NOTES ON IRCINIIDAE FROM KOREA

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ABSTRACT

Sponges of the order Dictyoceratida are poorly known in Korea. Twelve species of the family Irciniidae and two species of the family Spongiidae have been reported from many island and coastal areas of the East Sea, Yellow Sea and South Sea of Korea. Sponges belonging to the family Irciniidae are characterized by an anastomosing skeletal network of primary and secondary spongin fibres and fine filaments with terminal knobs. A new genus *Bergquistia* Sim and Lee, 2002, from Korea, is included into the family Irciniidae. The new genus is characterized by extremely simple fasciculated and uncored primary fibres. However, in the choanosomal region, primary fibres form a clearly detectable wider web. Secondary fibres form a very thin regular uncored network. The sponge surface has thick and regular conules. The colour is beige throughout the sponge, and the texture is slightly hard but compressible. Thickness of filaments is variable. To date, within the genus *Sarcotragus*, only very fine filaments have been described.

KEY WORDS

Dictyoceratida, Irciniidae, Korea.

INTRODUCTION

The genera *Psammocinia* Lendenfeld, 1889*, Ircinia* Nardo, 1833 and *Sarcotragus* Schmidt, 1862 were included in the family Thorectidae Bergquist, 1978, but BERGQUIST & WELLS (1983) noted that the genera *Ircinia, Sarcotragus* and *Psammocinia* composed a distinct sub-group within that large assemblage in having fine collagenous filaments within the sponge matrix and the presence of the furanosesterterpene variabilin. These genera were separated from the family Thorectidae and transferred to the family Irciniidae (BERGQUIST, 1995). Recently, a new genus *Bergquistia* Sim & Lee, 2002, from Korea, was included into the family Irciniidae. The new genus is characterized by uncored skeletal fibres, slender conules, slightly fasciculated primary fibres and simple secondary fibres. Four genera, *Bergquistia, Ircinia*, *Psammocinia* and *Sarcotragus* are included into the family Irciniidae (SIM & LEE, 2002b). To date, 23 species of the genus *Psammocinia* were reported worldwide. Among them, 10 species were reported from New Zealand (BERGQUIST, 1995; COOK & BERGQUIST, 1996, 1998), three from Australia (POLÉJAEFF, 1884), one from the Atlantic coast of the United States (POLÉJAEFF, 1884), and nine from Korea (SIM, 1998; SIM & LEE, 1998, 2001, 2002a). More than 40 species of the genus *Ircinia* have been reported worldwide (LAUBENFELS, 1948; BERGQUIST, 1980). Twenty of them were reported from Australia (LENDENFELD, 1889). Five species of

the genus *Sarcotragus* were reported from all over the world. Among them, two species, *S. spinosulus* Schmidt, 1862 and *S. foetidus* Schmidt, 1864, were reported from the Mediterranean Sea and one species, *S. arbuscula* Lendenfeld, 1889, from Australian Seas. Two species, *S. gapaensis* Sim & Lee, 2000 and *S. maraensis* Sim & Lee, 2000, were recorded from Korean waters (SIM & LEE, 2000). Only one species, belonging to the genus *Bergquistia* has been reported worldwide. *B. coreana* was recorded from Korean waters (SIM & LEE, 2002b) .

Sponges belonging to the family Irciniidae are found frequently in Korean and adjacent Islands waters, mainly from the subtidal zone, between 15 and 30 m depth. Among them, those belonging to the genus *Psammocinia* were found from many Korean localities, whereas those of the genera *Bergquistia, Ircinia* and *Sarcotragus* were very rare.

The present study aims to taxonomically assess the fauna of Irciniidae from Korea.

