

The Cyprinidae of Morocco and their gill Monogenea: systematic and biogeography

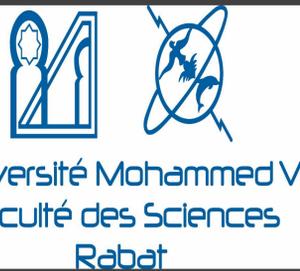
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Introduction

The Moroccan continental water is dominated by Cyprinids represented by 16 species, belonging to four genera: *Luciobarbus* Heckel (1843), *Labeobarbus* Rüppell (1836), *Carasobarbus* Karaman (1971) and *Pterocapoeta* Günther, 1902.

These species present a problematic identification, because of the polyploidization, of their intra & inter generic hybridization, and also by their complex evolutionary history.

In addition to morphological and genetic methods applied for systematic and phylogeny of host species, the study of specific parasites, in particular the gill monogeneans, represents one of the ways which can be helpful for investigating the recent distribution and historical biogeography of their hosts.

Materials and methods

From April 2014 to June 2015, more than seven hundred specimens of barbels were caught from 40 localities in different Moroccan rivers and dams, using gill nets or electrofishing.

Immediately after being caught, fish were dissected, two gill arches were frozen on site after being removed, and two others were conserved according to Justine *et al.* (2012) method, then the parasites isolated were mounted in a mixture of glycerine and ammonium picrate or Hoyer's medium.

The parasites are identified at 400x or 1000x, magnification under a microscope, and the measurements were performed using Image J software.

Results and Discussion

The examination of morphological characters of the fish collected indicate that they belong to three genera:

Luciobarbus with 10 species



Fig 1: *L. lepineyi*



Fig 2: *L. nasus*



Fig 3: *L. pallaryi*

Carasobarbus with one species



Fig 4: *C. fritschii*

Pterocapoeta with one species



Fig 5: *P. maroccana*

Liste of species investigated	List of <i>Dactylogyrus</i> found
<i>Luciobarbus</i> sp 1	<i>D. fimbriphallus</i> ; <i>D. sp 1</i> ; <i>D. sp 14</i> ; <i>D. sp 19</i>
<i>Luciobarbus</i> sp 2	<i>D. sp 2</i> ;
<i>Luciobarbus</i> sp 3	<i>D. fimbriphallus</i> ; <i>D. sp 3</i> ; <i>D. sp 19</i>
<i>Luciobarbus pallaryi</i>	<i>D. fimbriphallus</i> ; <i>Dactylogyrus atlasensis</i> ; <i>D. sp 7</i> ; <i>D. sp 13</i> ; <i>D. sp 17</i> ; <i>D. sp 18</i> ; <i>D. sp 19</i>
<i>Luciobarbus lepineyi</i>	<i>D. fimbriphallus</i> ; <i>D. sp 4</i> ; <i>D. sp 5</i> ; <i>D. sp 6</i> ; <i>D. sp 8</i> ; <i>D. sp 9</i> ; <i>D. sp 10</i> ; <i>D. sp 11</i> ; <i>D. sp 12</i> ; <i>D. sp 15</i> ; <i>D. sp 19</i>
<i>Luciobarbus mouloyensis</i>	<i>D. fimbriphallus</i> ; <i>D. sp 19</i> ; <i>D. sp 20</i>
<i>Luciobarbus ksibi</i>	<i>D. ksibii</i>
<i>Luciobarbus nasus</i>	<i>D. borjensis</i>
<i>Luciobarbus labiosa</i>	<i>D. ksiboides</i>
<i>Carasobarbus fritschii</i>	<i>D. marocanus</i> ; <i>D. zatensis</i> ; <i>D. volutus</i>
<i>Pterocapoeta maroccana</i>	<i>D. sp 16</i>

Table of the investigated species and their gill monogeneans

The examination of gill arches reveals the presence of 28 species of *Dactylogyrus*. Morphology and morphometric measurements of sclerotized parts of haptor (anchors, marginal hooks and connective bars) and reproductive organs (copulatory organ and vaginal armament) show that 20 of them are most likely new species.

