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Distribution of the Kelp Boring Parasitic Amphipod *Ceinina japonica* (Amphipoda: Eophliantidae) in Rishiri and Rebun Islands, the Sea of Japan with Their Host Transition under Laboratory Conditions

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Abstract. Distribution of the kelp boring parasitic amphipod *Ceinina japonica* Stephensen, 1933 of the kelp *Saccharina japonica* var. *ochotensis* (Miyabe) N. Yotsukura, S. Kawashima, T. Kawai, T. Abe & L. D. Druehl in Rishiri and Rebun Islands was researched from April to July 2016. They occur widely on the coasts of both islands. An illustration of *C. japonica* from Rebun Island is provided. Under laboratory conditions, *C. japonica* have two transition ways of transitions from old host kelp to new host, one is by crawling to the new host and another is by swimming.

Keywords: Hokkaido, kelp, parasitic crustacean, *Saccharina japonica* var. *ochotensis*, transition experiment

Introduction

Aquaculture and fisheries are important for the economy of Rebun Island and Rishiri Islands, northern Hokkaido, Japan, Sea of Japan, and particularly the kelp *Saccharina japonica* var. *ochotensis* (Miyabe) N. Yotsukura, S. Kawashima, T. Kawai, T. Abe & L.D. Druehl (Miyabe, 1902; Yotsukura *et al.*, 2008) is one of the most important aquaculture and fisheries resources. The kelp *Saccharina japonica* var. *ochotensis* widely distributes in the two islands. In both islands, the bed rock bottom dominates along the shores, and this continues from 0 m to 10 m in depth, with the center of forest locating in 0–2 m depth. The kelp boring parasitic amphipod *Ceinina japonica* Stephensen, 1933 bores into the blade and stipe of sporophytes of the kelp. In both fields of aquaculture and fisheries, this species has caused serious problems for aquacultured and natural resources of the kelp (Kinoshita, 1947; Kanbara, 1962). This amphipod has been reported from Ulreung Island, Korea (Kim & Kim, 1991), Iwate Prefecture in Tohoku, Japan (Kodama *et al.*, 2017), Simoda, Shizuoka Prefecture (Aoki, 2013), Rishiri and Rebun Islands, mainland of Hokkaido (*e.g.* Stephensen, 1933; Akaike *et al.*, 2002), but detailed information of their distribution in Rishiri and Rebun Islands remains unclear, and their biological information is limited to host sea algae, occurrence section in the kelp host, obtained date, and prevalence in the coast of Hokkaido (Akaike *et al.*, 2002). Also, information on the host transition of *C. japonica* remains unknown.

In the present study, we examined the distribution of *C. japonica* from a total of eight localities in Rebun and Rishiri Islands, and also observed the transition methods between

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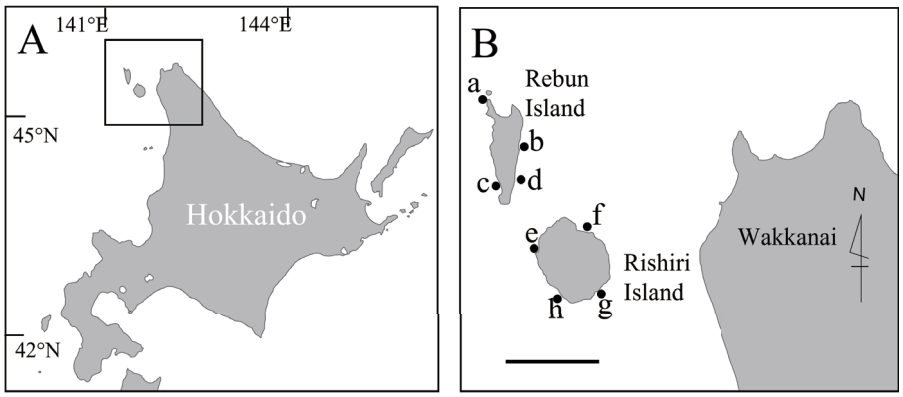

Figure 1. Maps showing the sampling stations.
B is a magnification of the area of northern Hokkaido shown in A. a, Sukoton; b, Akaiwa; c, Motochi; d, Tsugaru; e, Kutsugata; f, Oshidomari; g, Oniwaki; h, Senhoshi. Scale bar in B is 20 km.

old host to new host of them under laboratory conditions.

