990; 1 ind., st. 38, 27 IX 1990; 10 inds., st. 51, 8 VIII 1990; 1 ind., st. 53, 8 VIII 1990; 10 inds., st. 55, 9 VIII 1990; 21 inds., st. 57, 9 VIII 1990; 8 inds., st. 58, 9 VIII 1990; 7 inds., st. 59, 9 VIII 1990; 1 ind., st. 60, 8 VIII 1990; 41 inds., st. 61, 9 VIII 1990; 3 inds., st. 75, 5 IV 1990; 5 inds., st. 83, 13 X 1990; 4 inds., st. 87, 15 X 1990; 2 inds., st. 115, 27 IX 1990; 2 inds., st. 116, 27 IX 1990; 6 inds., st. 118, 27 IX 1990; 3 inds., st. 121, 5 IV 1990; 3 inds., st. 126, 5 IV 1990; 2 inds., st. 127, 5 IV 1990; 2 inds., st. 129, 3 XI 1990; 3 inds., st. 139, 27 V 1990; 32 inds., st. 142, 10 VI 1990; 1 ind., st. 159, 29 IV 1990; 1 ind., st. 161, 27 VII 1990; 14 inds., st. 165, 29 VII 1990; 7 inds., st. 166, 28 VII 1990; 55 inds., st. 167, 6 VII 1990; 8 inds., st. 173, 15 IV 1990; 2 inds., st. 174, 15 IV 1990; 2 inds., st. 178, 15 IV 1990; 33 inds., st. 180, 15 IV 1990; 25 inds., st. 182, 15 IV 1990; 2 inds., st. 200, 14 IV 1990.

Diagnosis: Body rectangular form, lorica firm, granulated at dorsal plate. Anterodorsal margin with very weakly developed median 2 spines. No posterolateral spines.

Description: Intermediate dorsal spines weakly developed, pattern indistinct. The more posterior of these protuberances about three-fourths of length of lorica from anterior end, and often quite pronounced. Especially anterior dorsal margin paralleled. Cuticular protuberances on either side of foot opening relatively close together and markedly convergent. Lorica length 80 μ , its width 68 μ , length of spine 5 μ , foot opening 14 μ ,

of width 12 μ .

Remarks: The Korean specimens somewhat differ from Ahlstrom (1940), Sharma (1983) and Koste & Shiel (1987) in that its anterior dorsal margin is more or less curved and the posterior region is more rounded.

Distribution: Cosmopolitan.

13. *Brachionus forficula forficula* Wierzejski, 1891 (Pl. II, Fig. 5)

Brachionus forficula Wierzejski, 1891 (p. 51, fig. 3a); Daday, 1910 (p. 95, Taf. 4; fig. 21); Collin *et al.*, 1912 (p. 213, fig. 420); Rylov, 1935 (p. 65, T. 8, fig. 67); Ahlstrom, 1940 (pp. 162-163, pl. 7, fig. 8; pl. 20, figs. 1-2); Yamamoto, 1949a (p. 95, fig. 17); Mizuno, 1964 (p. 54, pl. 17: fig. 7); Wulfert, 1966 (p. 61, Abb. 6a-e); Chengalath *et al.*, 1973 (p. 37, fig. 27, pl. B); Sharma, 1983 (p. 36, fig. 52); Koste and Shiel, 1987 (p. 988, fig. 20: 2a-c, 3a-c).

Brachionus forficula f. *forficula*: Mizuno and Takahashi, 1991 (p. 206, fig. 23).

Brachionus forficula forficula: Koste, 1978 (pp. 95-96, T. 14: 7c, e); Song and Kim, 1989 (p. 146, fig. 5: D-E).

