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## Redescription of *Triops longicaudatus* (LeConte, 1846) (Notostraca, Triopidae) from Korea

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한국산 투구새우류 1종, *Triops longicaudatus* (LeConte, 1846) (배갑 목,  
투구새우 과) 의 재기재

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### 적 요

경남 창녕 및 삼천포의 논에서 채집된 투구새우류 1종, *Triops longicaudatus* (LeConte, 1846)을 재기재한다. 이것은 국내 최초의 배갑류에 대한 기록이다.

Key words: Redescription, *Triops longicaudatus*, Notostraca, Korea.

## INTRODUCTION

The Notostraca is an order of the branchiopod Crustacea, comprising about eleven species of two genera in a single family (Linder, 1952; Longhurst, 1955). The members of the order have shield-shaped carapace, usually occur in temporary pools of freshwater or brackish water, being most common in the drier regions of the world. In East Asia, four notostracan species have been known from Japan and China (Ueno, 1927, 1940; Iwaihara, 1968, 1977; Akita, 1971), but neither of which ever known from Korea.

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This study was supported by grant from the Korea Science and Engineering Foundation (KOSEF 901-0405-005-2).

In the present study we are dealing with one Korean notostracan species. This is the first record of the notostracan fauna in Korea.

The materials were collected from the ricefields at Ch'angnyŏng-ŭp, Ch'angnyŏng-gun (35° 33' N, 128° 30' E) and Hyangch'on-dong, Samch'ŏnp'o-shi (34° 56' N, 128° 05' E) in South Korea on July 5, 1986 and May 28, 1991, respectively. The samples were preserved in 70 percent ethanol. The drawing and measuring were made with the aid of a camera lucida. All specimens examined are deposited in the Department of Molecular Biology, Seoul National University.

The classification was based on Longhurst (1955). The terminology is after that of Linder (1952), Longhurst (1955), McLaughlin (1980) and Schram (1986).

## SYSTEMATIC ACCOUNTS

Class Branchiopoda Laterille, 1817	새각 강
Order Notostraca Sars, 1867	배갑 목
Family Triopidae Keilhack, 1910	투구새우 과 (신칭)
Genus Triops Schrank, 1803	투구새우 속 (신칭)

***Triops longicaudatus*** (LeConte, 1846) 긴꼬리투구새우 (신칭) (Figs. 1-3)

*Apus longicaudatus* LeConte, 1846 [cited from Linder, 1952 (p. 53)]; Linder, 1952 (p. 53, Pl. 5, figs. 2,3, Pl. 6, Pl. 7, figs. 1,2); 1959 (p. 574, fig. 25.1).

*Triops longicaudatus*: Longhurst, 1955 (p. 46, Fig. 2G, H, Fig. 5D, D', D'', Fig. 14A, Fig. 16); Akita, 1972 (p. 217, Figs. 1-3).