Materials and Methods

Distribution

Sampling was conducted at the eight localities in Rebun Island and Rishiri Island, northern Hokkaido, Japan (Fig. 1). The kelp *S. japonica* var. *ochotensis* from Sukoton, Akaiwa, Motochi, and Tsugaru of Rebun Island as well as Kutsugata, Oshidomari, Oniwaki and Senhoshi of Rishiri Island were collected in April 2016 and July 2016 (Fig. 1). At each sampling locality, five annual sporophytes were randomly collected from a depth of 0–1 m. Collected sporophytes were dissected and then checked for the presence or absence of *C. japonica* under a stereomicroscope (Olympus SHZ10, Olympus, Tokyo, Japan), also collected *C. japonica* were observed to illustrate the whole body.

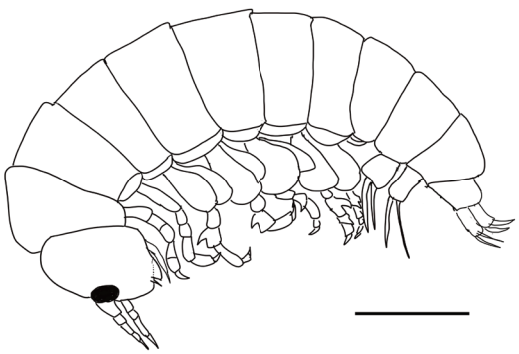

Figure 2. Line drawing of *Ceinina japonica*.
Sample was collected from Tsugaru, Rebun Island, northern Hokkaido, Japan (Fig. 1d) on 3rd March 2017. Scale bar is 1 mm.

Behavior observations

Samples for behavior observations and for the host transferal experiment were collected from Tsugaru (Fig. 1) on 30 July 2016. Three large 2nd year *S. japonica* var. *ochotensis* sporophytes were collected and dissected to collect the total fifteen samples of *C. japonica*. Also, three annual *S. japonica* var. *ochotensis* sporophytes were collected for observations of host transition.

Five *C. japonica* individuals were placed in a glass petri dish with a diameter of 11.1 cm and depth 1 cm to observe their transferal behavior. The first year sporophyte was also put in the petri dish and in initial distance between the sporophyte and five *C. japonica* individuals was 7 cm (Fig. 3A), size of the sporophyte was cut to 10 cm in length for blade and 0.7 cm diameter for stipe. Total length of the samples for the

observations were measured from tip of rostrum to terminal end of the telson. Observations were carried out from 31st July 2017 to 1st August 2017 and water temperature was recorded at 9:00 am 1st August 2017.

Transferal experiment

To observe attachment to the new host by *C. japonica*, five individuals were contained in a glass aquaria of 37 cm width, 22 cm length, 26 cm depth. Measurements of the samples for the experiments were taken from tip of rostrum to terminal end of the telson. A total of four aquariums were set up and a total twenty *C. japonica* individuals with each aquarium containing five individuals. In two of the tanks a sporophyte of 10 cm in blade length and 0.7 cm diameter for stipe was hung in midwater and in the other two tanks one sporophyte was placed on the bottom (Fig. 3B). In each five individuals were put on the bottom of the tanks, between the sporophyte and the five individuals a distance of 7 cm was set when experiment was started (Fig. 3AB). The experiment was carried out from 9:00 am 31st July 2016 to 10:00 am 7th August 2016. The number of attached *C. japonica* individuals on the sporophyte of four tanks was counted at 10:00 am every day during the experimental periods. Water temperature was recorded at the same time.

Results

Distribution

In all sampling points, *C. japonica* was found from the collected sporophytes. The illustration of a specimen from Tsugaru is shown in Fig. 2.

