

## Description and population dynamics of *Dactylogyrus legionensis* n.sp. from *Barbus barbus bocagei* Steind.

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### ABSTRACT

*Dactylogyrus legionensis* n. sp., a monogenean parasite from the gills of *Barbus barbus bocagei* from the Esla river (León, NW Spain), is described and its population dynamics discussed. It differs from the closely related species, *D. balistae*, in the presence of vaginal armour and in the morphology of the copulatory organ. *D. legionensis* was found on 30-40% of barbel, with a mean intensity of 13.71 and maximum infection levels in autumn-winter. The prevalence and intensity of infection rose significantly with the age and length of the barbel, and were higher in females than in males. *D. legionensis* showed preference for the second and first gill arches, sector III and the internal zone of each hemibranch.

### INTRODUCTION

Two species of Dactylogyridae have been previously recorded from the barbel of the Iberian Peninsula: *Dactylogyrus* sp. Simón-Vicente, Ramajo-Martín & Encinas-Grandes, 1975, subsequently described as *D. balistae* by Simón-Vicente in 1981, and *D. bocagei* Alvarez-Pellitero, Simón-Vicente & González-Lanza, 1981.

A new species of the genus *Dactylogyrus*, found in barbel of the Esla river, is described in the present work. Data on some aspects of the parasite/host/habitat relationships are also given.

### MATERIALS AND METHODS

The barbel (*Barbus barbus bocagei*) were caught in three stretches of the Esla river (Valencia de Don Juan, Villaornate and Villafer, the first being the upper stretch) which are the barbel and barbel-carp zones of the river, at altitudes of 748 to 718 m, and with gradients of 1.46 to 0.53‰, annual mean temperatures of 10 to 12°C and annual mean rainfalls of 400 to 500 mm.

273 barbels, two to eight years old and 14.5 to 43 cm long, were collected and examined from March 1977 to December 1979.

The gills were examined as soon as possible after the fish were killed, so the parasites could be observed *in vivo*. Some specimens were fixed in 5% formalin or mounted in ammonium picrate-glycerine (50%). Measurements were taken on drawings made with a camera lucida. The measurements and terminology of the chitinous structures are given according to the system outlined by GUSEV (1955), PROST (1957) and BYKHOVSKAYA-PAVLOVSKAYA *et al.* (1964). We have adopted the resolution of the IVth International Congress of Parasitology (Warsaw, 1978) for numbering the hooks, as published by GUSEV (1979).

All measurements are expressed in mm.

In order to determine the influence of the age and length of the barbel on the infections we used the correlation coefficient ( $r$ ) and the deviation "t" for testing its significance ( $P=0.05$ ).

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Host sex influence was studied using the chi-square test ( $2 \times 2$  table) for the prevalence and Student's "t" for the intensity of infection ( $P=0.05$ ).

The distribution of the parasite on the gills was analysed according to the scheme proposed by Lambert & Maillard (1975).

## RESULTS AND DISCUSSION

### (A) Description of the species and comparison with related species

#### *Dactylogyrus legionensis* n. sp. (Fig. 1)

*Host:* *Barbus barbus bocagei* Steind.

*Location on the host:* gills.

*Geographical distribution:* Esla river (Valencia de Don Juan, Villaornate and Villafer) (León) (Duero basin, NW Spain).

*Number of specimens studied:* 15.

*Holotype and paratypes:* in the collection of the Laboratory of Parasitology of the Veterinary Faculty and the Experimental Agricultural Station of León. Nos. PA-8 and PA-9.

#### *Description* (range of measurements with mean in parentheses)

Length 0.470–1.030 (0.752), width 0.115–0.220 (0.164).

Pharynx 0.035–0.060 (0.043)  $\times$  0.030–0.060 (0.041).

*Hamuli* 0.038–0.045 (0.041) long; short outer process 0.003–0.005 (0.004) and wide and strong inner process 0.019–0.025 (0.021) long and 0.007–0.011 (0.009) wide. Basal part 0.020–0.034 (0.031). Point 0.018–0.025 (0.021).

