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A New Record of the Herring, *Sardinella lemuru* (Pisces: Clupeidae) from Korea

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Two specimens of *Sardinella lemuru* Bleeker, 1853 were collected for the first time from the adjacent waters of Cheju Island, Korea, in March 1997. *S. lemuru* is very similar to *S. zunasi* (Bleeker, 1854) in external features but differs in the number of anal fin rays. While *S. lemuru* is difficult to differentiate by color from *Clupea pallasii* valenciennes, 1847 the two are easily differentiated by their gill raker counts. We propose "Bali-paen-dang-i" as a new Korean name for *S. lemuru*.

Key words : *Sardinella lemuru*, herring, new record, Korea

Introduction

The fishes of *Sardinella* which is belonging to the family Clupeidae is distributed in the tropical and subtropical waters of the world (Wongratana, 1980). The genus comprises of approximately 21 species which inhabit both Atlantic and Indo-West Pacific (Whitehead, 1985). They live along the coastal areas with high productivity and mainly feed zooplankton.

Although many taxonomic works have been done, most species of *Sardinella* have many difficulties in identification each other (Chan, 1965). Regan (1917) distinguished *Sardinella* from *Harengula* and Fowler (1941) investigated the herrings from the Philippin archipelago. Chan (1965) revised the systematic works for *Sardinella* from the Indo-Pacific and Wongratana (1983) reported 24 new clupeoid species from the Indo-Pacific. Whitehead (1985) revised all the clupeoid species from the world.

In Korea, only one species, *Harengula zunasi* has been reported by Chyung (1977), thereafter, Youn (1996) studied the systematics and morphology of the families Engraulidae and Clupeidae from Korea, in which two *Sardinella* species were regarded as valid species in Korea.

In the present study, we provided illustrations and some osteological features of *S. lemuru* collected from Korea for the first time.

Materials and Methods

Two specimens of *Sardinella lemuru* caught in the adjacent waters of Cheju Island were obtained at the fish market in Cha-gal-chi, Pusan. Measurements, counts and hierarchy followed Chan (1965) and Nelson (1994). The bone structure was investigated under microscope after removing the flesh and stainning by Alizarin Red S. The specimen was deposited in the Ichthyology Laboratory, Pukyong National University (PKNU).

Results

***Sardinella lemuru* Bleeker, 1853 (Fig. 1)**
(New Korean name : Bali-paen-daeng-i)

Sardinella lemuru Bleeker, 1853 : 500 (type locality : Batavia, Indonesia)
Sardinella lemuru : Wongratana, 1980 : 111, Whitehead, 1985 : 103, Paxton *et al*., 1989 : 157.

Fig. 1. *Sardinella lemuru* Bleeker, PKNU970310, 211.80 mm in standard length.

1. Description

Dorsal fin rays 17; Pectoral fin rays 16～17; Pelvic fin rays 9; Anal fin rays 16～17; Scutes 19 +15 = 34; Lower gill rakers 157～160; Vertebrae 23+25 = 48.

Snout length 3.71～3.91 mm (mean 3.81 mm, n = 2), upper jaw length 2.50～2.53 mm (mean 2.52 mm, n = 2), orbital length 4.83～4.98 mm (mean 4.90 mm, n = 2), postorbital length 2.11～2.20 mm (mean 2.15mm, n = 2) in head length (Table 1).

Body elongate and subcylindrical, its depth 25.35～25.45% of standard length, but greatly compressed anteriorly and posteriorly; dorsal and ventral profiles very gently curved in similar form, however the former is slightly more curved; belly rounded, fairly sharply keeled; body depth greatest at the dorsal fin origin, its depth less than 30% of standard length.

Head rather short, as long as the body depth; snout bluntly pointed, the length somewhat longer than the orbital length; eye moderate size, heavily covered by adipose tissue with a vertical slit at the pupil.

Mouth terminal; upper jaw bordered by premaxillary, maxillary and supramaxillaries; maxillary extending below anterior margin of pupil, expanded portion of the second supramaxillary a symmetrical paddle shaped; lower jaw slightly projecting beyond the upper; dentary deep, the tip bluntly pointed; no teeth on jaws (Fig. 2).

