ADDITIONAL COMMENTS ON THE STRUCTURE AND RELATIONSHIPS OF THE MIRAPINNIFORM FISH FAMILY KASIDOROIDAE[1]

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ABSTRACT

Further study of *Kasidoron edom* shows that in the structure of the upper jaw, hyal apparatus, and caudal skeleton, the Mirapinniformes are more advanced than has been suspected. In as far as information is available, *Kasidoron* does seem comparable in these structures to *Eutaeniophorus* and *Mirapinna* and it does seem fair to take it as an ordinal representative. Study of the pelvic tree yields no new information on its possible function.

INTRODUCTION AND ACKNOWLEDGMENTS

The initial report on the Kasidoroidae (Robins & de Sylva, 1965) concerned the gross description, biological notes, and remarks on habits and relationships. This report treats the character of the maxilla and premaxilla and their structural relations, the hyal bones and the number and arrangements of the attached branchiostegals, the configuration of the terminal or hypural caudal vertebra, the number of vertebrae, and the results of study of the histology of the pelvic appendage. These findings require a new look at the systematic placement of the mirapinniform fishes.

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Many ichthyologists have commented on *Kasidoron* since its description. Some of the comments inevitably affected this subsequent report. In this regard I thank Donn Eric Rosen (American Museum of Natural History) and D. E. McAllister (National Museum of Canada). Donald P. de Sylva and Frederick H. Berry reviewed the manuscript. Mrs. Priscilla Holland prepared the sections of the pelvic appendage and provided the basis for the descriptive notes on this structure that are included in this paper. Radiographs of the type series of *Kasidoron edom* were made at the Brunswick Laboratory of the U. S. Bureau of Commercial Fisheries through the courtesy of William W. Anderson, Jack W. Gehringer, and Frederick H. Berry.

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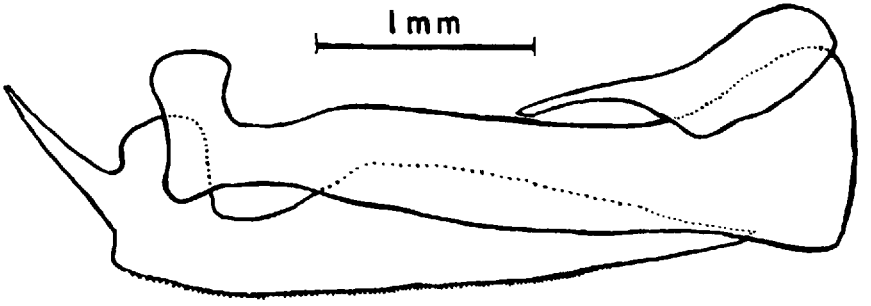

FIGURE 1. Lateral view of premaxilla, maxilla, and supramaxilla of *Kasidoron edom*.

PREMAXILLA-MAXILLA RELATIONSHIPS

Figure 1 depicts the general relationships of the premaxilla and maxilla as they are situated when the mouth is closed. The premaxilla is provided with a strong ascending or nasal process that is oriented at about 130° to the axis of the maxillary or tooth-bearing process. It also bears a well-organized articular process which is received by the rotating head of the maxilla, and it has a definite dorsal blade on the maxillary process. The head of the maxilla is a socket which rotates on the articular process of the premaxilla. Posteriorly and dorsally there is a well ossified supramaxilla which continues forward as a narrow process. The premaxilla rides mesial to the maxilla when the mouth is closed (note dotted line in Fig. 1).

HYAL REGION

Figure 2 shows the general appearance of the epihyal, ceratohyal, and hypohyal bones, and the positions of the attached branchiostegal spines. The triangular epihyal abuts against the broadened distal end of the ceratohyal; actually an area of cartilage provides the basis of connection—there is no suture. The ceratohyal narrows abruptly from its distal end to form what is often called the shaft of the ceratohyal. Anterior to the ceratohyal are two hypohyals arranged one above the other. The nine branchiostegal spines are in two groups, the distal four being larger and attached along the external face of the epihyal (the distal three) and the distal end of the ceratohyal (the fourth). The remaining five are small by comparison and are loosely connected to the edge of the shaft of the ceratohyal. At the specific request of Dr. McAllister I examined the ceratohyal in detail and found as a result a small foramen in the center of the ceratohyal. The two hypohyals are separated from each other and from the ceratohyal by cartilage as noted in the figure.

