様　式　Ｃ－１９、Ｆ－１９－１、Ｚ－１９　（共通）

科学研究費助成事業　　研究成果報告書

令和　５ 年　 ６ 月 ２０ 日現在

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研究種目：基盤研究(C)（一般）
研究期間：2020～2022
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研究課題名（和文）Native or invasive? Biodiversity, distribution and systematics of Ostracoda (Crustacea) in Japanese rice fields

研究課題名（英文）Native or invasive? Biodiversity, distribution and systematics of Ostracoda (Crustacea) in Japanese rice fields

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交付決定額（研究期間全体）：（直接経費）　　2,200,000円

研究成果の概要（和文）：私たちの研究の結果、水田に生息するカイミジンコについての理解が深まり、水田から2 つの新種のカイミジンコが発見されました。そのうちの 1 種は記述済みであり、2 種目は現在研究中です。私たちは外来種の貝虫が日本に侵入し定着する可能性のある経路、すなわちペット取引を特定しましたが、これらの種は日本の水田に侵入する可能性があります。

研究成果の学術的意義や社会的意義
As rice is the staple food in Japan, it is essential to fully understand the rice field ecosystem. Yet ostracods, which are often abundant in rice fields, are poorly studied, and their impacts on rice harvests not fully understood. This project aimed to address this issue.

研究成果の概要（英文）：Our research resulted in a better understanding of ostracods inhabiting rice fields, and the discovery of two new ostracods species from rice fields, one of which we have described, and the second one we are working on. We have identified a possible route for invasive ostracod species to enter and become established in Japan, namely the pet trade, and these species have the potential to become invasive in Japanese rice fields.

研究分野：Zoology

キーワード：Ostracoda　Crustacea　Rice fields　Taxonomy　Invasive species

１．研究開始当初の背景

Of the over 6,000 species of flora and fauna associated with rice fields, many can have an influence on the rice field ecosystem. Ostracods are known to be one of the most abundant and diverse microfaunal groups in rice fields, and some scientific studies have demonstrated that they can influence rice harvests. However, there is very little research in this area, with some fundamental questions remaining unanswered. Many rice field ostracod species are poorly described, which hinders taxonomic and ecological work, and some are new species that have yet to be described and named. It is therefore essential to reassess and improve the taxonomy of rice field species in order to be able to form the crucial foundations of rice field studies. In other countries, a number of ostracod species found in rice fields are considered invasive, with rice fields facilitating the introduction and spread to surrounding natural habitats. There are some species in Japan that are likely invasive, but to identify such species, the taxonomy needs to be improved and expanded. It is essential to know which species are likely invasive, and provide detailed descriptions so that they can be identified and monitored in the future. Potential routes for invasive freshwater ostracods also need to be identified.

２．研究の目的

The purpose of the research was to expand the data available on freshwater ostracods inhabiting rice fields in Japan, re-describe poorly known species, describe and name species currently unknown to science, produce DNA barcodes of common rice field species, create a taxonomic framework of rice field ostracods, and highlight species that may be invasive to Japan.

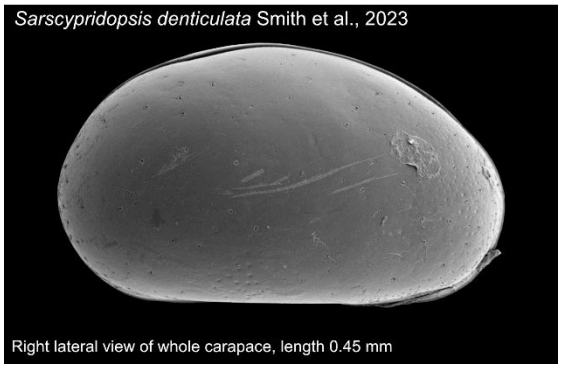
３．研究の方法

The taxonomic aspects of this study relied on conventional techniques of ostracod taxonomy. Dissections of ostracods specimens were conducted using very fine needles, with the appendages mounted on glass slides and sealed under a cover slip for transmitted light microscopy observations. Valves were kept dry in micropalaeontological cavity slides. For imaging, scanning electron microscopy was used for the valves, while appendages were drawn using high magnification optical microscopy. In order to facilitate taxonomic assessments, and increase the ease of species identification, the entire suite of limbs was targeted for drawing, and carapaces extensively photographed. DNA barcoding used standard techniques.