Material examined: 2 inds., st. 28, 25 IX 1990; 2 inds., st. 32, 25 IX 1990; 1 ind., st. 34, 28 IX 1990; 1 ind., st. 42, 24 IX 1990; 12 inds., st. 46, 25 IX 1990; 19 inds., st. 51, 9 VIII 1990; 17 inds., st. 53, 8 VIII 1990; 12 inds., st. 54, 8 VIII 1990; 56 inds., st. 58, 9 VIII 1990; 26 inds., st. 59, 9 VIII 1990; 21 inds., st. 60, 8 VIII 1990; 30 inds., st. 70, VIII 1990; 2 inds., st. 71, 7 VIII 1990; 5 inds., st. 73, 9 VIII 1990; 2 inds., st. 89, 15 X 1990; 1 ind., st. 90, 15 X 1990; 3 inds., st. 102, 25 IX 1990; 1 ind., st. 103, 25 IX 1990; 10 inds., st. 105, 25 IX 1990; 12 inds., st. 106, 25 IX 1990; 23 inds., st. 107, 25 IX 1990; 1 ind., st. 108, 26 IX 1990; 1 ind., st. 113, 26 IX 1990; 5 inds., st. 115, 27 IX 1990; 3 inds., st. 117, 27 IX 1990; 8 inds., st. 118, 27 IX 1990; 2 inds., st. 130, 3 XI 1990; 3 inds., st. 161, 27 VII 1990; 9 inds., st. 165, 29 VII 1990; 19 inds., st. 166, 28 VII 1990; 1 ind., st. 172, 3 X 1990; 27 inds., st. 196, 24 VII 1990; 37 inds., st. 197, 24 VII 1990.

Description: Lorica rigid, divided into dorsal and ventral plate, somewhat compressed dorso-ventrally. Anterodorsal margin with four bluntly pointed spines, of which laterals longer than medians. Lorica terminates posteriorly in two stout, usually long. Spines at foot opening very large, thick and bent inwards. Posterolateral spines strong, somewhat smaller than the length of body.

Distribution: Eastern Europe, Africa, Japan, Korea.

14. *Brachionus forficula* f. *minor* Voronkov, 1913 (Pl. II, Fig. 6)

Brachionus forficula var. *minor* Voronkov, 1913 (p. 103; cited from Ahlstrom, 1940).

Brachionus forficula minor: Sharma, 1987 (p. 271, figs. 4-5).

Brachionus forficula f. *minor*: Fadeew, 1925c (p. 228, figs. 8-9; cited from Ahlstrom, 1940); Koste, 1978 (p. 96, T. 14; 7b); Fernando and P-Zankai, 1981 (p. 212, fig. 11); Sharma, 1983 (p. 37, fig. 53); Koste and Shiel, 1987 (p. 988, fig. 20: 3e); Mizuno and Takahashi, 1991 (p. 206, fig. 25).

Material examined: 8 inds., st. 46, 25 IX 1990; 40 inds., st. 51, 8 VIII 1990; 3 inds., st. 53, 8 VIII 1990; 23 inds., st. 54, 8 VIII 1990; 24 inds., st. 58, 9 VIII 1990; 6 inds., st. 59, 9 VIII 1990; 28 inds., st. 70, 7 VIII 1990; 4 inds., st. 71, 7 VIII 1990; 7 inds., st. 117, 27 IX 1990; 2 inds., st. 118, 27 IX 1990; 14 inds., st. 196, 24 VII 1990; 54 inds., st. 197, 24 VII 1990.

Diagnosis: Posterolateral two spines pointed, subequal, and swellings on inner sides of their bases, 1/5 of total length. Width of posterior lorica much narrower than *B. forficula forficula*.

Description: Anterodorsal margin with four spines; medians more or less shorter than laterals. Spines

rounded or pointed at tips. Lorica terminates posteriorly in two stout, sickle-like swellings curved inward. Posterior spines relatively closer together than *B. forficula forficula*. Length 95-110 μ , width 60-75 μ , posterolateral spine 18-25 μ .

Remarks: This species is regarded as reduced form of *B. forficula forficula* by Ahlstrom (1940).

Distribution: America, Japan, Korea.

15. *Brachionus forficula* f. *angularis* Sudzuki, 1955

(Pl. II, Fig. 7)

Brachionus forficula f. *angularis* Sudzuki, 1955 (p. 132, fig. 2: c); Sudzuki, 1964 (p. 46, T. 10-12); Mizuno and Takahashi, 1991 (p. 206, fig. 26).

