

Comparative Osteology of the Sciaenid Fishes from Japan and Its Adjacent Waters—II. Vertebrae

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Abstract Examining the vertebrae of 15 species of the sciaenid fishes collected from the waters around Japan and the China Sea, it was found that these species are divided into five groups on the basis of the vertebral characters; *Nibea*-, *Johnius*-, *Argyrosomus*-, *Pseudosciaena*- and *Collichthys*-forms. The *Nibea*-form is represented by the fishes of the genera *Nibea* and *Miichthys*; *Johnius*-form by the genera *Johnius* and *Wak*; *Argyrosomus*-form by the genera *Argyrosomus* and *Atrobucca*; *Pseudosciaena*-form by the genus *Pseudosciaena*; and *Collichthys*-form by the genus *Collichthys*.

Of the five forms of the vertebrae, the *Nibea*-form is the most generalized and the *Johnius*-, *Collichthys*- and *Pseudosciaena*-forms are considered to be specialized. The *Argyrosomus*-form seems to be intermediate between the *Nibea*- and *Pseudosciaena*-forms. It is concluded that the vertebrae are useful character, as well as the cranium and sagitta, for the systematic studies of the sciaenid fishes.

Introduction

In 1948, Shaw and Yu described several characteristics of the vertebrae of two sciaenid fishes belonging to the genus *Pseudosciaena* and clarified the differences of these two species. In his study of the axial skeletons of teleostean fishes from Japan, Hotta (1960) described the characters of the vertebrae, i.e., the number of vertebrae and shape of the basal processes, in five sciaenid species. Takahashi (1961) also investigated the vertebrae of five sciaenid fishes collected from the Inland Sea of Japan for identification of the prey fishes in the fish stomach. Kim and Kim (1965), examining the vertebrae of seven Korean sciaenid species, found the specific variation of basal processes which project from anterior several columns.

In the present paper, the vertebrae of 15 Japanese sciaenid species were examined, reaching to the conclusion that these sciaenid fishes should be divided into five forms based on the shape of the anterior several vertebrae and on their vertebral counts.

Material and Method

Material and method used in this study was the same as those employed in the previous paper (Taniguchi, 1969). The species examined were listed as follows; *Nibea albiflora* (Richardson), *N. mitsukurii* (Jordan and Snyder), *N. semifasciata* Chu, Lo and Wu, *N. diacanthus* (Lacépède), *N. japonica* (Temminck and Schlegel), *Miichthys miiuy* (Basilewsky), *Johnius belengerii* (Cuvier and Valenciennes), *Wak tingi* (Tang), *Argyrosomus argentatus* (Houttuyn), *A. macrocephalus* (Tang), *Atrobucca nibe* (Jordan and Thompson), *Pseudosciaena polyactis* (Bleeker), *P. crocea* (Richardson), *Collichthys niveatus* Jordan and Starks and *C. lucidus* (Richardson).

Description and Comparison of Vertebrae

Vertebral count: The vertebrae of the sciaenid fishes are usually 25 in number inclusive of the urostyle. But the fishes of the genera *Pseudosciaena* and *Collichthys* have more number of vertebrae, usually 26 in *P. crocea* and *C. lucidus*, 27 in *C. niveatus* and 29

in *P. polyactis*.

Basal processes of vertebrae: In the fishes of this family, each of anterior several vertebrae has paired processes ventrally, to which the anterior part of the gas-bladder is tightly attached. Those processes named herein as basal processes are referable to the basal plates of the fishes of the genus *Pseudosciaena* by Shaw and Yu (1948), because the processes are not plate-like in the members of the sciaenid fishes, except for *Pseudosciaena* and *Collichthys*. Based on the degree of development of the basal processes, the sciaenid fishes are divided into following five groups (Fig. 1); *Nibea*-*Johnius*-, *Argyrosomus*-, *Pseudosciaena*- and *Collichthys*-forms.

(1) *Nibea*-form: This form is represented

by the fishes of the genera *Nibea* and *Michthys*, in which the basal processes of the vertebrae are not well developed. The processes of second to fifth vertebrae show a little variation and the hemal canal is comparatively shallow (Fig. 1 C-G). Even if the processes are developed, the basal processes of the third vertebra are never longer than the transverse length of the vertebra. There is an visible incision at the middle part of the process of the fourth vertebra.