MATERIALS AND METHODS

Diagnoses of previously recorded and already described species were taken from type specimens preserved in the Natural History Museum, Hannam University, Daejeon, Korea. These species are: *Sarcotragus gapaensis* Sim & Lee, 2000 (Por. 33), *S. maraensis* Sim & Lee, 2000 (Por. 32), *Ircinia* sp., *Psammocinia samyangensis* Sim & Lee, 1998 (Por. 30), *P. mammiformis* Sim & Lee, 1998 (Por. 27), *P. lobata* Sim & Lee, 2002 (Por. 38), and *Bergquistia coreana* Sim & Lee, 2002 (Por. 40). Sponge specimens were collected using SCUBA diving from the South Sea including Jejudo Island, the East Sea and the West Sea of Korea. Specimens were fixed in 95 % methyl alcohol or absolute alcohol and stored, separately, in alcohol of the same quality. Observation of the sponge surface and conules were made using a stereo microscope. The skeletal arrangement and filaments were studied under light microscope and SEM (Hitachi, S-3000N).

RESULTS

During the period 1988 to 2001 45 sponge specimens belonging to the family Irciniidae were collected from 27 localities of South Korea:, 12 species were identified in total. Nine of them were included in the genus *Psammocinia*, 2 in the genus *Sarcotragus* and 1 species in the genus *Bergquistia.* Additionally, one *Ircinia* sp. has been also collected from Korean waters.

Surface

All Korean sponges belonging to the family Irciniidae have well developed conules on the surface. Conules are formed by primary fibres protruding out of the surface and are reinforced by spicules or sand inside and outside the primary fibre. The conules have very diverse shapes. They differ in form, being sharp or round, height, thickness, distance and type of connection each other. The species of the genus *Psammocinia* have either round or sharp ended conules. *P. samyangensis* shows sharp and short conules, reduced in number. In *P. mammiformis*, the end of conules is mammiform (Fig. 1A). The surface of the species belonging to the genus *Sarcotragus* and *Ircinia* is strongly conulose, conules being sharp ended (Figs 1B-C). *S. maraensis* and *S. gapaensis* have sharp ended conules and their tops are connected each other by a membrane, reminding a folding screen (Fig. 1B). *Ircinia* sp. has peculiar conules

with a crown like aspect (Fig. 1C). Among the Korean sponges of the family Irciniidae, the highest conules are 8 mm high (*S. maraensis*), the smallest 0.5 mm high (*P. gageoensis*). Conules of *Bergquistia coreana* are slende but well developed, 1 - 3 mm high, 2 - 4 mm apart (Fig. 1D).