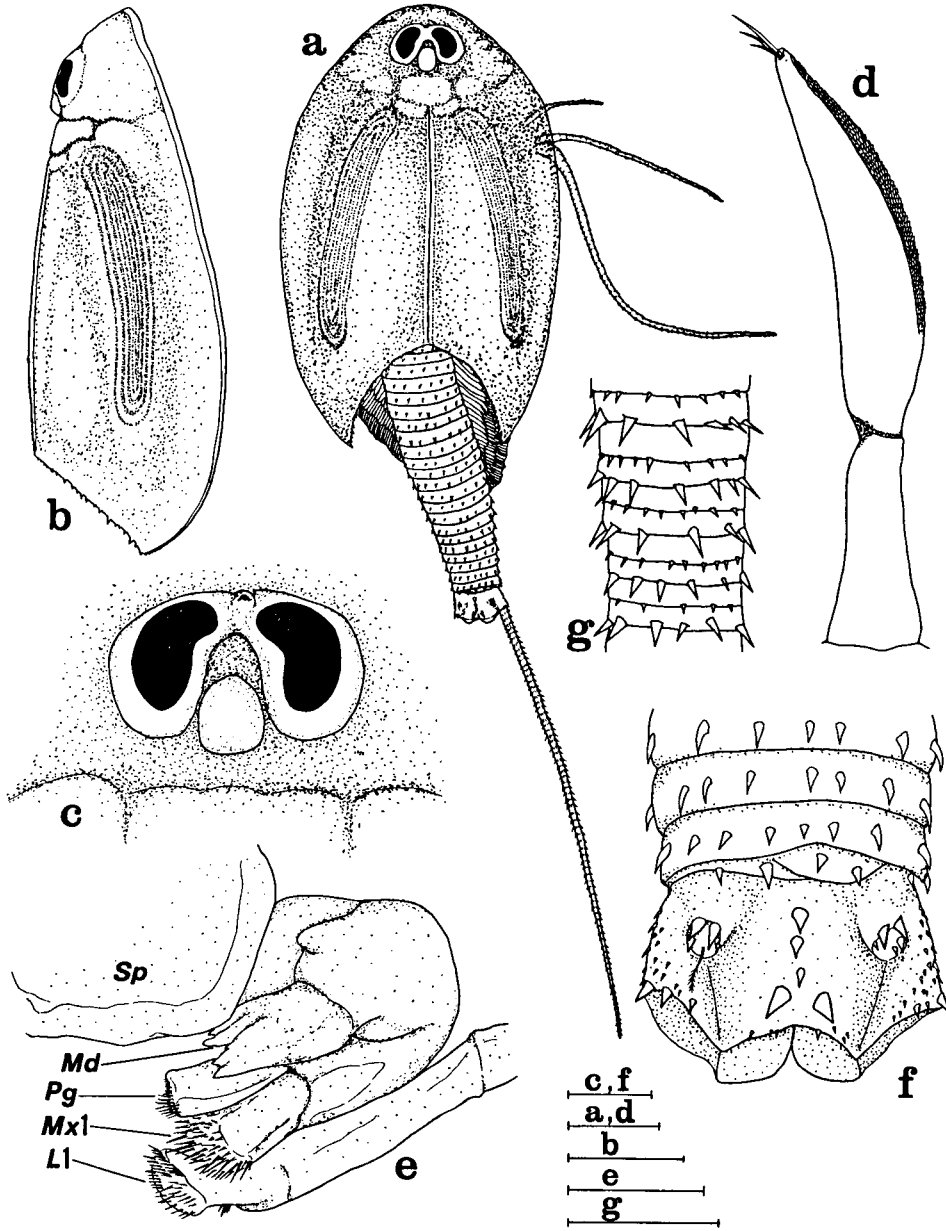
*Apus aequalis* Packard, 1871 [cited from Linder, 1952 (p. 53)]; Ueno, 1927 (p. 262, figs. 31, 31a-31f).

**Material examined:** 19 females (young) collected from ricefields at Ch'angnyŏng-ŭp, Ch'angnyŏng-gun by I.H. Kim on July 5, 1986 and 1 female (ovigerous) from ricefield at Hyangch'on-dong, Samch'ŏnp'o-shi by S.M. Yoon and M.K. Shin on May 28, 1991.

**Female:** Body dark green in live specimens, cylindrical, widened and flattened anteriorly; length of body (excluding furca) 0.56 - 2.68 mm. Number of body segments varying from 36 to 37 (postermost segment sometimes incomplete); thoracic segments 11, leg-bearing abdominal segments 17 - 19, apodous (legless abdominal) segments 7 - 8 in number, respectively. Each segment without supernumerary spines, bearing about 8 spines directed posteriorly on its dorsal surface (Figs. 1a, 1f, 3a).

Carapace (Figs. 1a, 1b) oval, with distinct mandibular and cervical grooves; median length 0.36 - 1.59 mm, maximum breadth 0.43 - 1.68 mm. Dorsal surface without any ornamentation (numerous small denticles scattered in young). Carina beginning at region near cervical groove and extending posteriorly along midline to posterior margin of carapace, without terminal spine, with several marks of denticles on posterior half (in young, with about 35 small denticles arranged along all length). Posterior margin excavated, armed with 43 - 54 spines of unequal size. Lateral margin evenly curved, without spinules (armed with numerous spinules in young). Maxillary glands elongated.

Compound eyes large, paired in semicircular form, with their anterior parts close each other, located beneath larger swelling of same form at anterior fifth along midline of carapace. Ocellus simple and small, situated on midline of carapace directly anterior to compound eyes. Dorsal organ large and round, forming



**Fig. 1.** *Triops longicaudatus* (LeConte, 1846), adult female: a, habitus, dorsal view; b, carapace, lateral view; c, compound eyes and dorsal organ; d, right antennule; e, left mouth part, ventral view; f, posterior apodous segments and telson, dorsal view; g, middle part of furca. Abbreviations: L1 = first leg; Md = mandible; Mx1 = first maxilla; Pg = paragnath; Sp = subfrontal plate. (Scales: d = 0.25 mm; f, g = 0.5 mm; c, e = 1 mm; a, b = 5 mm).

small mound at posterior excavated region of swelling containing compound eyes (Fig. 1c).