(2) *Johnius*-form: This form is represented by the genera *Wak* and *Johnius* in which the basal processes on fourth vertebra are well specialized, forming a horse-shoe-like arch (Fig. 1 A, B). The hemal canal, therefore, runs under the horse-shoe-like arch. The

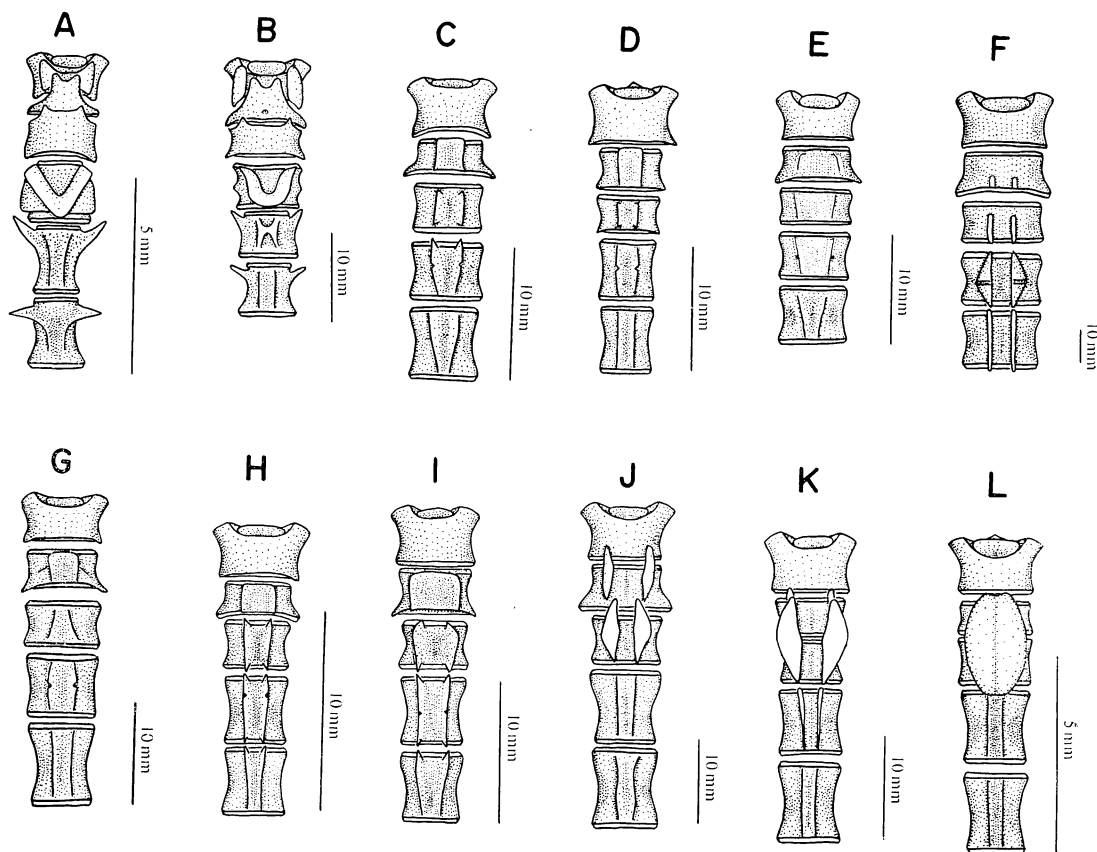


Fig. 1. Ventral view of anterior several vertebrae. A: *Johnius belengerii*, B: *Wak tingi*, C: *Nibea albiflora*, D: *N. mitsukurii*, E: *N. diacanthus*, F: *N. japonica*, G: *Michthys miuy*, H: *Atrobucca nibe*, I: *Argyrosomus argentatus*, J: *Pseudosciaena crocea*, K: *P. polyactis*, L: *Collichthys niveatus*.

first vertebra has a pair of flat basal processes. The second vertebra is remarkably reduced in size and its ventral part projected anteriorly, supporting the first vertebra dorsally. The parapophyses on fifth and sixth vertebrae are projected anteroventrally.

(3) *Argyrosomus*-form: This form comprises the fishes of the genera *Argyrosomus* and *Atrobucca* (Fig. 1 H, I). The basal processes on third and fourth vertebrae are more developed in this form than in the *Nibea*-form. This form is characterized by the basal processes on third vertebra being longer than the transverse length of the vertebra. An incision is also present at the middle part of the process of the fourth vertebra.

(4) *Pseudosciaena*-form: This form is represented by the fishes of the genus *Pseudosciaena* (Fig. 1 J, K), in which the basal processes of third vertebra project ventrally and make a form of human-foot-print, that were called as the basal plate by Shaw and Yu (1948). The ventral portion of this processes are flatish, more or less covering the second vertebra.

(5) *Collichthys*-form: This form comprises the fishes of the genus *Collichthys* (Fig. 1 L). In contrast to the characteristic basal processes of fourth vertebra in the *Johnius*-form, third vertebra has a developed and specialized basal process in the members of the *Collichthys*-form. The right and left basal processes of third vertebra are close together, forming an elliptical plate, which resembles well to that in the members of the *Pseudosciaena*-form. The hemal canal of vertebrae runs through the dorsal side of the plate.