Material examined: 8 inds., st. 51, 8 VIII 1990; 2 inds., st. 71, 7 VIII 1990; 3 inds., st. 164, 30 VII 1990.

Diagnosis: Lorica oval. Anterodorsal margin with 4 spines pointed at tips; median spines somewhat smaller than the laterals. Posterolateral spines with different shape; in dorsal view, left spine short, ended blunt; right spine long, pointed at tips.

Description: Body oval loricate compressed dorso-ventrally. Anterodorsal margin with four bluntly pointed spines. Lateral spines 1.3-1.5 times as long as medians. Length 100-115 μ , width 75-90 μ , posterolateral spine; right 10-20 μ , left 6-10 μ .

Remarks: This species is recorded only Asia regions by Sudzuki (1955). This animal from Korea is very much alike to Sudzuki (1955), but the right spine (in dorsal view) is smaller than that.

Distribution: Japan, China, Taiwan, Korea.

16. *Brachionus diversicornis diversicornis* (Daday, 1883)

(Pl. III, Fig. 3)

Schizocerca diversicornis Daday, 1883 (p. 213, Taf. II; figs. 5-7; cited from Daday, 1910); Hudson and Gosse, 1889 (p. 54, pl. 34, fig. 10); Daday, 1910 (p. 88, Taf. 4; fig. 19); Haring, 1913 (p. 94); Rylov, 1935 (pp. 65-66, T. 8, fig. 68); Yamamoto, 1949b (p. 141, fig. 20a-d); Mizuno and Takahashi, 1991 (p. 212, fig. 48).

Brachionus (Schizocerca) diversicornis: Mizuno, 1964 (p. 54, pl. 17: fig. 9).

Brachionus diversicornis: Ahlstrom, 1940 (pp. 161-162, pl. 9, figs. 6-7; p. 20, figs. 3,5); Sudzuki, 1957 (p. 12, fig. 2A); Ruttner-Kolisko, 1974 (p. 69, fig. 32d: 30); Sharma, 1983 (p. 37, fig. 3); Koste and Shiel, 1987 (p. 982, fig. 17, 2).

Brachionus diversicornis diversicornis: Koste, 1978 (p. 86, T.15: 5a-d, Abb. 30:g).

Material examined: 3 inds., st. 23, 26 IX 1990; 18 inds., st. 25, 26 IX 1990; 26 inds., st. 27, 26 IX 1990; 1 ind., st. 28, 26 IX 1990; 3 inds., st. 33, 25 IX 1990; 11 inds., st. 46, 25 IX 1990; 4 inds., st. 48, 25 IX 1990; 4 inds., st. 51, 8 VIII 1990; 2 inds., st. 54, 8 VIII 1990; 17 inds., st. 59, 9 VIII 1990; 11 inds., st. 85, 15 X 1990; 16 inds., st. 86, 15 X 1990; 12 inds., st. 87, 15 X 1990; 3 inds., st. 90, 15 X 1990; 1 ind., st. 93, 15 X 1990; 1 ind., st. 96, 16 X 1990; 3 inds., st. 98, 14 X 1990; 2 inds., st. 101, 14 X 1990; 19 inds., st. 105, 25 IX 1990; 9 inds., st. 108, 26 IX 1990; 2 inds., st. 116, 27 IX 1990; 8 inds., st. 129, 3 XI 1990; 2 inds., st. 130, 3 XI 1990; 2 inds., st. 132, 3 XI 1990; 6 inds., st. 161, 27 VII 1990; 11 inds., st. 165, 29 VII 1990; 1 ind., st. 172, 3 X 1990; 1 ind., st. 174, 15 IV 1990; 1 ind., st. 178, 15 IV 1990.