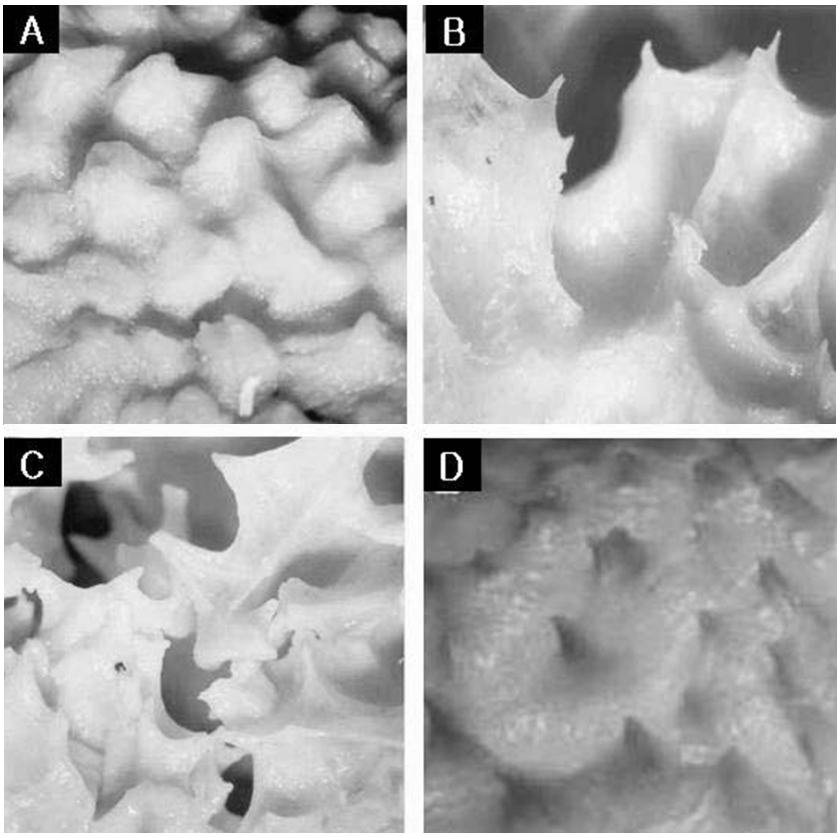

Fig. 1. Conules. **A,** conules of *Psammocinia mammiformis*. **B,** conules of *Sarcotragus maraensis*. **C,** conules of *Ircinia* sp. **D,** conules of *Bergquistia coreana*.

Filamentous membrane on the sponge surface

The sponge surfaces of the Korean species of Irciniidae are characterized by membranes made of filaments, spongin material and sometimes sand and spicules. The specimens belonging to *Ircinia, Sarcotragus* and *Bergquistia* lack or almost lack sand covering (Figs 2B-D). The surface of *Psammocinia* specimens is armoured with sand or has a sand crust which is mixed with filaments, spongin material and spicules (Fig. 2A). Armoured surface or sand crust are the most important characteristics for distinguishing the genus *Psammocinia* from other genera of the family Irciniidae. The filamentous membrane of *S. maraensis* and *S. gapaensis* is free from sand or spicules. The filamentous membrane of *Ircinia* sp. is mixed with small amounts of sand, but it is distinguishable from the sand crust of the genus *Psammocinia*. The filamentous

membrane of *P. lobata* has a heavy crust with sand, spicules and filaments. The surface of *P. samyangensis* is armoured with large sand grains.

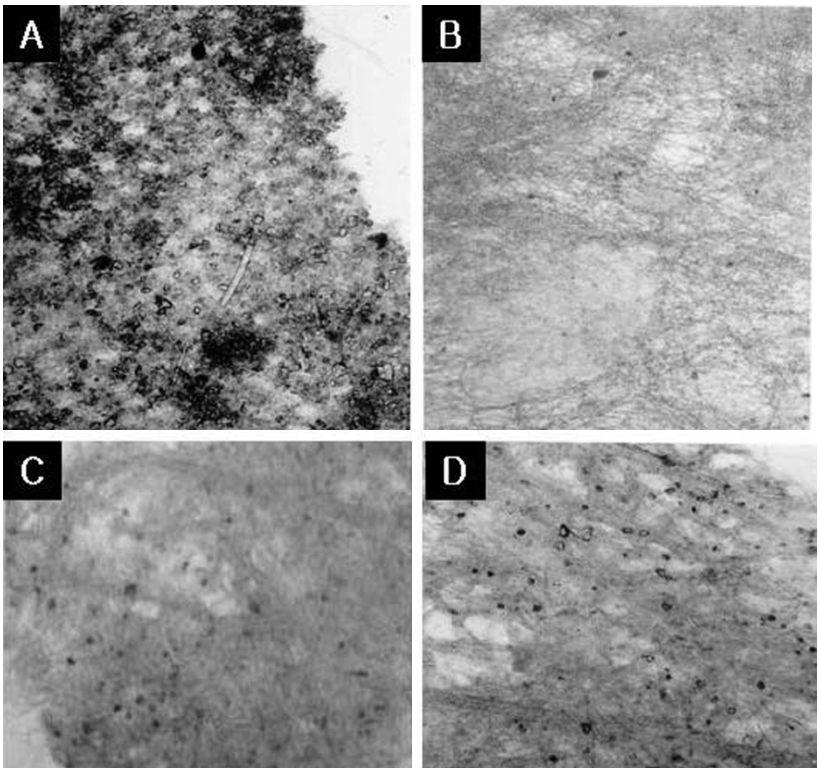

Fig. 2. Sponge surface. **A,** sand crust of *Psammocinia samyangensis.* **B,** membrane of *Sarcotragus maraensis.* **C,** membrane of *Ircinia* sp. **D,** membrane of *Bergquistia coreana.*

