



An exploration of *Echinoderes* (Kinorhyncha: Cyclorhagida) in Korean and neighboring waters, with the description of four new species and a redescription of *E. tchefouensis* Lou, 1934*

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Abstract

A large collection of kinorhynch specimens from coastal and subtidal localities around the Korean Peninsula and in the East China Sea was examined, and the material included several species of undescribed or poorly known species of *Echinoderes* Claparède, 1863. The present paper is part of a series dealing with echinoderid species from this material, and includes descriptions of four new species of *Echinoderes*, *E. aspinosus* **sp. nov.**, *E. cernunnos* **sp. nov.**, *E. microaperturus* **sp. nov.** and *E. obtuspinosus* **sp. nov.**, and redescription of the poorly known *Echinoderes tchefouensis* Lou, 1934.

Key words: East Sea, East China Sea, kinorhynch, Korea, meiofauna, taxonomy

Introduction

Echinoderes Claparède, 1863 appears to be the most diverse genus within the Kinorhyncha. Species of this genus have been found in most marine benthic substrates, on latitudes ranging from the Arctic to the tropics, and from the intertidal zone down to the deep sea. Still, our information about their global distribution is extremely fragmented, as is our knowledge about their total biodiversity. As it is the case with most other minor meiofaunal taxa, our current knowledge about their geographical distribution is to a great extent a reflection of the activities of the few experts that have addressed the group through time. For the genus *Echinoderes* and its closest relatives, we can consider the east American coast, from Maine to Belize, relatively well-examined thanks to a lifelong effort of Robert P. Higgins (see, e.g., Higgins 1964, 1977, 1983). Also the Mediterranean and West European coasts are relatively well-explored through the pioneering work of Zelinka (1928), as well as more recent efforts of Higgins (1978, 1985), Huys & Coomans (1989), Pardos *et al.* (1998), GªOrdóñez *et al.* (2008), and Herranz *et al.* (2012).

The best explored region in East Asia is probably the area between Southeast Russia, the Korean Peninsula and Japan. *Echinoderes* around Korea, and in neighboring Russian and Japanese waters, have first of all been addressed in several studies facilitated by A. V. Adrianov. He has described two species from Korean waters, *E. koreanus* Adrianov, 1999 in Adrianov & Malakhov (1999) and *E. ulsanensis* Adrianov, 1999 in Adrianov & Malakhov (1999), and additional four from nearby Japanese or Russian localities that very well could occur around the Korean Peninsula as well: *Echinoderes multisetosus* Adrianov, 1989, *E. filispinosus* Adrianov, 1989, *E. aureus* Adrianov, Murakami & Shirayama, 2002a, *E. sensibilis* Adrianov, Murakami & Shirayama, 2002b. Besides the contributions of Adrianov and collaborators, other studies have also added to our knowledge about kinorhynch biodiversity in the region. *Echinoderes tchefouensis* Lou, 1934 was described from nearby Chinese waters (see also

Note

홍조류 에탄올 추출물 및 다양한 용매 분획물의 라디칼 소거능

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Radical Scavenging Activity of Ethanol Extracts and Solvent Partitioned Fractions from Various Red Seaweeds

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Abstract : The EtOH extracts of red seaweeds (*Symphyocladia latiuscula*, *Chondrus ocellatus* and *Carpopeltis affinis*) and solvent partitioned fractions were investigated for their 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) and 1,1-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging effects and the total phenolic contents were correlated with ABTS and DPPH radical scavenging activities. The EtOH extracts and their solvent partitioned fractions exhibited strong ABTS and DPPH radical scavenging activities. Among the solvent partitioned fractions obtained from *n*-Hexane (HX), methylenchloride (MC), ethylacetate (EA), and butanol (BuOH), the HX fraction from *C. affinis* showed higher radical scavenging activities than other fractions. Total phenolic contents showed significant correlation ($r^2 = 0.709$) with ABTS radical scavenging activity. The results of this study suggest that the strong radical scavenging activity of HX fraction from *C. affinis* is a promising natural antioxidant for healthcare products.