Description: Lorica rigid, composed two plate (a dorsal + a ventral), quite compressed dorso-ventrally. Anterior dorsal margin four spines; of which lateral spines much elongated, medians very short, intermediates perfectly obliterate. Anterior ventral margin somewhat firm and elevated. Median sinus more or less developed. Lorica becomes somewhat narrowed in posterior region, two spines present; usually right spine long, left

short, or nearly equal in length to right. Foot opening between bases of posterior spines; rounded tongue-like projection of dorsal plate overhangs foot opening. Size 300-500 μ .

Distribution: Europe, Asia, Africa, America.

17. *Brachionus falcatus falcatus* (Zacharias, 1898) (Pl. I, Fig. 7)

Brachionus falcatus Zacharias, 1898 (p.133, pl.4, fig. 4; cited from Ahlstrom, 1940); Daday, 1910 (p.93, Taf.4; figs. 15-16); Collin *et al.*, 1912 (p.212, fig. 419); Harring, 1913 (p.21); Rylov, 1935 (pp.64-65, T.8, fig. 66); Ahlstrom, 1940 (p.164, pl. 10, figs. 1-3); Tafall, 1942 (p.51, pl. 10, figs. 99-100); Yamamoto, 1949a (p.93, figs. 10, 10'); Mizuno, 1964 (p.54, pl. 17: fig. 8); Hauer, 1965 (p.346, Abb.5); Gillard, 1967 (p.5, fig. 2); Pourriot, 1968 (p. 479, pl. 1, fig. 9); Chengalath *et al.*, 1973 (p.37, figs. 24-26); Ruttner-Kolisko, 1974 (p.69, fig. 32d: 32); Sharma, 1983 (p.37, figs. 7-8); Mizuno and Takahashi, 1991 (p.212, fig. 47).

Brachionus falcatus falcatus: Sharma, 1983 (p.36, fig. 50); Koste, 1978 (p.83, T.14: 2a-b); Koste and Shiel, 1987 (pp.980-981, fig. 17: 1a-e, g,h).

Material examined: 1 ind., st. 71, 7 VIII 1990.

Diagnosis: Lorica quite compressed dorsoventrally; spines tapering. Anterior intermediate spines similar to posterolateral spines; about 1/3 of total body length.

Description: Anterior dorsal margin with six spines, of which intermediates much longer than other spines, curved ventrally. Lateral and median spines about equal length and very short. Lorica rigid, composed two plate (1 ventral + 1 dorsal). Posterior dorsal spines very long and well developed, often somewhat twisted. Length of posterior spines similar to body. Foot opening between bases of posterior spines.

Distribution: Cosmopolitan.

Genus *Platyas* (Harring, 1913)

18. *Platyas quadricornis* (Ehrenberg, 1832) (Pl. III, Fig. 4)

Noteus quadricornis Ehrenberg, 1832 (p. 143, pl. 4, fig. 5; cited from Ahlstrom, 1940); Hudson and Gosse, 1886 (vol. 2, pp. 121-122, pl. 28, fig. 5); Collin *et al.*, 1912 (p. 214, fig. 421).

Platyas quadricornis var. *quadricornis*: Mizuno and Takahashi, 1991 (p. 214, fig. 49).

Platyas quadricornis: Harring, 1913 (p. 84); Ahlstrom, 1940 (pp. 174-175, pl. 18, figs. 6-9); Tafall, 1942 (p. 61, pls. 11-12, figs. 111, 113, 134); Yamamoto, 1949b (p. 141, fig. 21); Hauer, 1965 (p. 372, Abb. 29); Chengalath *et al.*, 1973 (p. 43, fig. 56, pl. D); Koste, 1978 (pp. 63-64, T. 6:1-2; T. 7:1-2); Mamaril and Fernando, 1978 (p. 125, fig. 49); Song and Kim, 1989 (pp. 142-143, fig. 3: a-c).

Platyas quadricornis var. *quadricornis*: Mizuno and Takahashi, 1991 (p. 214, fig. 49).