Antennule (Fig. 1d) small, divided into two segment; distal segment long, weakly curved interiorly, with 3 sensory setae of unequal size on distal end, bearing numerous small papillae on distal two-thirds of outer

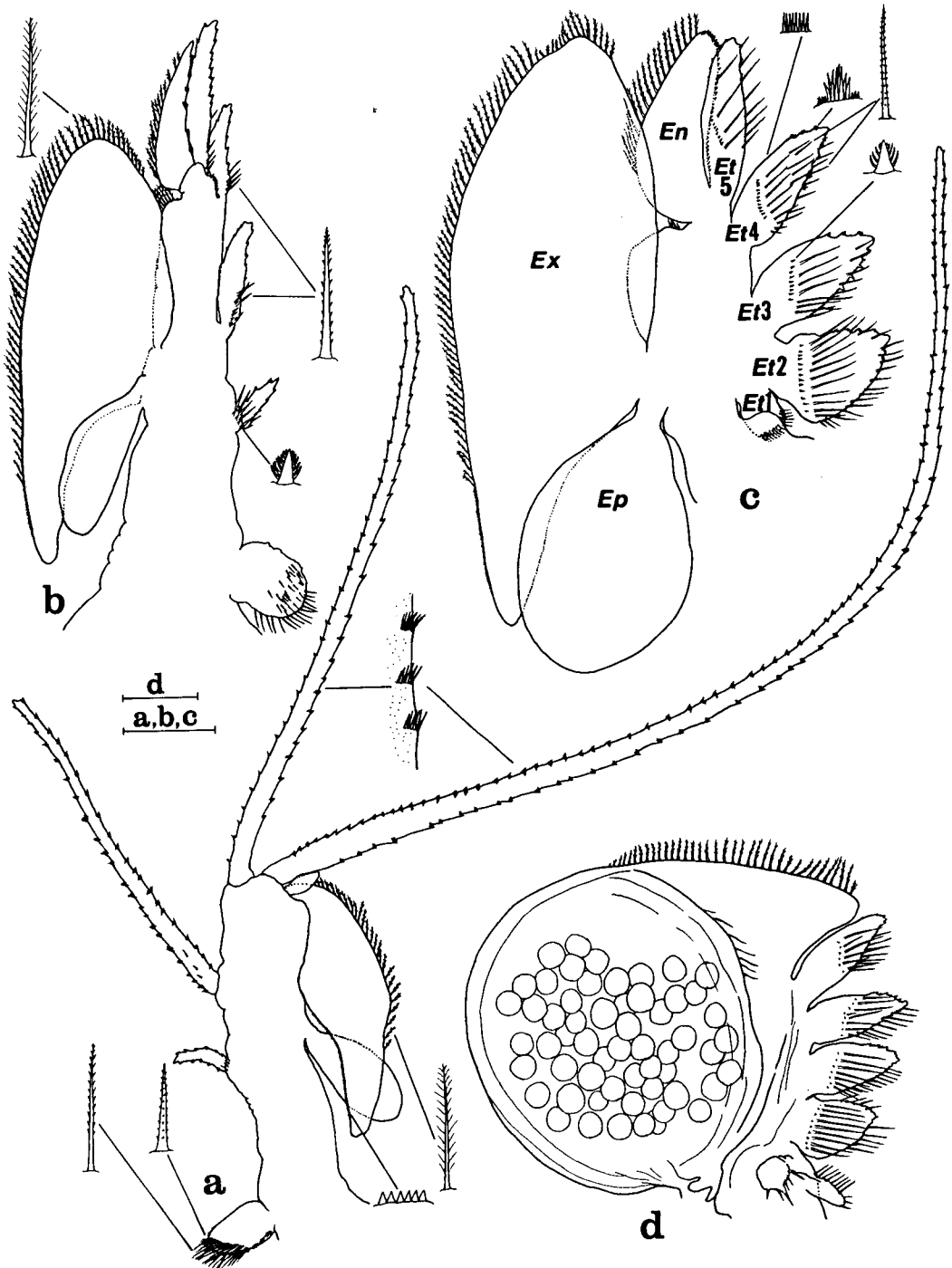
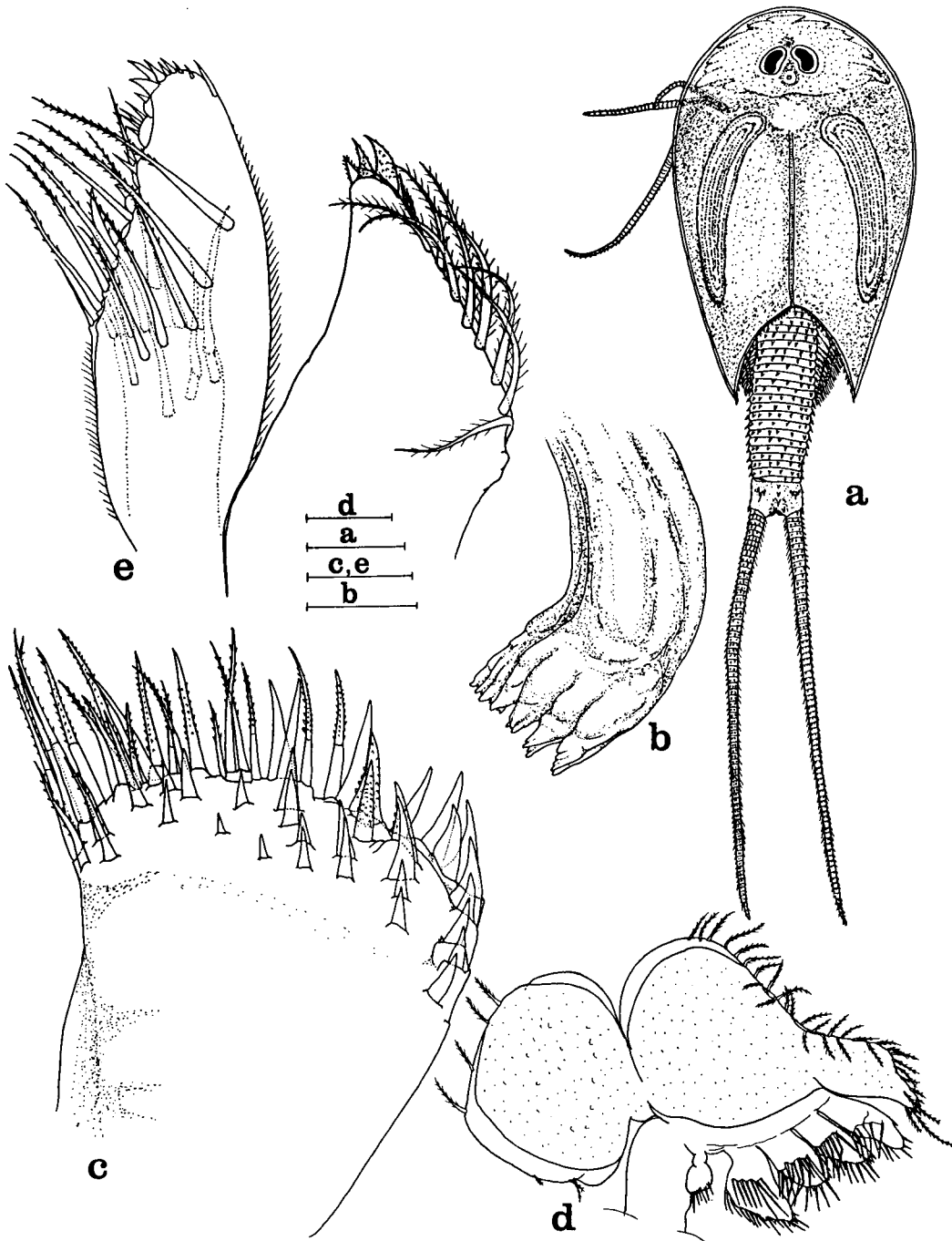


