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HIPPOLYTE PRIDEAUXIANA LEACH, 1817: FIRST RECORD FOR THE NORTHERN ADRIATIC AND OBSERVATIONS ON MIMETIC COLOURATION

Roland R. MELZER

Zoologische Staatssammlung München, Münchhausenstr. 21, 81247 München, Germany
& Department Biologie II, Ludwig-Maximilians-Universität München, Großhaderner Straße 2, 82152 Planegg-Martinsried, Germany
e-mail: melzer@snsb.de

Martin HEß

Department Biologie II, Ludwig-Maximilians-Universität München, Großhaderner Straße 2, 82152 Planegg-Martinsried, Germany

Manuel A. STAGGL

Fakultät für Lebenswissenschaften, Universität Wien, Althanstr. 14, A-1090 Wien, Austria

Tihomir MAKOVEC & Borut MAVRIČ

Marine Biology Station, National Institute of Biology, Fornače 41, 6330 Piran, Slovenia

ABSTRACT

We present the first record of Hippolyte prideauxiana Leach, 1816 for the northern Adriatic and the second record for the Adriatic Sea based on seven specimens we found during our faunistic inventory of the marine protected area of the Brijuni National Park, Croatia. Moreover, we give the first description of the appearance of 7 mm-juveniles and discuss the stage-specific traits of the crinoid mimesis of this species.

Key words: *Hippolyte prideauxiana*, colouration, *Antedon mediterranea*, mimesis, Adriatic Sea

HIPPOLYTE PRIDEAUXIANA LEACH, 1817: PRIMO RITROVAMENTO PER L'ADRIATICO SETTENTRIONALE E OSSERVAZIONI SULLA COLORAZIONE MIMETICA

SINTESI

Gli autori presentano il primo ritrovamento di Hippolyte prideauxiana Leach, 1816 per l'Adriatico settentrionale e il secondo per il mare Adriatico, in base a sette esemplari trovati durante l'inventario faunistico condotto nell'area marina protetta del Parco nazionale di Brioni, in Croazia. Nell'articolo viene inoltre riportata la prima descrizione dell'aspetto di giovani esemplari di 7 mm, e vengono discussi i tratti specifici della fase di mimesi crinoide di questa specie.

Parole chiave: *Hippolyte prideauxiana*, colorazione, *Antedon mediterranea*, mimesi, mare Adriatico

INTRODUCTION

Species of *Hippolyte* Leach, 1814 are masters of camouflage that by virtue of their chromophores adapt to various substrates, e.g., algae and seaweed. *Hippolyte inermis* Leach, 1816 and a few other Mediterranean species exhibit seaweed mimesis, viz. they perfectly imitate the green colour of the seaweed. Even more sophisticated types of mimesis are found in species of *Hippolyte* that are epizoans of other marine invertebrates. *Hippolyte prideauxiana* Leach, 1817 is exclusively found on crinoids, e.g., *Antedon mediterranea* (Lamarck, 1816) (d'Udekem d'Acoz, 1996, 2007). These species match in appearance the same colouration as the crinoid. So far, females, immature females and males have been described by d'Udekem d'Acoz (1996, 2007). According to his observations, males and

immature females have a dorsal red and yellow stripe, a ventrolateral red line, and two transverse red and yellow lines on the carapace. Adult females are similar, but the transverse lines are found all over the body. Until now there has been only one published record of this species for the Adriatic Sea (near Rijeka; Kirinčić, 2006), though its host, *A. mediterranea* is not a rare species in this part of the Mediterranean.

MATERIAL AND METHODS

While scuba diving off the coast of the Brijuni archipelago, we searched crinoids, *Antedon mediterranea*, for *Hippolyte prideauxiana*. Afterwards, we identified the *Hippolytes* from underwater photos or took them together with their hosts to the lab to take aquarium photos of the living shrimp and observe their colouration and