Characteristics of the skeletal fibres

The primary and secondary skeletal fibres of Korean sponges belonging to the family Ircinidae are generally pithed and laminated. Primary fibres often form massive complex fascicles. The anastomosing fibre skeleton is regular and often arranged to form rectangular meshes. In the genus *Psammocinia*, primary fibres are weakly fasciculated (*P. samyangensis,* Fig. 3A), and are often almost obscured by the accumulation of sand. The primary fibres of the genus *Ircinia* frequently attain great size being woven into complex fascicles, while secondary fibres are relatively simple (Fig. 3B). COOK & BERGQUIST (1998) described secondary webs, which are generally larger than those in *Psammocinia* species. The fasciculated primary fibres of the genus *Sarcotragus* have a clearly visible characteristic pith. The primary fibres of *S. maraensis* and *S. gapaensis* are the most complex in the Ircinidae and have well developed secondary webs (Figs 3C, 4B). Sometimes it is difficult distinguishing primary from secondary fibres, because secondary fibres form a widely spreaded secondary web. In the case of *B. coreana*, primary fibres are weakly fasciculated as in

P. samyangensis or *Ircinia* sp., but *B. coreana* is easily distinguishable from *Psammocinia* and *Ircinia,* because its fibres are clear of detritus, except the primary fibres near the conules (Figs 4D-E). In addition to this character, the fibres of *B. coreana* are distinct from the fibres of other species of the genus *Sarcotragus*, because they are very heavily fasciculated.

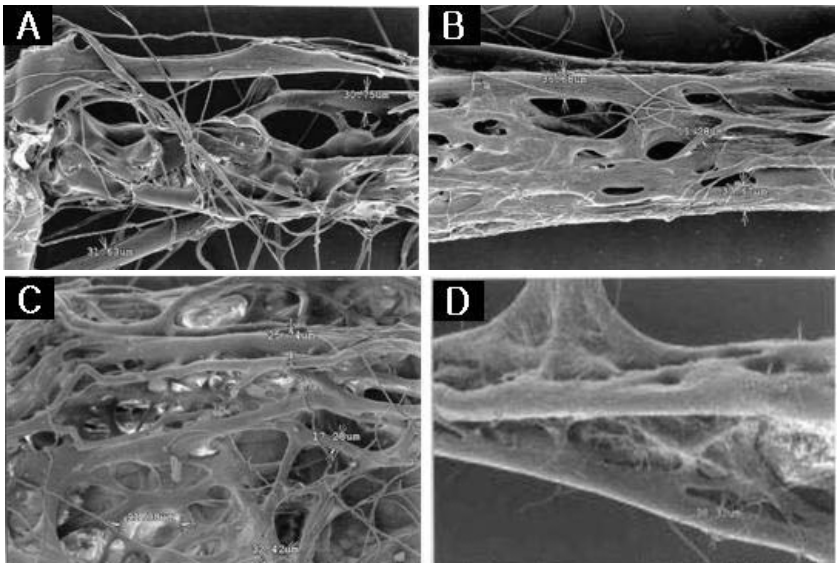

Fig. 3. Fasciculated fibres. **A,** *Psammocinia samyangensis.* **B,** *Ircinia* sp. **C,** *Sarcotragus maraensis.* **D,** *Bergquistia coreana.*

Detritus in skeletal fibres

The primary fibres of the Korean species belonging to the family Irciniidae may often incorporate a core of foreign material. The secondary fibres are generally uncored. In the genus *Psammocinia*, the primary fibres have large quantities of sand and spicules inside and outside (*P. samyangensis,* Fig. 4A). Sometimes, large sand grains in the fibres can completely obscure their axis. The primary fibres are fragile, because they are cored with much sand. The secondary fibres are partly cored with a small amount of sand grains. Primary fibres of *Ircinia* species are cored with detritus while secondary fibres are free from detritus. *Ircinia* sp. has a small amount of sand or spicules in the primary fibres (Fig. 4C). Primary fibres and secondary fibres of *Sarcotragus* species lack or almost lack foreign inclusions. Primary fibres of *S. maraensis* and *S. gapaensis* are clear of sand or spicules, but sometimes the latter appear close to the conules (Fig. 4B). In *Bergquistia*, primary and secondary fibres are clear from debris, except in conules (Figs 4D-E). However, this genus differs from *Sarcotragus* due to its weakly fasciculated primary and secondary fibres.