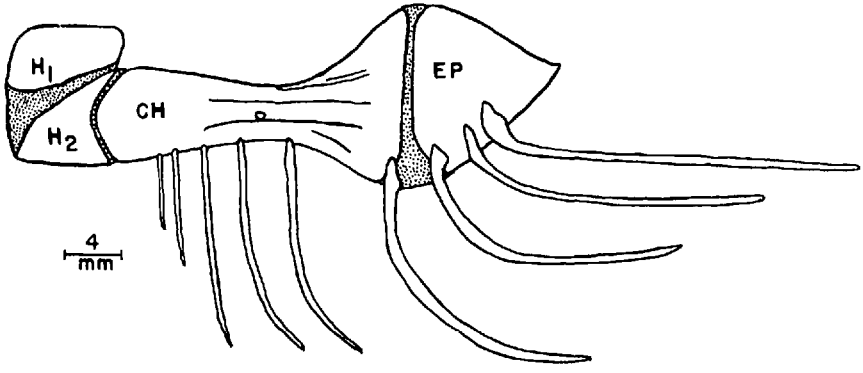

FIGURE 2. Lateral view of epihyal (EP), ceratohyal (CH), and hypohyal (H_1 and H_2) of *Kasidoron edom*. Stippled areas represent cartilage. The small circle centrally located on the ceratohyal is a foramen (see text for discussion).

VERTEBRAL COLUMN

The terminal vertebra in the specimen examined has the lower half of the centrum poorly ossified. The upper part ends in a well developed and strongly upturned urostyle. There are six broad hypural elements (three ventral and three posterior) and two bilaterally paired elements that can be considered uroneurals. The attachment sites of the 19 principal caudal rays (10 above, attached to hypurals 4, 5, and 6 and the first uroneural; 9 below, attached to hypurals 1, 2, and 3) are indicated on Figure 3.

Numbers of vertebrae could be determined accurately for the three larger specimens and there were 29 in each instance. The smallest paratype had 28 or 29 and probably the latter. In the holotype and largest paratype there were 17 and 18 caudal and 12 and 11 precaudal vertebrae respectively. The holotype was injured to the extent that there is partial fusion of two caudal vertebrae. The humped dorsal profile seen in the illustration of *Kasidoron edom* (Robins & de Sylva, 1965: 191, Fig. 1) marks the position of the second and third neural spines which, along with the first, are especially long.

PELVIC APPENDAGE

The following account is based largely on information provided by Mrs. Priscilla Holland. The leaf-like structures are covered by a thin, clear epidermis that is covered by small papillae and which is easily sloughed. The sections show no evidence of this, or only a few fragments, the outer layer in the sections being the dermis with its heavy infusion of melanophores.

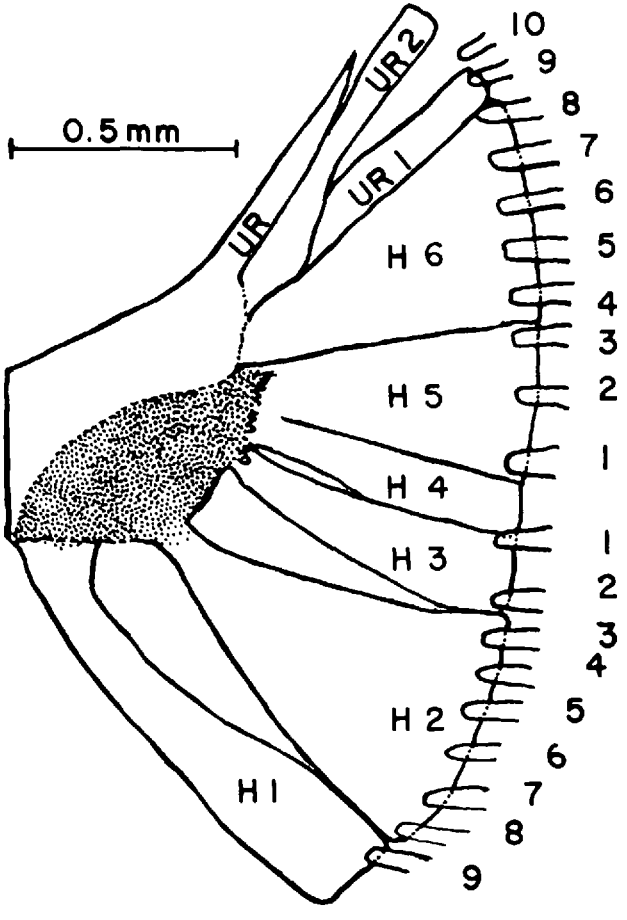

FIGURE 3. Lateral view of terminal or hypural vertebra of *Kasidoron edom*. Numbers 1-10 represent the attachment sites of the upper 10, and 1-9, and attachment sites of the lower nine, principal caudal rays (total 19). H_1 to H_6 are the hypurals, UR_1 and UR_2 the uroneurals, and UR the urostyle. The stippled area represents cartilage.