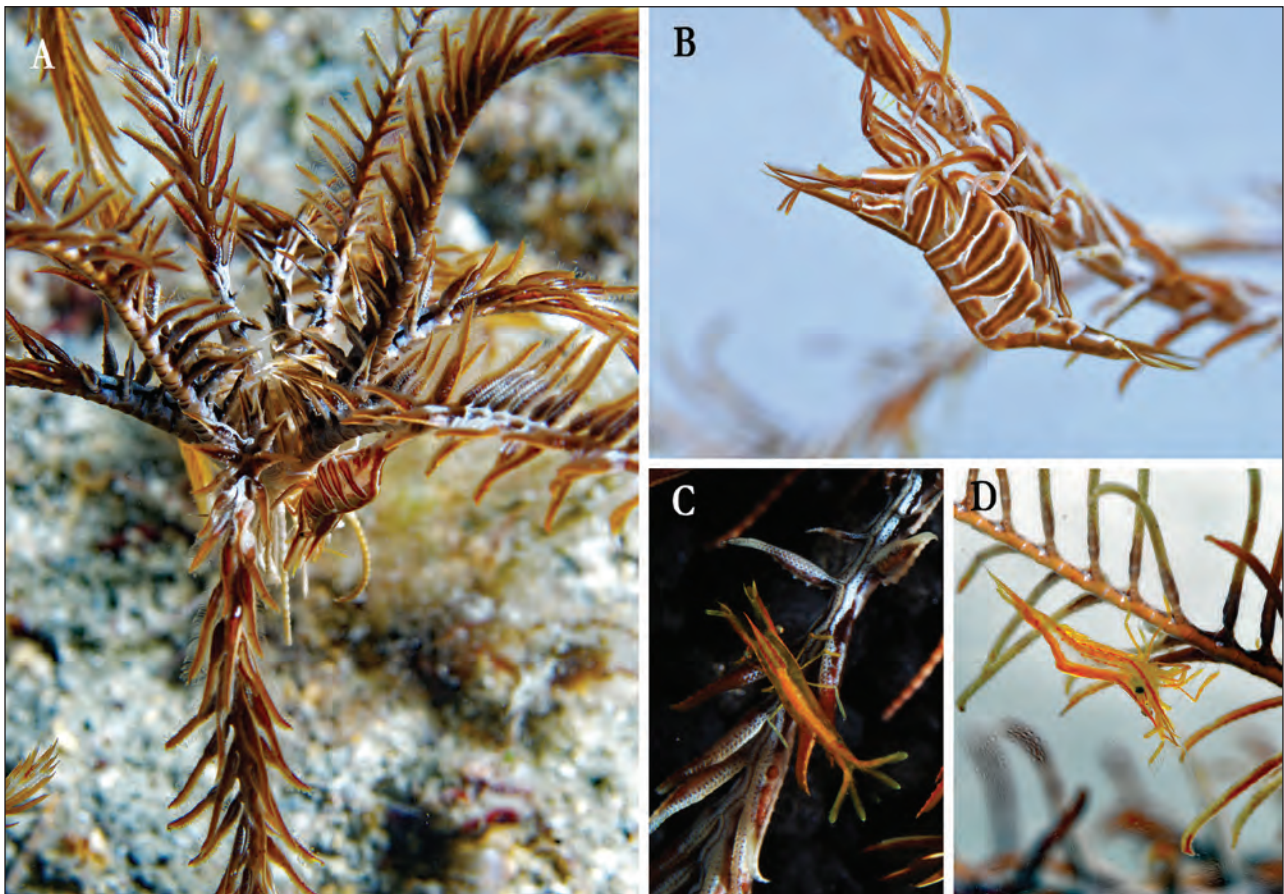


Fig. 1: *Hippolyte prideauxiana*. A) Adult female photographed in the wild at its usual resting place on the ventral side of an *Antedon mediterranea* near the cirri (photo: B. Mavrič). B) Another adult female showing a perfect *Antedon* mimesis (aquarium photo: M. Staggl). C) Juvenile on top of pinnules, dorsal view (aquarium photo: B. Mavrič). D) Lateral view showing that the transversal stripes are not yet present (aquarium photo: M. Staggl).
 Sl. 1: *Hippolyte prideauxiana*. A) Odrasla samica, fotografirana v naravi med mirovanjem na spodnji strani morske lilije blizu cirrov (foto: B. Mavrič). B) Odrasla samica, ki se dobro prikriva na morski liliji (akvarijski posnetek: M. Staggl). C) Mladostni primerek na vrhu pinul, hrbtni pogled (akvarijski posnetek, foto: B. Mavrič). D) S strani je vidno, da prečnih prog še ni (akvarijski posnetek: M. Staggl).

behaviour. For identification in the lab we used the key and detailed species description by d'Udekem d'Acoz (1996). We found *H. prideauxiana* at two localities, the south slope of Otok Gaz (44°56'8.33" N, 13°43'6.56" E) at a depth of about 23 m and off Rt Lansir (44°56'24.82" N, 13°44'33.39" E), also at about 20 m. Three of the specimens have been preserved in 75 % ethanol, one egg-carrying female (total length 22 mm), one female not carrying eggs (18 mm) and a juvenile (7 mm). They are stored in collns Arthropoda varia at the Bavarian State Collection of Zoology.

RESULTS

During our faunistic studies in the marine protected area in the Brijuni National Park (Melzer *et al.*, 2016; Ceseña *et al.*, 2017), we documented a specimen of *H. prideauxiana* on *A. mediterranea* at the south slope of Otok Gaz at a depth of about 23m in May 2018. In May 2019, we searched numerous crinoids in situ and found six more specimens of *H. prideauxiana*. Two of these, again, were documented off Otok Gaz, while the remaining four specimens were found off Lansir. In Figure 1A, a photo taken in the wild is shown; Figs. 1B, C and D show images captured in a photo aquarium in the lab. Five of the altogether seven observed specimens were adult females, and two were juveniles of about 7 mm length (Figs. 1C, D).