Preopercle smooth, crescent-shaped, bears a little ridges on its surface; opercle smooth, rectangular, without radiating grooves; subopercle small, with a dorso-anterior process (Fig. 3A). Gill rakers well developed, very fine, numerous

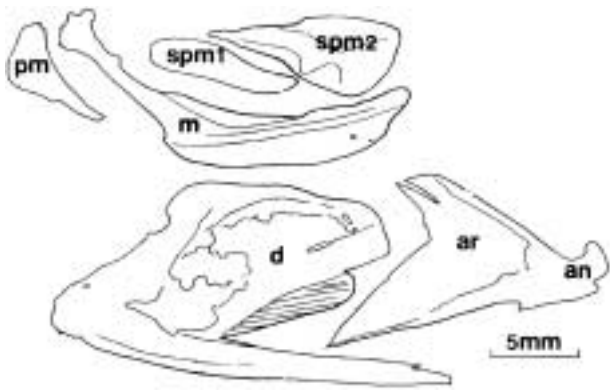

Fig. 2. Jaw bones of *Sardinella lemuru* Bleeker. an : angular, ar : articular, d : dentary, m : maxillary, pm : premaxillary, spm1 : first supramaxillary, spm2 : second supramaxillary.

and closely set from one another (Fig. 3B).

Dorsal fin single, the origin is nearer to the tip of snout than to base of caudal fin; dorsal fin base short, the length 3.09～3.3 mm (mean 3.20 mm, n = 2) in predorsal length. Pelvic fin small, the origin under the 8th ray of dorsal fin, the length 5.41～5.87 mm (mean 5.64 mm, n = 2) in prepelvic length. Anal fin base rather short, the length 5.77～6.20 mm (mean 5.99 mm, n = 2), last two rays somewhat longer and more extensively branched than preceding rays (Fig. 4). Caudal fin well forked with pointed upper and lower lobes.

Body covered by thin, somewhat adherent cycloid scales, which has only one continuous transverse groove distally, and 4 pairs of interrupted one anteriorly (Fig. 5). Predorsal median ridge covered by the adjacent side of tow longitudinal rows of scales.

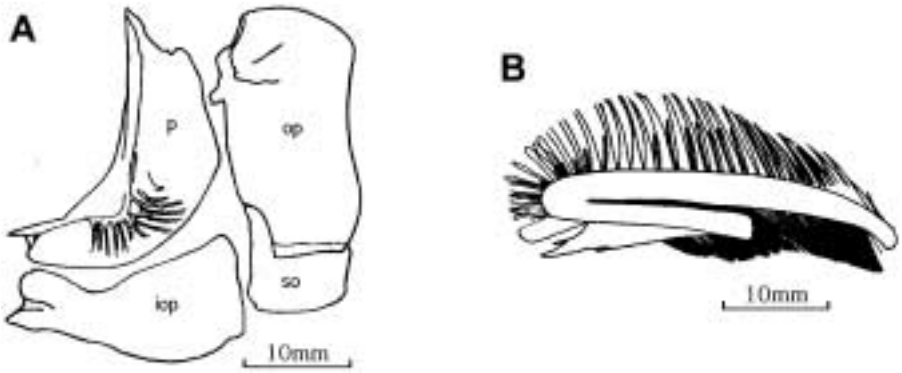

Fig. 3. Opercular bones (A) and gill rakers (B) of *Sardinella lemuru* Bleeker. opercular bones, iop : interopercle, op : opercle, p : preopercle, so : subopercle.

Fig. 4. Anal fin rays of *Sardinella lemuru* Bleeker showing the last two rays elongated.

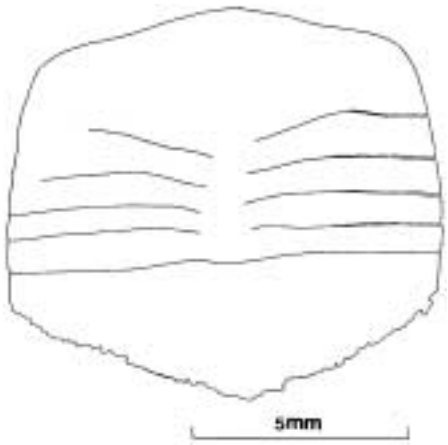

Fig. 5. Scale in the upper region off pectoral fin of *Sardinella lemuru* Bleeker.

2. Color in fresh

Body dark blue dorsally, but silvery white ventrally. Head yellowish silver with a black spot superiorly in the gill-opening. Dorsal, pectoral and anal fins yellowish white, otherwise pelvic whitish, caudal grayish with a black tip.

3. Distribution

Southern Korea, southern Japan, Taiwan Island, Hong Kong, Philippines, southern coasts of East Java and Bali, Western Australia, Phuket, Thailand.