Behavior observations

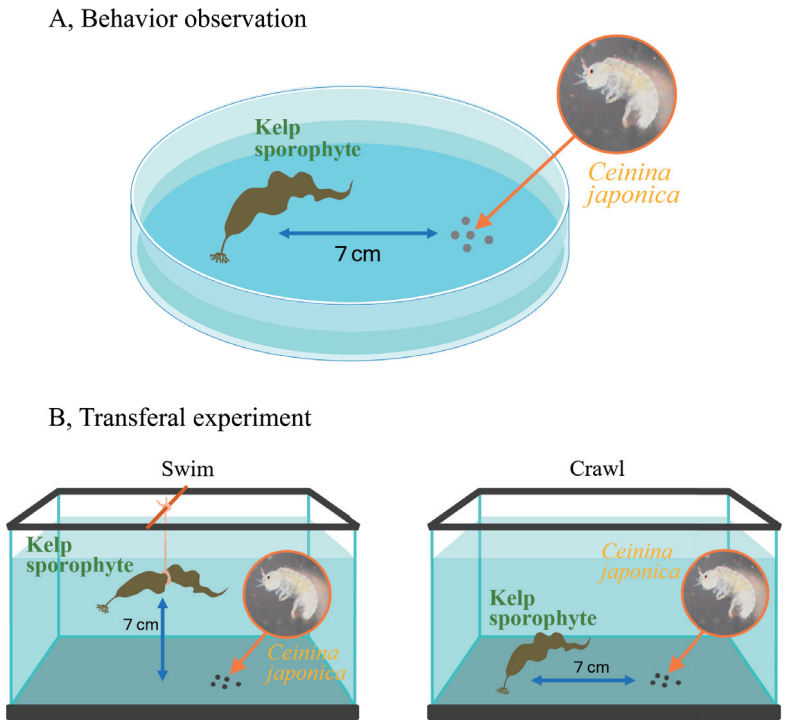

Figure 3. Schematic diagram of the behavior observation and transferal experiment of *Ceinina japonica* under laboratory conditions.

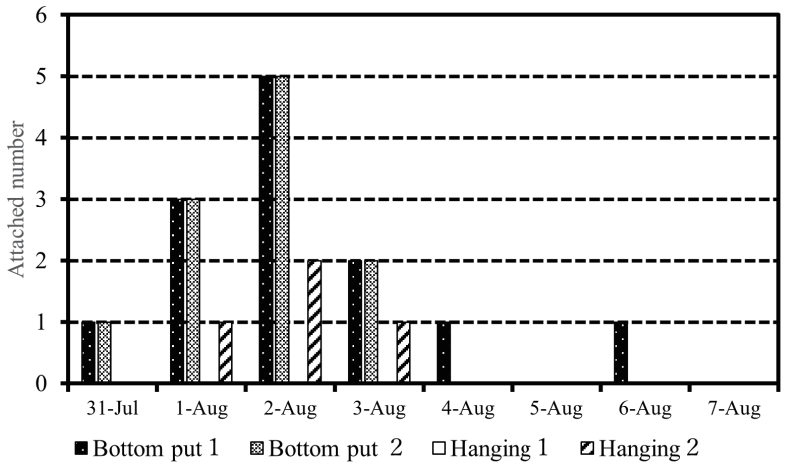

Figure 4. Changes of the number of individuals of *Ceinina japonica* attached to new hosts in the transferal experiment (Fig. 3B).

Under observation of behavior, water temperature was 20.1 ℃. Mean ± SD of the total length of the samples of *C. japonica* was 2.6 ± 1.5 mm. The samples of *C. japonica* approached the sporophyte using two ways. It was observed that an individual slowly crawled to the kelp sample and the other two individuals quickly swim to the kelp sample. The individual that clawed, attached on the bottom of the glass aquaria without moving its pleopods whereas the swimming individuals detached away from bottom of the glass aquaria and quickly flapped their pleopods. The remaining two individuals stayed in the same place as at the start of the observations.

Transferal experiment

Under the transferal experiment, mean water temperature was 19.1 ± 0.6 SD ℃. Mean total length of the samples of *C. japonica* is 2.0 ± 1.1 SD. Attachment of *C. japonica* on the kelp on bottom of experimental tank was observed throughout 31st July to 4th August and 6th August, the attached number ranged from 1 to 5 in the two aquariums (Fig. 4). The *C. japonica* on hanging sporophyte occurred from 1st to 3rd August, attached number reached 2 only in Hanging 2 whereas there is no attaching on the kelp of Hanging 1 (Fig. 4). It was observed that all individuals attached on this margin of the sporophytes and *C. japonica* did not attach on the surface of the kelps.