Material examined: 1 ind., st. 28, 26 IX 1990; 1 ind., st. 29, 26 IX 1990; 1 ind., st. 35, 28 IX 1990; 12 inds., st. 50, 25 IX 1990; 1 ind., st. 52, 24 IX 1990; 3 inds., st. 71, 7 VIII 1990; 1 ind., st. 73, 9 VIII 1990; 1 ind., st. 119, 27 IX 1990; 1 ind., st. 143, 10 VI 1990; 1 ind., st. 196, 24 VII 1990.

Description: Body flat, lenticular form. Lorica circular, rigid, and considerably compressed dorso-ventrally, granulated serrated at margins. Anterior dorsal margin with two stout median spines that taper but little and bluntly to nearly truncate at their tips usually toward more or less ventrally. Mental margin firm, circular and depressed toward center. Posterior margin with two rather short and stout, parallel spines, third to half width of lorica apart. Foot opening in ventral side having 3 sections with two long, pointed conical

toes. Size 200-350 μ .

Distribution: Cosmopolitan.

ABSTRACT

The systematic study of freshwater rotifers was conducted on the materials collected from 205 sites in South Korea. As a result, 1 species, 9 subspecies, 2 varieties and 6 forms of two genera, *Brachionus* and *platyas* in Family Brachionidae were identified, of which, 1 subspecies and 4 forms are new to the Korean fauna: *Brachionus urceolaris bennini*, *B. angularis* f. *bidens*, *B. quadridentatus* f. *rhenanus*, *B. forficula* f. *minor*, and *B. forficula* f. *angularis*. Total 134 species, 15 subspecies, 9 varieties and 9 forms representing 14 families 40 genera are now recorded from Korea by adding the 1 subspecies and 4 forms newly described in the present paper.

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EXPLANATION OF PLATES

Plate I

- Fig. 1. *Brachionus urceolaris* var. *rubens*. 1a, dorsal view; 1b, ventral view.
- Fig. 2. *Brachionus patulus patulus*. 2a, dorsal view; 2b, ventral view.
- Fig. 3. *Brachionus urceolaris bennini*. 3a, dorsal view; 3b, ventral view.
- Fig. 4. *Brachionus leydigi* var. *rotundus*. 4a, dorsal view; 4b, ventral view.
- Fig. 5. *Brachionus quadridentatus quadridentatus*. 5a, dorsal view; 5b, ventral view.
- Fig. 6. *Brachionus quadridentatus* f. *brevispinus*. 6a, dorsal view; 6b, dorsal view with egg.
- Fig. 7. *Brachionus falcatus falcatus*. 7a, dorsal view; 7b, ventral view. All scale lines 50 μ .

Plate II

- Fig. 1. *Brachionus quadridentatus* f. *rhenanus*. 1a, ventral view; 2b, dorsal view; 1c, ventral view with egg.
- Fig. 2. *Brachionus budapestinensis budapestinensis*. 2a, ventral view with egg; 2b, dorsal view (foot extended).
- Fig. 3. *Brachionus angularis angularis*. 3a, ventral view (foot and corona extended); 3b, dorsal view; 3c, ventral view.
- Fig. 4. *Brachionus angularis* f. *bidens*. 4a, dorsal view; 4b, ventral view.
- Fig. 5. *Brachionus forficula forficula*. 5a, dorsal view (foot extended); 5b, dorsal view with egg.
- Fig. 6. *Brachionus forficula* f. *minor*. 6a, dorsal view; 6b, ventral view; 6c, ventral view (foot extended).
- Fig. 7. *Brachionus forficula* f. *angularis*. 7a, dorsal view; 7b, ventral view. All scale lines 50 μ .

Plate III

- Fig. 1. *Brachionus calyciflorus calyciflorus*. 1a, dorsal view; 1b, ventral view; 1c, dorsal view with egg.
- Fig. 2. *Brachionus calyciflorus* f. *amphiceros*. 2a, dorsal view (foot extended); 2b, ventral view with egg; 2c, dorsal view.
- Fig. 3. *Brachionus diversicornis diversicornis*. 3a, dorsal view; 3b, ventral view.
- Fig. 4. *Platyas quadricornis*. 4a, dorsal view; 4b, ventral view. Scale line 100 μ .