Dorsal bar 0.027–0.038 (0.032)  $\times$  0.003–0.007 (0.005), V-shaped, with the ends slightly widened. No ventral bar.

Marginal hooks of the third pair are larger than the others, 0.032–0.041 (0.038) long, with handle 0.016–0.025 (0.021). First and second pairs 0.021–0.028 (0.025), handle 0.007–0.014 (0.011) and 0.020–0.027 (0.024), handle 0.007–0.012 (0.009), respectively. The rest of the hooks are similar in size: fourth, 0.027–0.035 (0.032), handle 0.012–0.017 (0.016); fifth, 0.026–0.032 (0.029), handle 0.012–0.017 (0.014); sixth, 0.026–0.033 (0.030), handle 0.010–0.017 (0.014); seventh, 0.025–0.031 (0.027), handle 0.009–0.016 (0.012).

The copulatory apparatus measures 0.053–0.068 (0.062). The cirrus is 0.049–0.060 (0.056) long and 0.001–0.003 (0.002) wide in the middle part; the basal part, which is widened, is 0.012–0.018 (0.015) long. The accessory piece runs approximately parallel to the cirrus at the beginning and is elongated in shape; beyond the middle of the tube it widens to form a ring-like structure encircling the tube. Part of this ring is strongly chitinized and part appears membranous. Distally, the ring continues on one side with a tube-shaped chitinous piece surrounding the cirrus and, on the other, with a laminar part, chitinized at the edge, which connects with the distal part of the tubular piece and seems to be flexible as it can appear in different positions. The tubular piece opens distally and has a strongly chitinized end.

The vaginal armour is a narrow tube, more or less S-shaped, which widens at the proximal end and has a triangular piece in the distal end. The tube is 0.024–0.033 (0.028) long along the curvature and 0.002–0.005 (0.003) wide.

Eggs are 0.068–0.083 (0.074)  $\times$  0.050–0.070 (0.061).

Excretory system—to describe the excretory system we have divided the body into three parts: anterior, posterior and haptoral, and designated as "L" the lateral flame cells.

We have observed the following flame cells: Anterior zone:  $2[(3L)+(2+2)+(3+3+3)]$ ; Posterior zone:  $2[(3L)+(3+3)+(3+3)+(3+2)]$ ; Haptor zone:  $2(2+2+1+2)$ .