Fig. 2. *Triops longicaudatus* (LeConte, 1846), adult female: a, right first leg, posterior face; b, right second leg, anterior face; c, right tenth leg, anterior face; d, right eleventh leg, anterior face. Abbreviations: En = endopod; Ep = epipod; Et (1 - 5) = endites 1 - 5; Ex = exopod. (Scales: a, b, c, d = 1 mm).



**Fig. 3.** *Triops longicaudatus* (LeConte, 1846), young female: a, habitus, dorsal view; b, distal part of mandible; c, right tenth leg, anterior face; d, right eleventh leg, anterior face; e, endopod and fifth endite of right eleventh leg, posterior face. (Scales: c, e = 0.1 mm; b, d = 0.5 mm; a = 2 mm).

margin. Antenna extremely reduced, vestigial.

Mandible (Figs. 1e, 3b) strongly bent, without palp; distal triturating surface widened, bearing about 7

large, distally denticulate teeth. First maxilla similar in shape to mandible, armed with many setae and spines on distal surface; about half of one side usually with spinose setae, some of which segmented, while opposite half with unequal-sized spines, some of which bearing fine denticles (Figs. 1e, 3c). Second maxilla absent.

First leg (Fig. 2a) consisting of 5 endites, endopod, exopod, and epipod. First endite rounded, fringed with series of grouped spinules on marginal round, bearing many denticulate spines and spinose setae on distal margin. Remaining 4 endites elongated as flagella, extremely increased in length posteriorly, each with group of spinules at distal end and series of grouped spinules along lateral surfaces on both sides; second endite very short, with about 10 long and thin spines on its base, 3 - 5 of which denticulate; third endite bearing 4 - 6 long and thin spines along about proximal eighth, 2 - 3 of which denticulate. Endopod very short, knob-like, without any ornamentation. Exopod well developed, directed proximally, fringed with plumose setae on outer margin and with dense spinules on inner margin.

Second leg (Fig. 2b) similar to first leg in general form and ornamentation, but 4 endites of equal size elongated in former while much shorter in latter. Endopod larger, fringed with dense spinules on outer side and with plumose setae on inner side.

Legs except first two and eleventh leg among all 58 - 63 legs, similar in shape each other, somewhat decreasing in size posteriorly, with diverse ornamentation as shown in Fig. 2c of tenth leg; first endite rounded, similar in ornamentation to that of first or second leg; remaining 4 endites not elongated, leaf-shaped, each armed with spinose setae, large serrated spines, groups of short and thin setae, and fine simple setules along marginal round, and bearing two kinds of transverse rows, one of which of long spinose setae and another of short serrated spines, on anterior middle surface in each endite.

Eleventh leg very similar in general form to tenth, but its 2 exopodites forming egg-sac which containing numerous brown eggs in mature females (Figs. 2d, 3d, 3e).

Telson (Fig. 1f) without supra-anal plates, with 4 groups of spines on dorsal surface; median spines consisting of total 5 spines, posterior two of which paired, arranged along midline of telson somewhat increasing in size posteriorly; setal spines comprising about 6 spines of unequal size surrounding dorsal sensory setae on each side; posterior marginal spines consisting of about 10 small spines along posterior margin of telson; furcal spines of about 5 small spines lined with baseline of furca on each side. Both lateral surfaces bearing several small spines scattered continuously to region of furcal spines.

Furca (Fig. 1g) long and thin, numerous segmented; each segment armed with ring of equal-sized spinules; heights of rings in two neighbouring segments somewhat different each other, and such two neighbouring rings repeated along all length of furca.

**Male:** Not found.

**Remarks:** Because most notostracan species appear to have great variations in their morphology, there have been a lot of confusions in identifying the species. Longhurst (1955) considered three characters, the armature of the telson, the presence or absence of the second maxilla, and the arrangement of the eyes and the dorsal organ, as important ones in this group.

The present species is distinguishable from *Triops cancriformis* (Bosch, 1801) and *T. granarius* (Lucas, 1864) by the absence of the second maxilla, and *T. australiensis* (Spencer and Hall, 1896) by the armature of the telson, especially the arrangement of the median spines.

The present specimens are mostly well accorded with Linder's (1952) and Longhurst's (1955) descriptions on the present species except one difference in the armature of the telson. In both young and fully

grown adult of the present specimens, the median spines of the telson comprise five large spines, though their arrangement is as usual, while the forms having one to four spines have only been known in *T. longicaudatus* (Leconte, 1846). This seems to be a variation, but the exact status of the present specimens will be confirmed by the further study with males.

The ornamentations of appendages, which were described and figured in this paper, have not been known yet in most notostracan species as well as in former descriptions of the present species. If such fine morphology be revealed in other species or populations, it can be a key to reduce the confusions in recognizing the species in this group.

**Distribution:** Korea, Japan, North to South America, W. Indies, Galapagos Islands, Hawaii.

## ABSTRACT

*Triops longicaudatus* (LeConte, 1846), a tadpole shrimp collected from ricefields at Ch'angnyŏng and Sarnch'ŏnp'o, Korea, is redescribed and illustrated. This is the first record of notostracan fauna in Korea.

## ACKNOWLEDGMENT

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