Discussion

The author recognized five forms in the vertebral features of the fishes of the family Sciaenidae. These five forms fundamentally accord with those grouping based on the sagitta (Chu et al. 1963) and on the neurocranium (Taniguchi, 1969). Of these five

forms of the vertebrae, the *Nibea*-form is thought to be the most unspecialized, and the *Johnius*-, *Pseudosciaena*- and *Collichthys*-forms are well specialized. The *Argyrosomus*-form is probably intermediate between the *Nibea*-form and the *Pseudosciaena*-form. The assumption that both *Pseudosciaena*- and *Collichthys*-forms are well specialized in the sciaenid fishes is also supported by having numerous vertebrae more than 25, because the fishes with 25 vertebrae are generally recognized as primitive group among the Perciformes. The *Pseudosciaena*-form and *Collichthys*-form seem to be intimate, because the basal processes of third vertebra are especially developed. The affinity between the *Johnius*-form and *Collichthys*-form is not so intimate as that between the *Pseudosciaena*-form and *Collichthys*-form, due to the fact that the basal processes, particularly of fourth vertebra, of the *Johnius*-form is developed. The horse-shoe-like arch process of the *Johnius*-form may have derived from such as the *Nibea*-form, but never from the *Argyrosomus*- and *Pseudosciaena*-forms. These trends in the derivation of the basal processes are largely in coincidence with those in the case of the sagitta and neurocranium.

As the Weberian apparatus found in the fishes of the Cypriniformes resembles to the basal processes of the *Pseudosciaena*-form, Shaw and Yu (1948) stated that these processes might be regarded as the rudimentary ossicle of the Weberian apparatus. But it is thought to be reasonable that the basal processes in this group of fish are not homologous with the Weberian apparatus, because it must be derived from a primitive form of the sciaenid fishes.

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Literature cited

- Chu, Y., Y. Lo and H. Wu. 1963. A study on the classification of the sciaenoid fishes of China, with description of new genera and species. Shanghai Scientific and Technical Publ. Co., Shanghai, i-ii, 1-100, pls. 1-40.
- Hotta, H. 1961. Comparative study of the axial skeleton of Japanese Teleostei. Norin-Suisan Gijutsu Kaigi, Contr. (5), 1-155, pls. 1-70.
- Kim, Y. and I. Kim. 1965. Osteological study of fishes from Korea (1). Comparative osteology of family Sciaenidae. Bull. Pusan Fish. Coll., 6(2): 61-76, pls. 1-8.
- Shaw, T. H. and S. V. Yu. 1948. Preliminary notes on the vertebral column of two important sciaenid fishes, *Pseudosciaena crocea* (Richardson) and *Pseudosciaena manchurica* (Jordan and Thompson). Quart. J. Taiwan Mus., 1(4): 1-13.
- Takahashi, Y. 1962. Study for the identification of species based on the vertebral column of the Teleostei in the Inland Sea and its adjacent waters. Bull. Nankai Reg. Fish. Res. Lab., 16: viii+1-62, pls. 1-122.
- Taniguchi, N. 1969. Comparative osteology of the sciaenid fishes from Japan and its adjacent waters—I Neurocranium. Jap. J. Ichthyol., 16(2): 15-27.

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日本およびその近海産ニベ科魚類の骨格の研究 II.
脊椎骨 谷口順彦

ニベ科魚類 15 種の脊椎骨の形態的特徴を記述し、その分化の状態を考察した。ニベ類の脊椎骨にみられる著しい特徴は、前部の数個の腹椎下面に鰓の先端が固着する 1 対の骨質隆起が存在することである。この隆起の形態により 5 類型（ニベ型、コニベ型、シログチ型、キングチ型およびカンダリ型）に分類される。ニベ型では数個の腹椎にそれぞれ未発達な 1 対の隆起線があり、とくに 4 番目の腹椎の隆起線が多少とも発達する。キングチ型、カンダリ型およびコニベ型では、その隆起が著しく特化して、1 対の平板状突起、楕円形の 1 個の平板状突起および馬蹄形突起などに変形したものがみられる。シログチ型の隆起はニベ型とキングチ型の間型とみなされる。キングチ型とカンダリ型では、とくに 3 番目の腹椎の隆起が発達しており、コニベ型では 4 番目の腹椎のそれが発達しているので、両者間の直接的類縁は考えられない。脊椎骨数は一般的に尾部棒状骨を含めて 25 であるが、キングチ型およびカンダリ型では 25 以上である。この事実はキングチ型とカンダリ型が脊椎骨 25 の基本群から派生したことを示している。

脊椎骨にみられる類型は頭蓋骨および耳石にみられる類型とよく一致しており、脊椎骨が重要な分類形質であることを意味する。

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