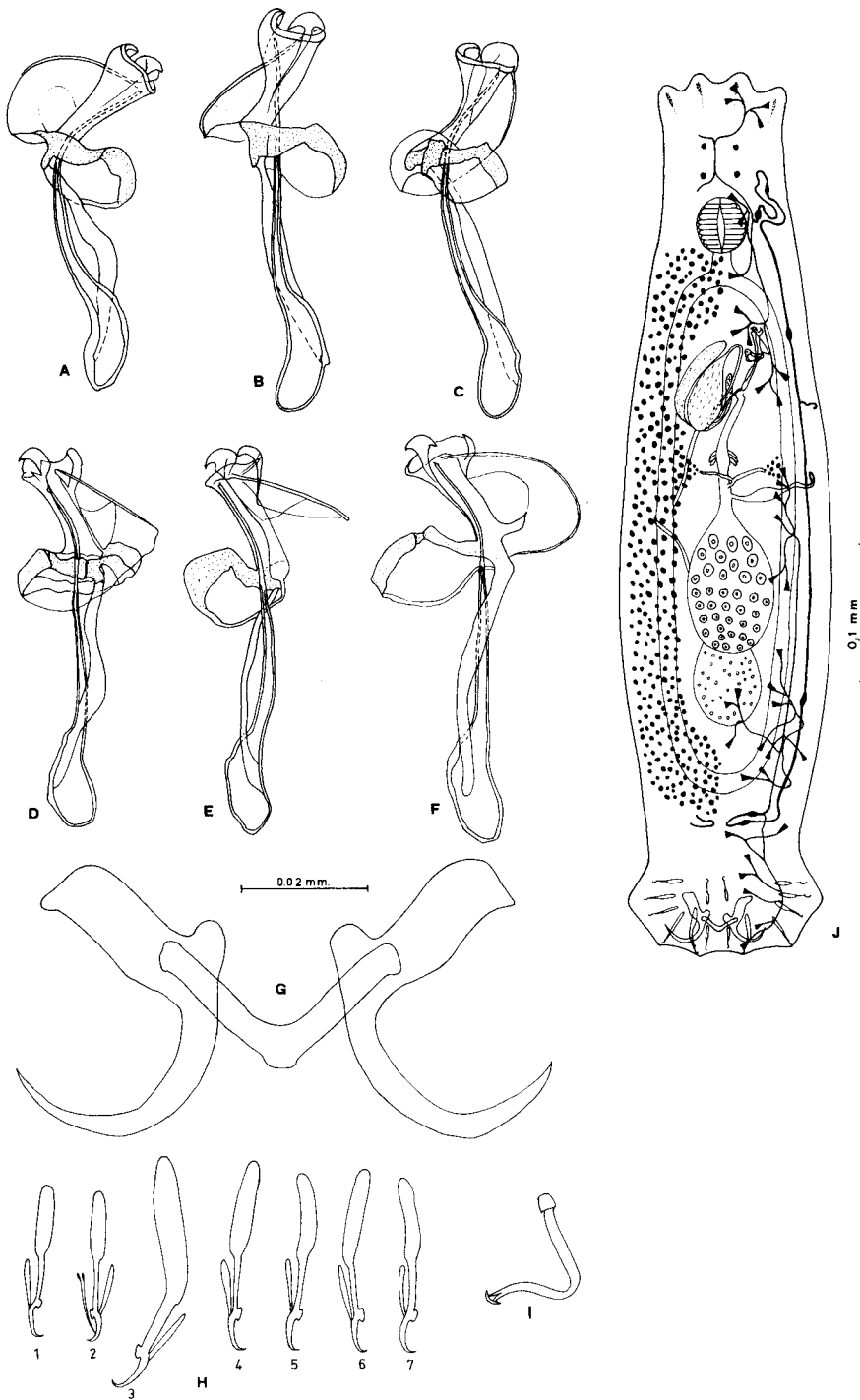


FIG. 1. *Dactylogyrus legionensis* n. sp. A-F.—Copulatory apparatus in different positions; G.—Hamuli and dorsal bar; H.—Marginal hooks; I.—Vaginal armour; J.—Diagram of a whole specimen. Excretory system only represented on the right and vitellaria on the left.

Of the two *Dactylogyrus* spp. previously described from *Barbus barbus bocagei*, *D. bocageii* Alvarez-Pellitero, Simón-Vicente & González-Lanza, 1981 belongs to the "varicorhini" type and is thus completely different from *D. legionensis*. *D. balistae* Simón-Vicente, 1981, although morphologically closer to our species, shows differences which are, in our opinion, sufficiently important to justify their taxonomic separation. *D. balistae* lacks vaginal armour, whereas we have observed it clearly in every specimen of *D. legionensis* studied.

The copulatory apparatus, although similar in both species, has a different structure. This is especially evident in the accessory piece. *D. balistae* shows a rhomboidal piece which separates from a ring-shaped branch and covers the connection between the accessory piece and the tube. *D. legionensis* lacks this rhomboidal piece and we have only observed a membranous part in the ring-like zone; this ring-like structure is always further from the cirrus base than in *D. balistae* and, moreover, in the latter the distal part of the accessory piece ends with an expansion consisting of two triangular blades, each with an opening, and there is a membranous hood surrounding the cirrus and a transparent wing which describes a wide spiral turn. In contrast, in *D. legionensis* the distal part of the accessory piece resembles a tube opening at the edge and ends with two chitinoid processes. There is also a membranous piece, but it is wider and does not describe a spiral turn. The over-all length of the cirrus is similar in both species but the basal part is shorter in *D. legionensis* (0.012–0.018) than in *D. balistae* (0.017–0.021).

The haptor of both species is generally similar, but the *hamuli* of *D. balistae* have a wider inner process (0.013–0.015) and are less incurved.

