INTRODUCTION

The gulls have a worldwide cosmopolitan distribution. They breed on every continent, including the margins of Antarctica, and are found in the high Arctic as well. One of the smallest of the "white-headed" gulls, the Mew Gull is common along Pacific Coast beaches in winter, it also occurs in Eurasia, where it is known as the "common gull." The common gull (Larus canus) has a wide distribution, breeding throughout temperate and sub-Arctic parts of Eurasia [1]. It is classified as Least Concern (LC) on the IUCN Red List. The common gull is not threatened at present. This species is one of the most abundant marine birds on the Korean East Coast [2].

The classification of Acuariidae depends largely on the pattern of the cords on the surface of the anterior end of the body [3,4]. Acuariidae is a family of spirurian nematodes. Like all nematodes, Acuariidae have neither a circulatory nor a respiratory system. They include about 40 genera and 300 species, most of which are parasites of birds. The cuticle of the anterior part of the body is with 'cords'-cuticular ridges or grooves- or epaulette-like thickenings. Both sides of the body, cords may be recurrent to the bottom or may not be. It is to use the cordon when one approaches to the identification of species.

The genus Cosmocephalus Molin, 1858 is parasitic in the esophagus or stomach of aquatic birds and uses fish as the intermediate host. The adult worms have circular cord-like thickening known as "cordon", which extends posteriorly from the mouth [5]. Although 13 species of Cosmocephalus have been reported, only 7 were considered valid [6]. The nematode Cosmocephalus obvelatus Creplin, 1925 has been reported from several species of gulls and other birds. C. obvelatus had been reported from all continents except Antarctica in a variety of families of fish-eating birds [7,8]. This nematode has been found in Canada, Brazil, Spain, and New Zealand in species of Larus and also in other birds [9,10]. Although a large number of parasitological studies have been carried out in many countries, no reference has yet been made for this helminth in Korea. The aim of the present study is to describe the genus Cosmocephalus that was never reported in Korea.

CASE DESCRIPTION

In July 2011, we collected 2 common gulls from the east
coast of Gangneung City, Korea. The gulls were found dead and were stored at -4 °C until examination for gastrointestinal helminths by dissection. The viscera were examined for parasites under a stereomicroscope. The nematodes were recovered from the gizzard of common gulls. Specimens were collected, rinsed in 0.85% saline, fixed with 10% formalin and studied using light microscopy (LM). For scanning electron microscopy (SEM), the worms were washed with 0.1 M phosphate buffer pH 7.4 (PB) and fixed with 2.5% glutaraldehyde in PB at 4 °C for 4 hr. After washing with PB, they were post-fixed with 1% osmium tetroxide at 4°C for 4 hr. The specimens were dehydrated in a graded ethyl alcohol series, dried by CO₂ critical point drier, coated with osmium tetroxide, and examined by a scanning electron microscope (Hitachi, S-4800, Tokyo, Japan) at 15 kV.

Measurements of this medium-sized acuariids are shown in Table 1. Two pseudolabia were observed at lateral side of the mouth with each bearing a pair of large cephalic papillae and 1 inconspicuous amphid (Fig. 1B). Cordons arose dorsally

---

**Table 1.** Comparisons of the metrical data (in micrometres) of Cosmocephalus obvelatus from various hosts and localities

| Source          | Species          | Host           | Locality     | Male | Body length (mm) | Maximum body width | Cordons, length | Cordons, width | Female | Body length (mm) | Maximum body width | Cordons, length | Cordons, width | Eggs |
|-----------------|------------------|----------------|--------------|------|------------------|--------------------|------------------|---------------|--------|------------------|--------------------|------------------|---------------|------|
| Anderson & Wong | C. obvelatus     | Larus delawarensis | Canada       | n=10 | 9.9-14.3        | 200-350            | -                | -             | n=10   | 15.8-22.3        | 320-500            | -                | -             | -    |
| Azuma et al.    | C. obvelatus     | Eudyptes crestatus | Chile        | n=8  | 9.6-13.0        | 240-300            | 380-520          | -             | n=10   | 11.7-22.8        | 280-480            | 420-800          | 27-32          | -    |
| Mutafchiev et al. | C. obvelatus | Larus argentatus | Bulgaria     | n=10 | 9.8-11.2        | 255-286            | 322-376          | -             | n=9    | 14.8-18.2        | 402-456            | 452-532          | -             | -    |
| Present study   | C. obvelatus     | Larus canus    | Korea        | n=2  | 9.1-9.3         | 224-246            | 399-407          | -             | n=3    | 15.5-15.9        | 302-342            | 501-548          | -             | -    |

**Fig. 1.** SEM micrographs of Cosmocephalus obvelatus (Creplin) from Larus canus. (A) Anterior end, female, lateral view; note reccurrent cordon (arrows). (B) Anterior end, female, apical view; note cephalic papillae (arrow heads), amphid (arrow), cuticular swellings dorsally and ventrally at the base of the pseudolabia (asterisks). (C) Cuticular plates, detail from the middle part of the descending arm of a cordon. (D) Bifurcated deirid and lateral alae (arrow). (E) Anterior end, lateral view; note lateral alae (arrow). (F) Posterior end, female, note nipple-like projection and phasmid (arrow).
and ventrally between pseudolabia (Figs. 1A, B, 2B), extending posteriorly in longitudinal direction and anastomosing laterally at about the level of the anterior quarter of the buccal cavity (Fig. 1B). Each cordon consists of a single row of cuticular plates (Fig. 1A, C). The salient bicuspid deirids were located on the posterior to cords (Figs. 1D, 2C). Lateral alae well-developed, extending from level just posterior of deirids to level about the middle of the body (Fig. 1D, E).

