

## **Morphometric and scanning electron microscopy of *Dactylogyrus minutus* Kulwièc, 1927 (Monogenea: Dactylogyridae) from the *Cyprinus carpio* var. *koi***

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Carp from the coloured koi variety is commonly used for both aquarism and earthen-pond culture. However, its culture has been affected by dactylogyrid species, causing massive mortality for more than four species of *Dactylogyrus* genus in the same host. In the present study, *Dactylogyrus minutus* specimens living on the gills of *Cyprinus carpio* were identified using light, confocal and scanning electron microscopy to characterize its morphological and morphometrical characters by the first time in Brazil. Samples of carp var. *koi* (weight of  $1.73 \pm 0.25$  g; total length of  $4.7 \pm 0.46$  cm) were obtained in September 2016 from a fish farm located in Biguaçu, Santa Catarina, Southern Brazil and transported live to Aquatic Organisms Health Laboratory. After acclimatization period, thirty fish were anesthetized in clove oil (75 mg/L) and were examined for the infestation intensity of parasites on the gills using a stereomicroscope. Specimens of *Dactylogyrus* were isolated and fixed in 70% ethanol for morphological identification, 10% formalin for confocal microscopy and 2.5% phosphate-buffered glutaraldehyde for scanning electron microscopy. The monogeneans were identified as *Dactylogyrus minutus* Kulwièc, 1927 (P 75%, MII  $3.55 \pm 2.91$ , MA  $2.66 \pm 2.95$ ). In general, the measurements ( $\mu\text{m}$ ) of 20-Hoyer's mounted specimens were close to those described by Kulwièc (1927): body 196-247 (216) long and 46-63 (53) wide at midbody, anchor total length 39-44 (42) long, with base length 33-37 (35) and point length 13-15 (14), anchor inner root 12-14 (13) long, outer root 5-6 (6) long. One single bar 28-32 (30) long, 14 marginal hooks 20-23 (22) long, male copulatory organ (MCO) 29-38 (34) total length. Oval egg 59-60 (60) long, 40-41 (40) total wide with one small appendage 5-6 (6). A pair of long anchors supported by a single bar longer rounded in the extremities at the dorsal side. In images obtained using confocal microscopy the shape of the bar was improved, evidencing the point in the extremities with a slight groove. The cirrus is a thin long tube which tapers anteriorly. There are two MCO accessory piece, one has a side branch and diverges into two points, and has approximately the same size as cirrus. Another piece is shorter originating at the opposite side. The vagina opens on the right side of the body anteriorly to the middle of the body, as shown by scanning electron microscopy. There was a previous report of *D. minutus* from Brazil in the same host but no morphological data were related. It can be considered that this study supports all the previous characterization, not only by the details of the haptor but also by the dorsal bar observation in a confocal microscopy and scanning electron microscopy. In fact, using these techniques the vaginal pore and specimens attached to the gills were observed. Morphometric measurements are given for the first time from koi carp collected in a fish farm from Brazil, which is important to highlight in case of a cosmopolitan fish parasite species.

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