Characteristics of the filaments

All the sponges of the family Irciniidae have fine interstitial collagen filaments emerging from holes in the primary and secondary fibres (Figs 5A-E). We consider

that filaments are continuously emerging from holes in the fibre, because the number of holes is small compared with the mass of filaments which reminds a cotton ball. Filaments have enlarged terminal knobs at the start point and the other end has a gradually tapers.

Filaments of *P. samyangensis*, *S. gapaensis*, *S. maraensis* and *Ircinia* sp. are 3 - 7 μm in thickness (Figs 5A-C). BERGQUIST (1980) and HOOPER (1994) reported that filaments of the genus *Sarcotragus* are always very fine. But, in our study, the thickness of filaments is not different among *Psammocinia*, *Ircinia* and *Sarcotragus*. In case of *B. coreana*, filaments are very thin, 0.7 - 2.5 μm in thickness (Fig. 5E), and two or three filaments may coil round each other forming a thicker filament which shows a peculiar surface figure (Fig. 5D).

CONCLUSIVE REMARKS

To date, 12 Korean sponges species are included in the family Irciniidae; 9 species belonging to the genus *Psammocinia,* 2 species belonging to the genus *Sarcotragus,* and 1 species belonging to the genus *Bergquistia*. Several specimens have been collected in Korea from coastal areas of the East Sea, Yellow Sea and South Sea. Among them, specimens belonging to the genus *Psammocinia* are found frequently in Korean waters, mainly in the subtidal zone, between 15 and 30 m depth. At present the genus *Ircinia* seems to be very rare.

The presence of filaments distinguishes the family Irciniidae among other Dictyoceratida. They occur in only four genera of the family Irciniidae. RUETZLER (1965), BERGQUIST (1980) and PULITZER-FINALI & PRONZATO (1980) always reported very fine filaments in the genus *Sarcotragus*. However, the present study suggests that the filament thickness in *Sarcotragus* species may be variable. In our study the thickness of filaments in some specimen of Korean *Sarcotragus* was close to that of sponges belonging to other genera within the family Irciniidae. Consequently, further proof is required in order to assess that these Korean specimen are really *Sarcotragus*.