４．研究成果

A new species of the genus *Sarscypridopsis* was recovered from a rice field in Kanagawa Prefecture, and this was extensively described and figured in a published paper to facilitate its future identification. The genus is mostly restricted to Africa, with only a couple of species found outside of this region, and with no congeners found nearby. The species that it most closely resembles is

native to Botswana. We therefore suspect that this species could be invasive in Japan.



A second new species, belonging to the genus *Dolerocypris*, was found in a rice field in Osaka. We are currently targeting the collection of additional specimens to facilitate a description. Three species of *Dolerocypris* are known from Japan, two from rice fields, and one from springs. It is therefore probable that this new species is native to the Japanese fauna.

Unfortunately, DNA barcoding of ostracod species was only partially successful. Of the 14 species targeted, only three species provided useable DNA barcodes. Although there has been some work using DNA analyses of ostracods, this technology is proving to be difficult to leverage for ostracods, and has yet to make a significant impact on taxonomic studies.

We have identified 18 ostracod species that are contaminants of pet shops' and hobbyists' aquaria in Japan. Some of these are also found in Japanese rice fields, but seven are found elsewhere and are exotic in Japan. These exotic species, from North and South Americas, South East Asia and Africa, are also found in rice fields in different countries. This highlights that these exotic species could potentially become invasive in Japanese rice fields, and that the pet trade is a viable route for invasive species to enter the country. Three species were undescribed. One species, most likely from South East Asia as evidenced by its congeners, is now described, named and published, which will provide a basis for further monitoring. Work on the other species is underway and at an advanced stage. This work highlights that some species previously only known from rice fields in Japan are also present in the pet trade, and poses the question, are they invasive in Japan?

A redescription was given of the ostracod *Potamocypris sudzukii* Okubo, 1992, a species that is found in rice fields and irrigation ponds in the Nansei Islands. Since a brief initial description 30 years ago, this species had not been reported since. The single paratype known to exist (the other type material is lost) was used to extensively redescribe and figure the species, and this revealed that it was in the wrong genus. It was transferred to the genus *Siamopsis*, previously only known from Thailand, the Philippines and Indonesia, in a recently published paper. It is envisaged that the correct genus assignment and redescription will facilitate further rice field records of this species in the future.

５．主な発表論文等

〔雑誌論文〕　計5件（うち査読付論文　5件／うち国際共著　4件／うちオープンアクセス　2件）

１．著者名 Robin James Smith, Hirokazu Ozawa, Keigo Kawashima, and Shizuko Nakai	４．巻 38
２．論文標題 A New Species of Pseudostrandesia Savatenalinton and Martens, 2009 (Ostracoda, Crustacea) Collected from Two Pet Shops in Central Japan: an Alien Species?	５．発行年 2021年
３．雑誌名 Zoological Science	６．最初と最後の頁 481-493
掲載論文のDOI（デジタルオブジェクト識別子） 10.2108/zs210027	査読の有無 有
オープンアクセス オープンアクセスではない、又はオープンアクセスが困難	国際共著 該当する

１．著者名 Robin James Smith, Hirokazu Ozawa, Aoi Mizukami, and Shizuko Nakai	４．巻 28
２．論文標題 A New Species of the Genus Sarscypridopsis (Crustacea: Ostracoda) Discovered in a Japanese Rice Field	５．発行年 2023年
３．雑誌名 Species Diversity	６．最初と最後の頁 5-13
掲載論文のDOI（デジタルオブジェクト識別子） 10.12782/specdiv.28.5	査読の有無 有
オープンアクセス オープンアクセスとしている（また、その予定である）	国際共著 該当する