Discussion

A previous study in Rishiri Island (Akaike *et al.*, 2002) showed that *C. japonica* occurred in Akaiwa, Rebun and Kutsugata in Rishiri Islands. The present study confirmed the two localities and added six localities in Rebun and Rishiri Islands. It is suggested that *C. japonica* occurs almost throughout the coast areas of the two islands. The present study also gave an illustration of *C. japonica* from Rebun.

Based on observation of behavior of moving to attach on a new host kelp sporophyte and transferal experiment to the sporophyte under laboratory conditions, *C. japonica* has two methods to attach to their new host kelp sporophyte. It is possible that their main way from the old host to the new host is by crawling

and they often move to their host by swimming. Several aquaculture fishermen said that newly established kelp aquaculture facility where locate more than 500 m away from the rocky shore, *C. japonica* often occur in the new kelp culture locality (unpublished information in Rishiri Island). As it is not possible that *C. japonica* can transit from the old host kelp on the rocky shore to the new host on the kelp aquaculture facility by crawling on the sea bottom, it is suggested that *C. japonica* swam to the new kelp aquaculture facility.

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Literature Cited

Akaike, S., A. Takiya, F. Tsuda, K. Motoya, & K. Takahashi, 2002. Seasonal occurrence of a kelp-boring amphipod, *Ceinina japonica* along the coasts of Hokkaido from 1997 to 2001. *Scientific Reports of Hokkaido Fisheries Experimental Station*, 61: 25–28. (in Japanese)

Aoki, M., 2013. Commentary: Crustaceans boring into algae. *Cancer*, 22: 71–72. (in Japanese)

Kanbara, H., 1962. Konbu no ryuushitsu to mushigai nitsuite. *Hokusuishi Geppo*, 19: 323–331. (in Japanese)

Kim, W. & C. B. Kim, 1991. The marine amphipod crustaceans of Ulreung Island, Korea: Part II. *The Korean Journal of Systematic Zoology*, 7: 13–38.

Kinoshita, T., 1947. Konbu to Wakame no zousyoku ni kannsuru kennkyuu. Hoppou Shuppansha, Sapporo, 79pp. (in Japanese)

Kodama, M., T. Kawamura, K. Nakamoto, N. Ohtsuchi, J. Hayakawa, T. Kitagawa & Y. Watanabe, 2017. A comparison of amphipod assemblages between canopy and understory strata in seaweed and seagrass beds off the coast of Otsuchi Bay, Japan. *Biodiversity Journal*, 8: 471–473.

Miyabe, K., 1902. Laminariaceae. Hokkaido Suisan Chosahokoku 3, Hokkaido Shokuminbu, Sapporo, 60pp. (in Japanese).

Stephensen, K., 1933. *Ceinina japonica* (n. gen. n. sp.), a new aberrant species of the amphipodan family Talitridae from Japan. *Transactions of the Sapporo Natural History Society*, 13: 63–68.

Yotsukura, N., S. Kawashima, T. Kawai, T. Abe, & L. D. Druehl, 2008. A systematic re-examination of four laminaria species: *L. japonica*, *L. religiosa*, *L. ochotensis* and *L. diabolica*. *Journal of Japanese Botany*, 83: 165–176.

利尻・礼文島におけるコンブノネクイムシの分布と宿主移動の室内実験

川井唯史

2016 年 4 ～ 6 月，利尻島と礼文島の合計 8 地点において，リシリコンブに穿孔して寄生し漁業被害を与えるコンブノネクイムシの出現を記録した．礼文島産のコンブノネクイムシの外部形態を示した．さらに，礼文島津軽より採集された 25 個体を用いて，移動行動と新しい宿主から古い宿主への移動を飼育実験下において観察した．室内飼育環境下において，コンブノネクイムシは宿主間の移動手段として遊泳と底面の這行による二通りの方法を取ることが観察された．