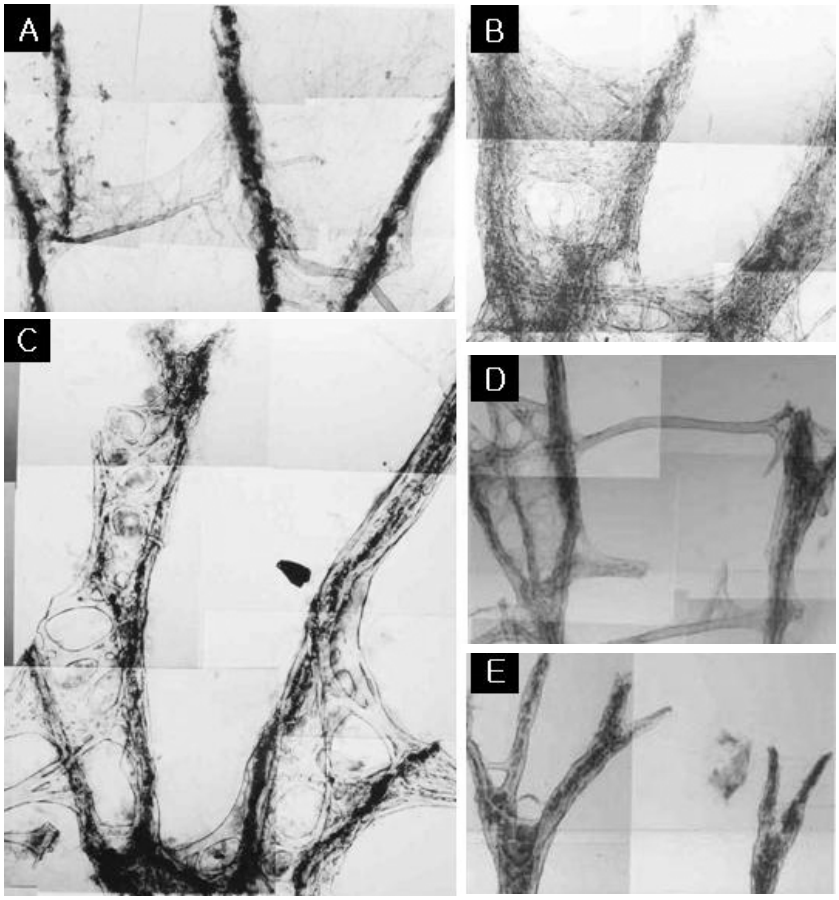

Fig. 4. Skeletal structure. **A,** *Psammocinia samyangensis*. **B,** *Sarcotragus maraensis*. **C,** *Ircinia* sp. **D-E,** *Bergquistia coreana*.

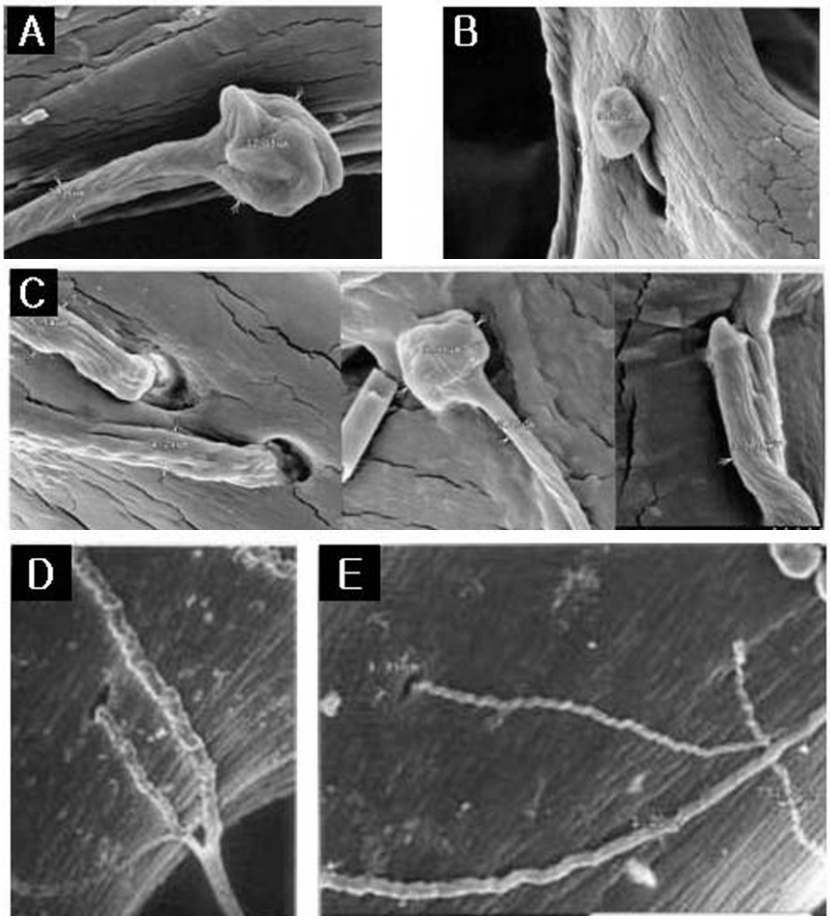

Fig. 5. Filaments. **A,** *Psammocinia samyangensis*. **B,** *Sarcotragus maraensis*. **C,** *Ircinia* sp. **D-E,** *Bergquistia coreana*.

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