Some sagittal sections show a long central tube, not much larger than a capillary, that apparently is a blood vessel since the cells are endothelial in character. Most of the internal structure of the leaf consists of loose, unorganized fibrous tissue with occasional fibroblast nuclei. There seems to be a gradient in differentiation of tissue for the connective tissue is more deeply stained and better organized at the proximal end of the leaf where transverse sections of blood vessels or blood sinuses are seen.

The leaf is more remarkable for what it lacks than for what it has. There is no sign of any specialized structure that could account for luminescence. There are no muscle fibers. The enclosed central blood vessel is only an enclosed tube that shows no indication of being either venous or arterial. Blood cells are extremely scarce and can be seen only at the proximal end of the organ. These cells had round nuclei and appeared to be primitive. Mature red blood corpuscles are absent. There is no indication of special nerve or blood supply to any epithelial structures that may have been present.

Internal Anatomy

Unfortunately, preliminary study of the body organs of *Kasidoron edom* resulted in removal and loss of some organs. No gonadal tissue remains. Mrs. Holland especially noted giant cells with polymorphic nuclei among the anterior interrenal cells.

Discussion

The pelvic appendage is a specialized feature of the Kasidoroidae and need not concern us. The results of the other studies alone require reevaluation of the position of the Mirapinniformes. In some of these features we can only assume that *Kasidoron* is representative of the order; the material of the other species is not of a condition to bear investigation. Some comparable data are available for *Mirapinna esau* and for *Eutaeniophorus festivus,* however (Bertelsen & Marshall, 1956: 5, fig. 2; 7, fig. 3; 21, fig. 12).

The premaxilla apparently has better developed ascending and articular processes in *Kasidoron* than in *Eutaeniophorus* and *Mirapinna.* The general arrangement of these structures is more in keeping with the various assemblages of pre-perciform fishes than with the clupeiform and myctophiforms (excluding the cetomimoids and neoscopelids). The arrangement of the supramaxilla and indeed of the entire upper jaw is much like that found in the broadened assemblage of cod-like fishes; see especially Rosen (1962: figs. 4 & 24).

The hyal apparatus with its four large branchiostegals attaching to the external face of the epihyal and enlarged distal end of the ceratohyal again suggests a higher placement of the order. *Eutaeniophorus festivus* (see Bertelsen & Marshall, 1956: 7, fig. 3) has the same cluster of four distal branchiostegals though ossification is less well developed and the whole hyal series is more fragmented. The number of branchiostegals along the shaft of the ceratohyal is of little value for they are often reduced or secondarily increased in number in many groups of fishes. The presence of the foramen in the ceratohyal according to McAllister (in litt.) is characteristic of the beryciform level of organization.

The caudal region of *Kasidoron* seems less sophisticated than its front end. Nineteen principal caudal rays however are consistent with a high preperciform level of organization. The terminal vertebra is not unlike that figured by Gosline (1961: 15, fig. 4A) for the zeiform fish *Antigonia.*

Many ichthyologists currently are concerned with the major classification of fishes. It is not the intention of this paper to attempt a new placement of the Mirapinniformes. In the first place many suspected relatives have not been studied with regard to the characters included here so that a shift higher on a phyletic tree may be more actual than relative; that is, the mirapinniform allies may themselves be dragged along in such a move, so that an entire galaxy of preperciform families will appear at the level of organization about comparable to the already existing cod (gadiform, ophidiiform, etc.), beryciform, and batrachoidiform assemblages. It is hoped, however, that these data will permit others to have a fuller view of the Mirapinniformes.

Finally it should be noted, in response to comments and queries, that *Kasidoron* is based on the second declension Greek noun *doron* which has the genitive *dorou* and the stem *doro-*, hence the familial derivative Kasidoroidae.

SUMARIO

COMENTARIOS ADICIONALES SOBRE LA ESTRUCTURA Y RELACIONES DE LA FAMILIA DE PECES MIRAPINNIFORMES, KASIDOROIDAE

Estudios posteriores de *Kasidoron edom* muestran que en la estructura de la mandíbula superior, el aparato hial y el esqueleto caudal, los mirapinniformes están más adelantados que lo que se había sospechado. De acuerdo con las informaciones disponibles, *Kasidoron* parece ser comparable en estas estructuras con *Eutaeniophorus* y *Mirapinna* y parece justo tomarlo como un representante del orden. El estudio del árbol pélvico no da nueva información sobre su posible función.

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