The other *Dactylogyrus* spp. from *Barbus barbus*, namely, *D. carpathicus* Zakhvatkin, 1951, *D. malleus* Linstow, 1877 and *D. dyki* ERGENS & LUCKY, 1959 all have a ventral bar and differ in the vaginal armour and haptoral structures, although the copulatory apparatus of *D. carpathicus* and *D. dyki* is similar to that in *D. legionensis*.

Other species of *Dactylogyrus* from *Barbus* and *Hemibarbus* are clearly different from *D. legionensis*. Those listed in the key of BYKHOVSKAYA-PAVLOVSKAYA *et al.* (1964) have a ventral bar and are also clearly different in the rest of the chitinoid structures. Those *Dactylogyrus* spp. from *Barbus* spp. which lack the ventral bar were described from Gabon (PRICE & GERY, 1968) and India (GUSEV, 1976) and show differences in the copulatory apparatus and haptoral structures, in addition to different hosts and geographical distribution.

Therefore, we consider our specimens to belong to a new species, named *D. legionensis* in reference to its geographical origin (from *Legio*, the Latin name of León).

#### (B) Prevalence and intensity of infection

30.40% of the barbels were parasitized, with a mean intensity 13.71 (maximum 96, minimum one). Prevalence was highest at Valencia de Don Juan (32.88%) and lowest at Villaornate (19.41%). The mean intensity was highest at Villaornate (23.55), the two other stretches showing lower values (12.6 in Valencia de Don Juan, five in Villafer).

There are therefore no clear differences in the infection levels between the upper and lower stretches of the river.

#### (C) Seasonal variations (Figs. 2 and 3)

Prevalence was maximal in autumn and early winter although there was a significant decrease in October. Following a minimum prevalence in January and

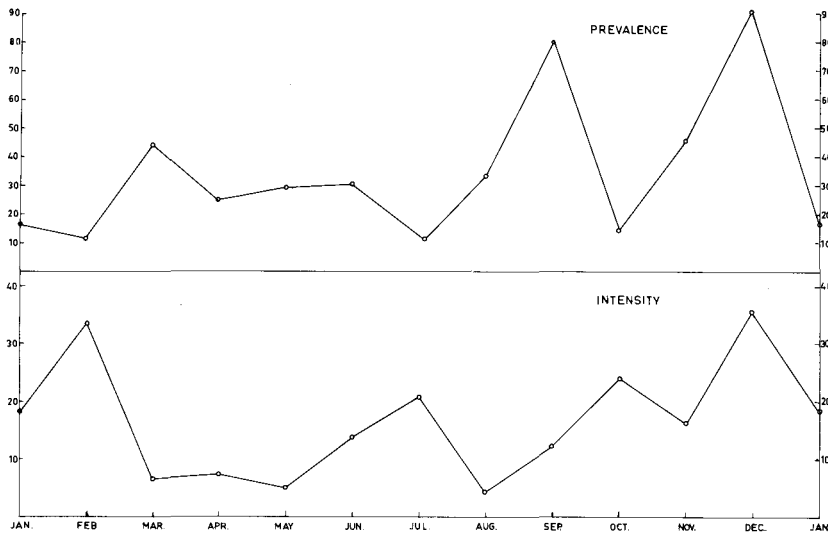


FIG. 2. Seasonal variations of the infections of *Dactylogyrus legionensis* in *Barbus barbus bocagei*.