Prominent phasmids situated subventrally near tip of tail (Fig. 1F). Male: Body length 9.1-9.30 mm. Maximum body width 224-246 μm. Tail 398 μm long.CORDONS extend to 501-546 μm from anterior end (Table 1). Caudal extremity of female tapered and round. Knob-like projection at tip of tail (Fig. 2E). Uterus packed with embryonated thick-shelled eggs (Fig. 2F).

**DISCUSSION**

*C. obvelatus* has been described several times using LM and SEM [3, 5, 6, 11, 12]. Although 11 species of *Cosmocephalus* have been reported [13], Anderson and Wong [7] redescribed *C. obvelatus* (Creplin, 1825) and believed that it as well as *C. imperialis* Morishita, 1930, *C. capellae* Yamaguti, 1935, and *C. jaenschi* Johnston & Mawson, 1941 were the only valid species. They considered *C. diesingi*, *C. faridi*, *C. firlottei*, and *C. firlottei* as junior synonyms of *C. obvelatus*. This concept was followed by Smogorzhevskya [14] and Diaz et al. [11]. Mutafchiev et al. [6] recently revised the genus *Cosmocephalus* thoroughly. They reported that *C. faridi* should be considered valid. Its unique character among congeners is the highly-elongate loop of the cordon, reaching up to 1/3 of the cordon length. In addition, they reported *C. podicipis* and *C. pelecani*. According to them, the genus *Cosmocephalus* consisted of 7 valid species currently. They proposed keys for identification of the species of the genus *Cosmocephalus*.

In general, the morphology and size of all *Cosmocephalus* species are quite different [6]. The main characters used to distinguish between them are the size of the body length, the presence of lateral alae, the shape of deirids, and the cordon length. Nevertheless, Diaz et al. [12] reported this species seems to exhibit great morphological stability, indicating a wide adaptability to different hosts and localities.

In the present study, most of the measurements of male and female *C. obvelatus*, except for a few variations, are within the ranges so far published [5-7]. Male worms were smaller than in other reports in their maximum body length (Table 1). Although little difference is found in measurements of the body length among specimens, the specimens studied here...
closely coincided with the description by Azuma et al. [5], Diaz et al. [11], and Mutafchiev et al. [6]. On the basis of the SEM observations, the morphological characters of our specimens fully confirmed the characteristics of C. obvelatus presented by Mutafchiev et al. [6]. Consequently, we concluded that the present specimens are identified as C. obvelatus. In Korea, the genus Cosmocephalus had not been recorded from any wild birds. This is the first report of the species in common gulls in Korea.

CONFLICT OF INTEREST

We have no conflict of interest related to this work.

REFERENCES

1. Brazil M. Birds of East Asia: Eastern China, Taiwan, Korea, Japan, and Eastern Russia. Helm Field Guides. London, UK. A & C Black Publishers. 2009, pp. 86-100.
2. Park JM, Choi SK, Kim SL. A study on the bird diversity of Gangneung watersheds region. Korean J Ornithol 2002; 9: 123-133.
3. Abou-Shafey HE. Desportesius invaginatus (Linstow, 1901) Chabaud and Campana, 1949 (Nematoda, Acuariidae) from Ardea ibis ibis with reference to the fine structure of the cordonis. Parasitologists United J 2012; 5: 49-57.
4. Mawson PM. Some Acuariinae (Nematoda) from Australian birds. Trans R Soc South Australia 1982; 106: 19-30.
5. Azuma H, Okamoto M, Ohbayashi M, Nishine Y, Mukai T. Cosmocephalus obvelatus (Creplin, 1825) (Nematoda: Acuaridae) collected from the esophagus of rockhopper penguin, Eudyptes crestatus. Jpn J Vet Res 1988; 36: 73-77.
6. Mutafchiev Y, Halajian A, Georgiev BB. Two new nematode species of the genus Cosmocephalus Molin, 1858 (Spirurida: Acuariidae), with an amended generic diagnosis and an identification key to Cosmocephalus spp. Zootaxa 2010; 2349: 1-20.
7. Anderson RC, Wong PL. Redescription of Cosmocephalus obvelatus (Creplin, 1825) (Nematoda: Acuarioida) from Larus delawarensis Ord (Laridae). Can J Zool 1981; 59: 1897-1902.
8. Wong PL, Anderson RC. The transmission and development of Cosmocephalus obvelatus (Nematoda: Acuarioida) of gulls (Laridae). Can J Zool 1982; 60: 1426-1440.
9. Rao NSK. Cosmocephalus firlottei n. sp. (family Acuariidae) from the sea gull Larus argentatus. Can J Zool 1951; 25: 173-177.
10. Rodrigues de Olivera H, Vicente JL. Nova espécie do gênero Cosmocephalus Molin, 1858 (Nematoda, Spiruroidea). Rev Bras Biol 1963; 23: 389-392.
11. Diaz JJ, Navone GT, Cremona F. New host and distribution records of Cosmocephalus obvelatus (Creplin, 1825) (Nematoda: Acuariidae), with morphometric comparison. Comp Parasitol 2001; 68: 277-282.
12. Diaz JJ, Cremona F, Navone GT. Helminths of the kelp gull, Larus dominicanus, from the northern Patagonian coast. Parasitol Res 2011; 109: 1555-1562.
13. Skrjabin KI, Sobolev AA, Ivashkin VM. Principles of nematology 14. Spirurata of animals and man and diseases caused by them. Part 3, Acuarioida. Moscow, Russia. Izdat, Nauka. 1965, pp. 264-299.
14. Smogorzhevskaya LA. Nematodes. Part 3. Acuarioida. In Sharpilo VP (ed.), Fauna Ukrainy. 1990, p 1-188 (in Russian).