4. Remark

The genus *Sardinella* was firstly established by Valenciennes (1847) and then has been defined by Regan (1917). Because morphological differences between most *Sardinella* species are subtle, so many errors have been caused for identification of the *Sardinella* species by many workers. Chyung (1977) reported *Harengula zunasi*, thereafter, Kim *et al.* (1994) placed *zunasi* to the genus *Herklotsichthys*. However, many authors like Regan (1917), Chan (1965), Wongratana (1980), Gloerfelt-Tarp and Kailola (1984), Whitehead (1985), Kim and Kang (1993) and Youn (1996) transferred *zunasi* to the genus *Sardinella*.

Regan (1917) primarily distinguished *Sardinella* from the genus *Harengula* by the differences in the size of the last two anal fin rays, not enlarged in *Harengula*. Chan (1965) involved a new character for differentiating them, that is the shape of the expanded portion of the second supramaxillary bone. *Herklotsichthys* differs from the genus *Sardinella* to have less fronto-parietal striae on

top of head presented by Gloerfelt-Tarp and Kailola (1984).

Therefore, *zunasi* should be transferred to the genus *Sardinella* rather than *Harengula* and *Herklotsichthys*.

After original description of *Sardinella lemuru* by Bleeker (1853), Chan (1965) treated the species as a synonym of *S. aurita*. Actually, most measurements of the present specimens conform well to the those of *S. aurita* (Table 1). However, many authors like Wongratana (1980), Gloerfelt-Tarp and Kailola (1984) and Nakabo (1993) recognized *S. lemuru* as a valid species.

The recent comprehensive work is that of Wongratana (1980), in which *S. lemuru* is well distinguished from *S. aurita* based on the differences of the distribution and the number of gill rakers. That is, *S. lemuru* has lower gill rakers 77~188 and lives from China to Australia. Although the range of the number of lower gill rakers is overlapped between two species, our specimens have lower gill rakers 157~160, therefore we consider ours as *S. lemuru*.

However, Eschmeyer (1998) stated that *S. lemuru* can not be distinguished as yet on morphological grounds from *S. aurita* which occurs in the Atlantic Ocean, it means they should be investigated in osteological as well as genetical aspects.

S. lemuru is very similar to *S. zunasi*, but they are easily distinguished by the number of anal fin rays (9 cf. 8 in *zunasi*) and lower gill rakers (77~188 cf. 48~57 in *zunasi*).

In recent, Youn (1996) carried out the taxonomic study of the family Engraulidae and Clupeidae from Korea, in which 10 genera 11 species of the family Clupeidae, 4 genera 7 species of the family Engraulidae were in detail revised in comparative anatomy. According to Youn (1996), *Sardinops immaculata, Harengula zunasi* were revealed as a synonym of *Sardinella jussieu* and *Sardinella zunasi* respectively. Therefore, the genus *Sardinella* comprises of 3 species including the present species *lemuru* in Korea.

We propose the new Korean name "Bali-pane-daeng-i" for *S. lemuru* Bleeker.

Table 1. Comparison of the measurments between *Sardinella aurita* and *Sardinella lemuru*

Characters	*Sardinella aurita* (Chan, 1965)	*Sardinella lemuru* (Present study)
Number of specimens	28	2
Standard length (mm)	65.0~165.5	211.8~220.4
In standard length		
Head length	3.66~3.84	3.96~3.99
Body depth	3.65~4.78	3.93~3.95
Predorsal length	2.18~2.31	2.20~2.28
Prepectoral length	3.82~4.10	4.25~4.67
Prepelvic length	1.81~1.97	1.97~1.98
Preanal length	1.22~1.35	1.25~1.26
In head length		
Snout length	3.09~3.75	3.71~3.91
Upper jaw length	2.41~2.49	2.50~2.53
Orbital length	3.53~4.33	4.83~4.98
Postorbital length	2.36~2.58	2.11~2.20

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청어과 Clupeidae, 밴댕이속 *Sardinella*에 속하는 *Sardinella lemuru* Bleeker, 1853 2개체가 1997년 3월에 우리나라 제주도 연안에서 처음으로 채집되었기에 이를 보고한다. *S. lemuru*는 동일속의 밴댕이 *S. zunasi*와 외부형태학적으로 매우 유사하나 뒷지느러미 연조수에서 잘 구별되며, 청어 *Clupea pallasii*와는 체색에서 매우 비슷하여 식별이 어려우나, 새파수에서 잘 구별된다. *Sardinella lemuru*의 국명을 "바리밴댕이"로 명명한다.