The females of *H. prideauxiana* had colourfull transverse bands covering the body including the pleon. They were white around the edges while the central area was red with a yellow midline. In addition, a red dorsal and yellow band was present. Conversely, in the juvenile specimens, the transverse bands were absent but the dorsal red and yellow stripe, as well as a ventrolateral red line on each side of the body were distinct. The adult shrimps very often sat at the base of the arms in such a way as to align their transverse stripes to the crinoids' pinnules. Conversely, the juvenile specimens spent a lot of time standing on top of pinnules oriented approximately in line with them in such a way that their longitudinal stripes were parallel to the pinnules. Otherwise, they moved around almost everywhere on the distal part of the arms.

DISCUSSION

Our records of this species are the second for the Adriatic and the first for the Northern Adriatic according to the biogeographic zones delineated by Bianchi (2004) and Relini (2010), where the southern border of biogeographic area "9", the northern Adriatic sector, is placed between Conero and Kamenjak.

In addition, our observations of our specimens' mark-

ings are of interest. Firstly, the colouration pattern of the females we observed corresponds very well with that described in d'Udekem d'Acoz (1996). Secondly, the 7 mm juveniles present another type of garb that is probably the ontogenetically earliest stage known to date and differs from those described earlier. These specimens had no transverse lines at all, but the longitudinal ones were already developed. We suggest that this stage is the forerunner of the colouration of the older shrimps, in other words, at some point during ontogeny, after a certain body size has been reached, the differentiation of transversal stripes begins, maybe first on the carapace (in males and/or immature females), and then all over the body (in mature females).

Looking at our photos of adults, it is very tempting to say that with respect to their colours, shape and size, the transverse stripes imitate pinnules, i.e., the side branches of the feather star's arms. Conversely, the longitudinal stripes of the much smaller juveniles could provide the same masquerade, but with a pattern twisted 90 degrees to that of the adults. There have been several detailed attempts to understand the mimetic colouration of species of *Hippolyte* (e.g., Hacker & Madin 1991; Duarte *et al.*, 2016, 2017). We suggest that similar analyses of *H. prideauxiana* could be very interesting.

It seems that the abundance of *H. prideauxiana* in the Northern Adriatic is relatively low, since we searched numerous *Antedons* during our campaigns in 2018 and 2019, and found altogether the seven specimens mentioned in this paper. Nevertheless, it's difficult to say whether our *Hippolytes* are hard to find because their camouflage technique is so close to perfection that they have been overlooked until present, or if the number of faunistic studies has been too low to detect them, or if they are really rare, indicating that the Brijuni MPA is a sanctuary for this species. Interesting to note is the fact that some of the authors have been studying the northern Adriatic benthos off Piran and Rovinj for decades using both scuba diving and dredges without finding a single individual of *H. prideauxiana*.

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HIPPOLYTE PRIDEAUXIANA LEACH, 1817: PRVI ZAPIS O POJAVLJANJU V SEVERNEM JADRANU S PODATKI O BARVNEMU PRIKRIVANJU

Roland R. MELZER

Zoologische Staatssammlung München, Münchhausenstr. 21, 81247 München, Germany
& Department Biologie II, Ludwig-Maximilians-Universität München, Großhaderner Straße 2, 82152 Planegg-Martinsried, Germany
e-mail: melzer@snsb.de

Martin HEß

Department Biologie II, Ludwig-Maximilians-Universität München, Großhaderner Straße 2, 82152 Planegg-Martinsried, Germany

Manuel A. STAGGL

Fakultät für Lebenswissenschaften, Universität Wien, Althanstr. 14, A-1090 Wien, Austria

Tihomir MAKOVEC & Borut MAVRIČ

Marine Biology Station, National Institute of Biology, Fornače 41, 6330 Piran, Slovenia

POVZETEK

Avtorji poročajo o prvi najdbi vrste *Hippolyte prideauxiana* Leach, 1816 v severnem Jadranu in drugem zapisu za celotno Jadransko morje. Podatki temeljijo na najdbah sedmih primerkov, najdenih med inventarizacijo favne v morskem zavarovanem območju v okviru Nacionalnega Parka Brijuni na Hrvaškem. Poleg tega avtorji podajajo prvi opis 7 mm dolgega juvenilnega primerka in razpravljajo o značilnostih prikrivanja različnih stadijev te kozice na morskih lilijah.

Ključne besede: *Hippolyte prideauxiana*, barvni vzorec, *Antedon mediterranea*, prikrivanje, Jadransko morje

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