Key words : red seaweed, *Carpopeltis affinis*, radical scavenging effect, ABTS, DPPH

1. 서 론

인체의 산화적 스트레스에 의해 발생하는 활성산소종 [superoxide anion(O_2^-), hydrogen peroxide(H_2O_2), hydroxyl 라디칼(OH) 등]은 미토콘드리아, 식세포 또는 세포질의 정상적인 대사과정 중에도 생성되며, 살아있는 생물의 세포 신호전달에 중요한 역할을 한다(Aruoma and Cuppette 1997; Cavas and Yurdakoc 2005). 그러나, 과발현된 활성

산소종들은 생체내의 세포막, 단백질, DNA 및 효소 등을 손상시키며, 세포와 조직에 해로운 반응을 일으켜 암, 뇌졸중, 당뇨 및 동맥경화 등의 질병을 유발한다. 또한, 활성산소종들은 노화와 밀접한 관련이 있는 것으로 알려져 있다(Feskanich et al. 1992; Regnstrom et al. 1992; Ames 1989; Cho et al. 2011). 따라서, 기능성 식품 및 의약품 산업에서는 활성 산소종들을 제거하기 위하여 가격이 저렴하면서 항산화 활성이 높은 butylated hydroxytoluene (BHT), butylated hydroxyanisole(BHA), propyl gallate (PG) 등의 합성 항산화제를 주로 사용하여 왔다. 그러나

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독도 화산체 정상부해역의 정밀해저지형 및 지구물리학적 특성 연구

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A Study on Detailed Bathymetry and Geophysical Characteristics of the Summit of the Dokdo Volcano

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We studied the detailed bathymetry and the geophysical characteristics of the summit of the Dokdo volcano using multibeam echosounding and geophysical survey data. The bathymetry around the main east and west islets of the Dokdo volcano shows very shallow within about 10 m water depth. From near islets to about 30 m b.s.l., the shallow water area has very steep slope and many irregular sunken rocks. The area from about 30 m to about 80 m b.s.l. shows gentle rises and falls, and less steep slope. The area from 80 m b.s.l. has gradually flat undulation and smooth slope seabed and is extended to offshore. The main islets of the Dokdo volcano and the rocky sea bottom elongated from the islets might be the residual part of the eroded and collapsed main crater of the Dokdo volcano. The bathymetry and the seafloor image(from backscattering) data show small craters, assumed to be formed by the eruption of later volcanism. The seafloor images propose that, except some areas with shallow sand sedimentary deposits, there are typical rocky bottom such as rocky protrusions and lack of sediments in the main morphology of the survey area. The stepped slopes of the seabed are deduced to be submarine terraces. The several prominent submarine terraces are found at the summit of the Dokdo volcano, suggesting repetition of sea level changes(transgressions and regressions) in the Quaternary. The results of the magnetic anomaly and the analytic signal have a good coherence with other geophysical consequences regarding to the location of the residual crater.

Key words : bathymetry, Dokdo, crater, submarine terrace, sea level change

본 연구는 현재까지 수행된 독도 화산체 정상부 해역의 정밀수심 및 지구물리 조사 자료를 종합하고 분석하여 정상부 해역의 정밀해저지형 및 지구물리학적 특성을 연구하였다. 독도 연안역 동도와 서도 사이 연결 수로는 약 10 m 이내의 얕은 수심을 이루고 있다. 독도 화산체 정상부해역의 전체적인 수심은 동도와 서도의 육지부부터 수면 아래 약 30 m 까지는 불규칙하며 급한 경사면을 가지고, 그 후 수심 약 30 m부터 수심 약 80 m 까지는 경사가 점차 낮아지다가 수심 약 80 m 이하로 완만한 경사를 보이면서 외해역으로 깊어진다. 독도 육지부와 그 북동쪽 및 북서쪽으로 연장되는 암반들은 독도를 생성시킨 화구륜의 잔해로 판단되며 동도와 서도는 화구륜의 남쪽 한부분일 가능성이 큰 것으로 생각된다. 또한 정상부 해역의 해저지형에서는 소규모의 움푹 패인 지형들이 나타나는데 이는 독도 형성 후 나중에 생성된 소규모 분화구의 흔적들로 추정된다. 독도 정상부 해역은 주로 암반이 많이 분포하지만 곳곳에서는 모래 퇴적층들도 나타나는 것을 볼 수 있다. 독도 화산체 정상부에는 계단형의 경사면들이 나타나는데 이는 제 4 기에 나타난 해침, 해퇴 등 해수면변화에 의해 만들어진 해저단구로 유추되며, 지역별로 차이가 있기는 하지만 주로 약 30 m, 60 m, 80 m 및 약 100 m의 수심대를 위주로 하여 몇 개의 주요 해저단구가 나타나는 것으로 판단된다. 자기이상도 및 아날니틱신호도를 살펴보면 수면 위 독도에서 연장되는 북동 및 북서쪽의 이상대들은 화구륜의 잔해로 예상되는 암반들의 위치와 유사하게 나타난다.

주요어 : 독도, 해저지형, 분화구, 해수면변화, 해저단구

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