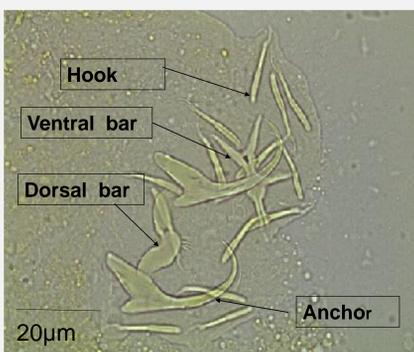


Fig 6: Haptor of *Dactylogyrus* sp. 1



Fig 7: Male copulatory organ and vagina of *Dactylogyrus* sp. 1

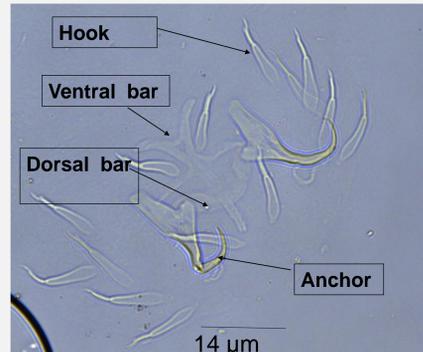


Fig 8: Haptor of *Dactylogyrus* sp. 2

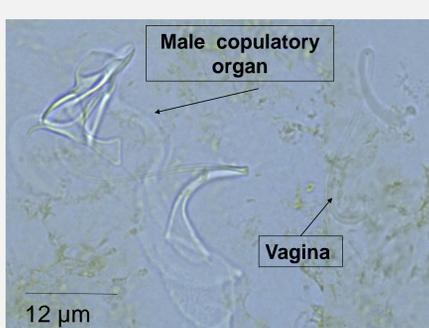


Fig 9: Male copulatory organ and vagina of *Dactylogyrus* sp. 2

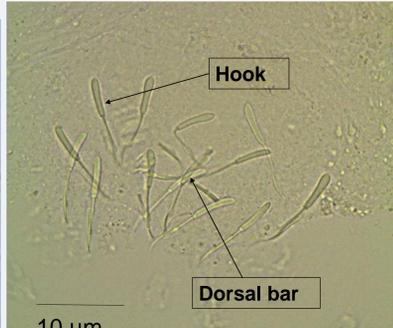


Fig 10: Haptor of *Dactylogyrus* sp. 3

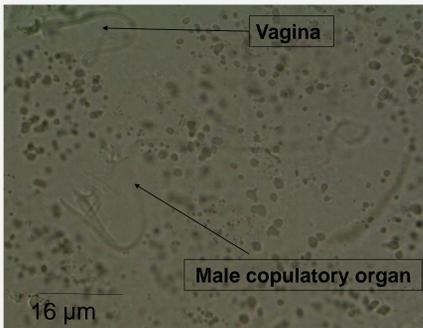


Fig 11: Male copulatory organ and vagina of *Dactylogyrus* sp. 3

Conclusion

Our results reveal the interest of taking the parasites in consideration for the study of their hosts (most of the Monogenean species are specific) and understanding of their population structure. In fact, *Dactylogyrus volutus* El Gharbi, Birgi & Lambert (1994) was found in the Eastern and Western populations of *Carasobarbus fritschii* Günther (1874), whereas *Dactylogyrus zatensis* El Gharbi, Birgi & Lambert (1994) was found in the North-western and South-western populations of this fish species. Thus, it seems that *Dactylogyrus* parasites can be used as markers of fish populations.

In this study we noticed the absence of the genus *Carasobarbus*, *Pterocapoeta* and *Labeobarbus* in South East Atlas and the ubiquity of *Luciobarbus* species in the rivers of Morocco. *Luciobarbus* being the only genus present in South East Atlas rivers.

Références bibliographiques:

Justine J.L., Briand M.J. and Bray R.A. (2012) A quick and simple method, usable in the field, for collecting parasites in suitable condition for both morphological and molecular studies. *Parasitol Research* 111: 341-351