

学位論文の要旨

氏名

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学位論文題目

東アジアの降河回遊性カワゴカイ属2種の分類と生活史

本論文では、日本の汽水域の普通種であるヤマトカワゴカイ (*Hediste diadroma*) の降河回遊性の生活史の詳細をまとめ、同様の降河回遊性の生活史をもつと思われる韓国産の未記載種 (*H. sp.*) の分類学的記載を行なった。

第1章では本論文全体の緒言として、北半球温帯域から記載されているカワゴカイ属全5種の分布を示し、汽水域生態系における本属の重要性について説明する。これらの5種はお互いに形態がよく似ているが、生殖・発生様式などの生活史特性が大きく異なり、降河回遊型と汽水域残留型のいずれかに類別される。本研究では、典型的な降河回遊性の生活史をもつことが知られているヤマトカワゴカイと、同様の生活史を持っていると思われる韓国産の未記載種に焦点を当てる。

第2章では、日本の汽水域に広く分布するヤマトカワゴカイの生活史の初期における幼生加入過程についての研究をまとめる。人工授精によって得られた初期幼生の走光性は、受精後3.5-4.0日の3体節ネクトキータの段階で正から負へと逆転し、これと同時に付属肢の形成と運動性繊毛の減退が見られた。この結果は、受精後数日を境に幼生生活が浮遊生活期から底層生活期に転ずることを示唆しており、この習性が河口周辺から外洋への流失を避けるのに役立っていると推測される。鹿児島湾の河川汽水域では、上げ潮時の遡上水塊から5-8体節期の浮遊幼生が採集され、干潮時には5体節期以上の底生幼体が汽水域の広い範囲の干潟表面から採集された。これらの結果に基づき、本種の幼生加入過程は以下

の3つのステップに分けられることが分かった。(1) トロコフォアから初期の3体節ネクトキータに至るまでの数日間の浮遊生活期、(2) 後期の3体節ネクトキータから5-8体節ネクトキータに至るまでの約1ヶ月の底層生活期、(3) 5-8体節ネクトキータの河川上流への遡上と汽水域の広範囲の干潟への定着。

第3章では、韓国産のカワゴカイ属の未記載種を、Han Riverの淡水域および汽水域上流部から採集された未成熟個体と、汽水域下流部から採集された生殖群泳中の成熟個体の標本に基づいて、分類学的に記載した。本種は、体後部の疣足に指状突起を持たず、関節部相称形の短複剛毛を持たないことから、未成熟段階ではアリアケカワゴカイ (*H. japonica*) とは識別できるが、ヤマトカワゴカイとヒメヤマトカワゴカイ (*H. atoka*) とは識別できない。しかし本種は、生殖群泳時に独特の生殖変態(体中部および体後部の疣足における関節部相称形の針状複剛毛の大幅な追加と背足枝の上足葉の肥大)を起こすことから、性成熟段階では世界の全5種と識別可能である。未成熟個体の形態(吻上の顎片数、疣足と通常剛毛の形態)は、生殖個体のそれらと良く一致した。本研究の結果から(1) 東アジアには降河回遊性のカワゴカイ属が3種(アリアケカワゴカイ、ヤマトカワゴカイ、未記載種)生息すること、(2) それらの生殖変態は種特異的であることが明らかになった。

第4章では総合考察として、カワゴカイ属多毛類の降河回遊の特性を、比較的研究が進んでいる甲殻類や魚類のそれと比較する。最後に、降河回遊性カワゴカイ属の研究における問題点と展望を示す。

Summary of Doctoral Dissertation

Title of Doctoral Dissertation:

Taxonomy and life history of two catadromous species of *Hediste*
(Nereididae, Annelida) in eastern Asia

Name: Kotaro Kan

In this dissertation, the details of the catadromous life history of *Hediste diadroma*, which is a common species in Japanese estuaries, are summarized. After that, an undescribed species of *Hediste* (*H. sp.*), which seems to exhibit a similar catadromous life history, is taxonomically described based on Korean specimens.

Chapter 1 is an introduction. Circumboreal distributions of five nominal species of *Hediste* in the north temperate zones are summarized. The importance of those species in an estuary ecosystem is explained. Though these five species are morphologically very similar to one another, there are marked differences in their reproductive and developmental characteristics, with species adopting one of two contrasting life cycle forms: catadromous or estuary-resident. This dissertation focuses on *H. diadroma* exhibiting a typical catadromous life history, and *H. sp.* probably exhibiting the same life history.

In Chapter 2, study on the larval recruitment process in the early phase of the catadromous life history of *H. diadroma*, which is widely distributed throughout Japan, is summarized. Phototaxis of planktonic larvae, produced by artificial fertilization, changed drastically from positive to negative during the 3-chaetiger nectochaeta stage, 3.5–4.0 days after fertilization. During this stage, three kinds of appendages appeared, and the bands of cilia used for locomotion were reduced; these results suggest that larvae shifted from the pelagic to the demersal stage at approximately 4.0 days after fertilization. The demersal stage seems to be effective at keeping the larvae around a river mouth, preventing them from washing out to sea. Field sampling took place in the lower reaches of the estuary, planktonic larvae of, mainly, 5- to 8-chaetiger stages were collected in evening high tides during the

spring tides in April and May. During the same period, benthic juveniles of 5- or higher chaetiger stages were collected at low tide from intertidal flats from a wide area of the estuary that adults inhabited. The present study shed light on the less-known larval recruitment process of *H. diadroma*, which seems to consist of the following three steps: (1) pelagic stage, which lasted from the trochophore to early 3-chaetiger nectochaeta stages for a period of a few days, (2) demersal stage, which lasted from the late 3-chaetiger nectochaeta to 5- to 8-chaetiger nectochaeta stages for a period of about a month, (3) upstream migration at the 5- to 8-chaetiger nectochaeta stages with rising tides and their settlement in tidal flats in a wide area of the estuary.

In Chapter 3, an undescribed *H. sp.* is taxonomically described based on immature individuals collected from the freshwater and the upper reaches of the estuary of the Han River in Korea, and mature individuals collected from the lower reaches of the same river during reproductive swarming. In an immature stage, *H. sp.* is morphologically distinguishable from *H. japonica* due to the presence of a digitate lobe at the tip of the postchaetal ligules only in anterior chaetigers, and the absence of homogomph falcigers, but indistinguishable from *H. diadrom* and *H. atoka*. However, *H. sp.* is distinguishable from all other five congeners in a sexually mature stage, where it shows a unique epitokous metamorphosis (addition of many homogomph spinigers and enlargement of notopodial dorsal ligule in middle and posterior parapodia) during reproductive swarming. The morphological characteristics (paragnath numbers on the proboscis and morphologies of parapodia and ordinary chaetae) of the atokous specimens well agree with those of the epitokous specimens. Our results show that (1) three catadromous species of *Hediste* (*H. japonica*, *H. doadroma*, *H. sp.*) are distributed in eastern Asia, and (2) epitokous metamorphosis is species specific in these three cadromous species.

Chapter 4 is a general discussion. The migratory characteristics of catadromous species of *Hediste* are compared with those of other catadromous macrobenthos and fishes which were relatively well studied. Finally, remaining problems and perspective of the study about catadromous species of *Hediste* are presented.