

Possible sexual dimorphism in *Pankowskichthys libanicus* (Neopterygii, Pycnodontiformes) from the Cenomanian of Lebanon

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Abstract - Sexual dimorphism is a commonly observed phenomenon in the natural world today but it is far more difficult to determine how common it was in extinct taxa. Here, we describe a new specimen of *Pankowskichthys libanicus* (Pycnodontiformes, Gladiopycnodontidae) from Haqel, Lebanon (MNHN HAK 1950), which has distinct morphological differences from the holotype of this taxon (IRSNB P9278) which occurs in Hjoula, Lebanon but has also been found at Haqel. Since most of the cranial and pectoral girdle morphologies as well as other postcranial characters are similar to that seen in IRSNB P9278, the distinctive characters seen in MNHN HAK 1950 are unlikely to define a second species but rather represent sexual dimorphic traits.

Keywords: Late Cretaceous, Gladiopycnodontidae, Haqel, sexual dimorphism

1. Introduction

Sexual dimorphism is a commonly observed phenomenon in the natural world today but it is far more difficult to determine how common it was in extinct taxa. There are numerous conditions that need to be fulfilled before an example of sexual dimorphism in the fossil record can be verified: specimens need to be in a similar locality and stratigraphic context (Scannella and Fowler, 2009), morphological differences need to be separated from diagnostic traits of distinct species (Ostrom and Wellnhofer, 1990) and ontogenetic processes need to be considered (Horner and Goodwin, 2006). When these conditions are met it is shown that there are several examples of sexual dimorphism found in the fossil record of vertebrates (Borkovic, 2013).

Here, we describe a new specimen of *Pankowskichthys libanicus* (Pycnodontiformes, Gladiopycnodontidae) from Haqel, Lebanon (MNHN HAK 1950), which has distinct morphological differences from the holotype of this taxon (IRSNB P9278) (Fig 1) which occurs in Hjoula, Lebanon

(Taverne and Capasso, 2014) but has also been found at Haqel (Gayet *et al.*, 2012). The morphological dissimilarities found are interpreted to be sexual dimorphic differences.

2. Materials and methods

Characters distinguishing MNHN HAK 1950 from the holotype (IRSNB P9278) are three ventral pointed tips projected from the base of prefrontal (MNHN HAK 1950) whereas there is only one in IRSNB P9278; the orbitosphenoid in IRSNB P9278 is hook shaped (Taverne and Capasso 2014) and located in the posterior orbital region in contrast to MNHN HAK 1950 where the same bone is lunar shaped and posterior to the mesethmoid; a pair of short horns present on the parietal in MNHN HAK 1950 that are absent in IRSNB P9278; the nuchal horn of MNHN HAK 1950 being more upright in contrast to the posteriorly pointing nuchal horn in IRSNB P9278 and spaces between spines on nuchal horn are concave in MNHN HAK 1950 but straight in IRSNB P9278.

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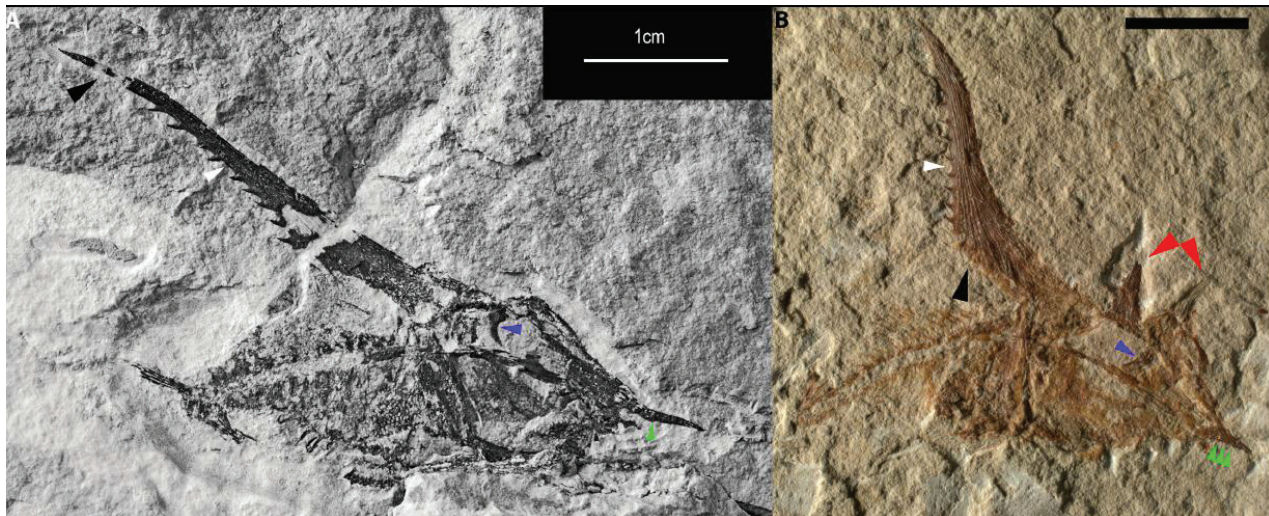


Figure 1. (a) Holotype specimen of *Pankowskichthys libanicus* IRSNB P9278 interpreted here to be the female. Photo modified from Taverne and Capasso (2014). (b) *P. libanicus*, MNHN HAK 1950 showing the pair of short horns above the orbit and which is interpreted to be the male. Arrows used to show differences in cranial structures between two morphotypes. Black arrows, orientation of nuchal horn; White arrows, spaces between spines on nuchal horn; Blue arrows, position and shape of orbitosphenoid; Red arrows, horns above orbit present on parietal; Green arrows, pointed ventral tips on prefrontal. Scale bar = 1 cm.

3. Discussions and conclusions

Possible sexual dimorphism has been reported in two other species of extinct pycnodontiform fishes, which are supposed to be sister to teleosts from the Cenomanian of Lebanon. Possible sexual dimorphism in the morphology and number of spines on the dorsal ridge scale has been reported in *Nursallia tethysensis* (Capasso *et al.*, 2009). A more extreme example can be found in *Hensodon spinosus* where males and females have a distinct assortment of horns and spines on the skull and cleithrum (Capasso *et al.*, 2010).

The marine Cenomanian of Lebanon is seen as a time and place where pycnodont fishes had very high levels of species diversity and morphological disparity (Marráma *et al.*, 2016). Since sexual dimorphism in pycnodonts previously has been observed in taxa from the Lebanese Cenomanian fauna it would seem highly probable that other pycnodont species found there also would have sexually dimorphic forms.

Since most of the cranial and pectoral girdle morphologies as well as other postcranial characters are similar to that seen in IRSNB P9278, the distinctive characters seen in MNHN HAK 1950 are unlikely to define a second species but rather represent sexual dimorphic traits. This case of sexual dimorphism in cranial osteology is also similar to the rare cases found in extant teleosts today such as *Kurtus gulliveri* (Berra and Humphrey, 2002), *Danionella dracula* (Britz *et al.* 2009), *Bolbometopon muricatum* (Muñoz *et al.*, 2012) and *Coryphaena hippurus* (Schuck, 1951). This finding indicates that sexual dimorphism may be especially pronounced in pycnodonts and may reveal that similar taxa currently classified as distinct species may be sexual dimorphs of one another. The diverse and morphologically disparate pycnodont fauna of the Cenomanian of Lebanon may be a particular hotspot for this biological phenomenon.

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