PLATE II

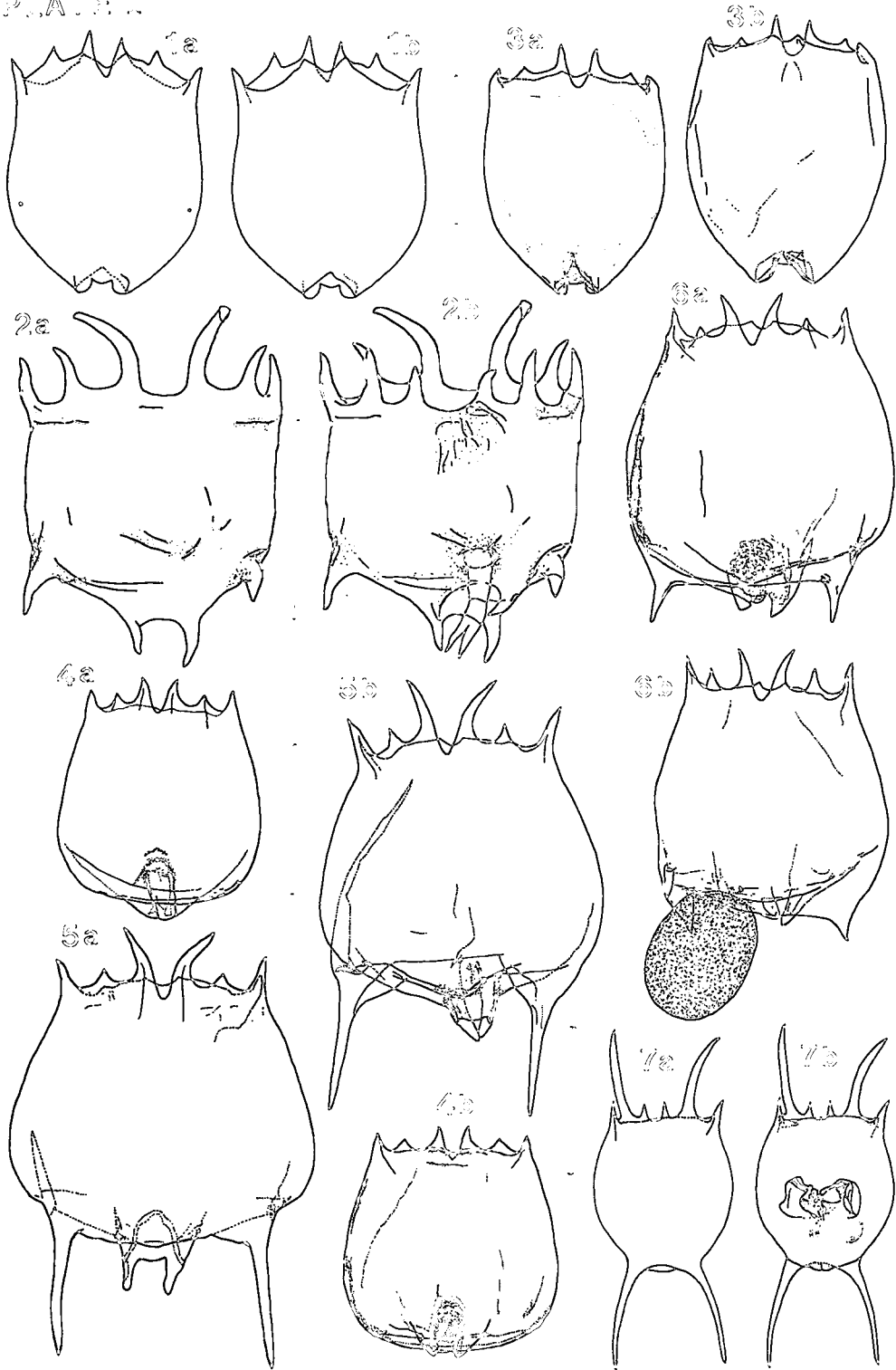


PLATE II