１．著者名 Tohru Hoshino, Science Club of Oze Senior High School , Akifumi Ohtaka and Robin J. Smith	４．巻 27
２．論文標題 New records of the signal crayfish (Pacifastacus leniusculus) and its ectosymbiotic branchiodellidan and ostracod from Lake Sugenuma in Gunma Prefecture, central Japan	５．発行年 2023年
３．雑誌名 Bulletin of the Gunma Museum of Natural History	６．最初と最後の頁 99-106
掲載論文のDOI（デジタルオブジェクト識別子） なし	査読の有無 有
オープンアクセス オープンアクセスとしている（また、その予定である）	国際共著 －

１．著者名 Robin James Smith & Cheon Young Chang	４．巻 5150
２．論文標題 Two new species of non-marine Ostracoda (Crustacea) of the genera Vestalenula Rossetti & Martens, 1998 (Darwinuloidea) and Microloxoconcha Hartmann, 1954 (Cytheroidea) from Tsushima, Japan, and a summary of the non-marine ostracod fauna of the island	５．発行年 2022年
３．雑誌名 Zootaxa	６．最初と最後の頁 529-555
掲載論文のDOI（デジタルオブジェクト識別子） 10.11646/zootaxa.5150.4.4	査読の有無 有
オープンアクセス オープンアクセスではない、又はオープンアクセスが困難	国際共著 該当する

1．著者名 Robin James Smith	4．巻 5293
2．論文標題 Descriptions of two Cypridopsinae (Ostracoda, Crustacea) species from the Nansei Islands, Japan, with the first records of non-marine ostracods from the Daito Islands	5．発行年 2023年
3．雑誌名 Zootaxa	6．最初と最後の頁 294-316
掲載論文のDOI（デジタルオブジェクト識別子） 10.11646/zootaxa.5293.2.5	査読の有無 有
オープンアクセス オープンアクセスではない、又はオープンアクセスが困難	国際共著 該当する

〔学会発表〕　計5件（うち招待講演　0件／うち国際学会　0件）

1．発表者名 中井静子，川嶋渓五，Robin James Smith，中澤洸弥，川邊陽平，中尾有利子，小沢広和
2．発表標題 アクアリウム産業が運ぶ外来種―移入経路となる水草（ポスター）
3．学会等名 Joint meeting of the Japanese Association of Benthology and the Plankton Society of Japan.
4．発表年 2021年

1．発表者名 Horne, D. J., Smith, A. J., Smith, R. J., Martens, K. Schon, I & Meisch, C.
2．発表標題 European freshwater ostracods in a Holarctic context: Taxonomic harmonisation of large databases
3．学会等名 SEFS12: Symposium for European Freshwater Sciences
4．発表年 2021年

1．発表者名 Smith, R. J.・ 小沢広和・水上葵・中井静子
2．発表標題 神奈川県産の淡水性Sarscypridopsis属貝形虫（甲殻亜門）1新種 （ポスター講演）
3．学会等名 日本動物分類学会第58回大会，豊橋市自然史博物館（愛知県）
4．発表年 2023年

１．発表者名
小沢広和・Smith, R. J.・川嶋渓五・中井静子・中尾有利子

２．発表標題
アクアリウム環境の現生淡水生貝形虫Pseudostrandesia属1新種と古生物学的意義（ポスター講演）

３．学会等名
古生物学会シンポジウム（オンライン開催）

４．発表年
2022年

１．発表者名
中井静子, 川嶋渓五, Robin James Smith, 中澤洸弥, 川邊陽平, 中尾有利子, 小沢広和

２．発表標題
アクアリウム環境におけるPseudostrandesia属貝形虫（甲殻亜門）1新種.（ポスター講演）

３．学会等名
日本動物分類学会第57回大会（オンライン開催）

４．発表年
2022年

〔図書〕　計0件

〔産業財産権〕

〔その他〕

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６．研究組織

	氏名 （ローマ字氏名） （研究者番号）	所属研究機関・部局・職 （機関番号）	備考
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７．科研費を使用して開催した国際研究集会

〔国際研究集会〕　計0件

８．本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関