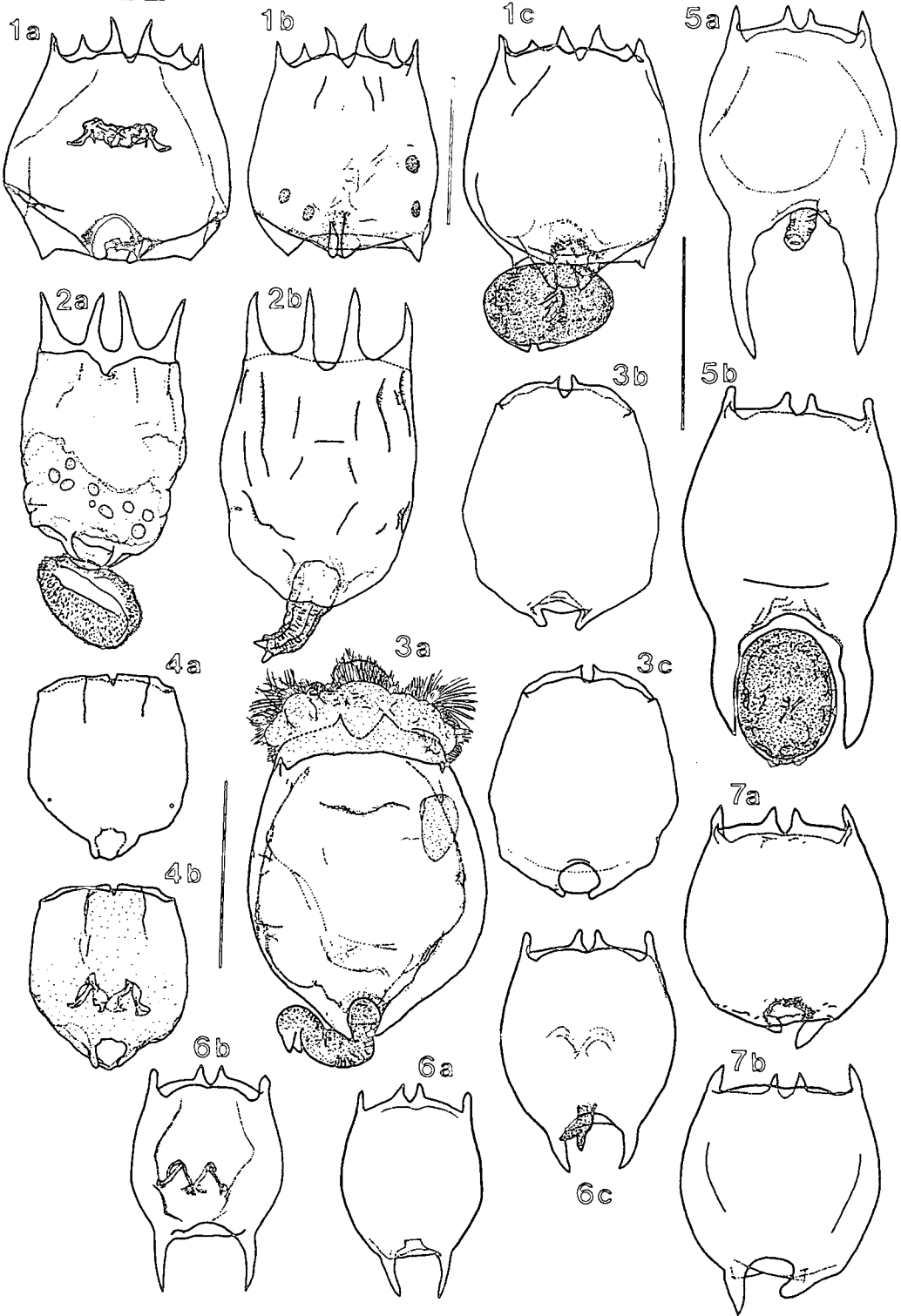


PLATE III