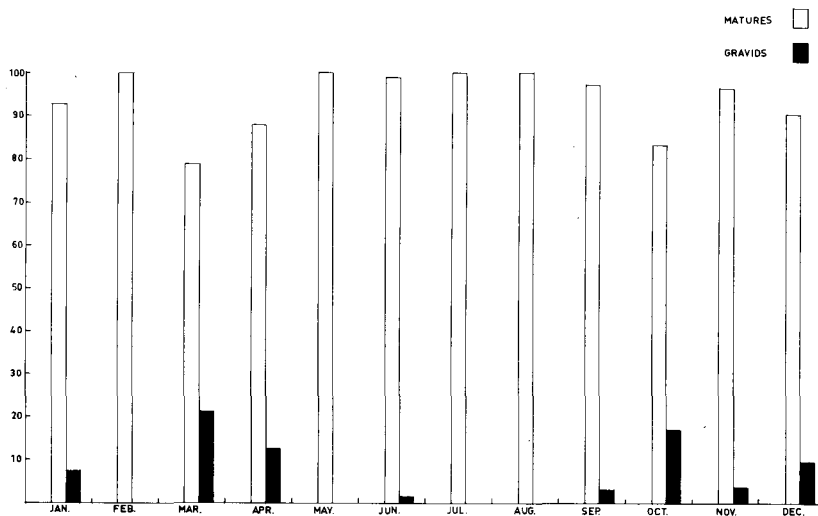


FIG. 3. Seasonal variations in the composition of the population of *Dactylogyrus legionensis* in *Barbus barbus bocagei*.

February, there was a rise in spring followed by another decrease to the minimum level in July.

The intensity curve was a little different; the minimum values were observed in the spring and in August and the maximum in autumn-winter, although there was also a relatively significant increase in July.

Gravid specimens were collected in two periods (Fig. 3), from September to January and from March to June (except May). The highest proportion of gravid worms during the first period occurred in October, and, during the second period, in March.

These results could indicate a relatively low optimal temperature for this dactylogyrid and differ from the observations of SIMÓN-VICENTE (1981) on *D. balistae*, who found this species to be more abundant from March to August and the

percentage of mature worms to be maximal in summer. Our results differ also from other authors' findings on *Dactylogyrus* spp. from Cyprinids; in general, they observed maximum infections in spring-summer and minimum in autumn-winter. (KOMAROVA, 1964; WIERZBICKA, 1974; CHUBB, 1977). Our model of seasonal variations is closer to that found for some dactylogyrids (Ancyrocephalinae) of American centrarchids, which also showed peaks of infection in winter (CRANE & MIZELLE, 1968; HANEK & FERNANDO, 1978a, b).

Most authors consider temperature to be the major factor determining seasonal variations in dactylogyrids, especially through its influence on the biology of the parasite (PROST, 1957; BAUER, 1962; CHUBB, 1975). Nevertheless, in this study, without discounting the influence of temperature, the relationship was not clear, as we observed maximum infections in autumn-winter. It is probable that other abiotic factors (light, pH, O<sub>2</sub>, salinity, etc.) or biotic ones (such as formation of shoals of fish in winter) may contribute to the situation observed.

#### (D) Influence of host factors on the infections

For this study we have only used the data from Valencia de Don Juan and Villaornate, as samples from Villafer were more sporadic.

##### *Age and length* (Table I)

In general, the prevalence and intensity of infection rose with the age and length of the barbel. This increase was statistically significant for the total data and for the Valencia de Don Juan stretch. This is similar to the situation observed by other authors for different species of Monogenea (KUROCHKIN, 1964; PALING, 1965; BAUER *et al.*, 1969).

##### *Sex* (Table II)

There was a tendency for female fish to be more heavily parasitized than males. Although the prevalence was only slightly higher in the former, intensity was significantly higher, both for the total data and the stretches considered separately.

There are few data in the literature dealing with the influence of host sex on Monogenean infections. Our results were in agreement with our own earlier observations on *Dactylogyrus* spp. from *Chondrostoma polylepis polylepis* (see GONZÁLEZ-LANZA *et al.*, 1980) whereas they contradicted the results of PALING (1965) on *Discocotyle sagittata*.

#### (E) Gill distribution (Fig. 4)

*D. legionensis* showed a preference for the second and first gill arches; sector III followed by II and IV; and the internal zone of each hemibranch. The left arches tended to be a little more parasitized than right ones. On the other hand, the anterior hemibranch of the first gill arch was less parasitized than the posterior one, whereas the opposite held for the remaining arches.

This distribution coincided, in part, with that observed by SIMÓN-VICENTE (1981) for *D. balistae* and agreed, in general, with the observations of various authors for different Monogeneans, especially regarding the preference for the second gill arch (OWEN, 1963; WILES, 1968; LAMBERT, 1972; WOOTTEN, 1974; HANEK & FERNANDO, 1978a, b).

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TABLE I. Influence of the age and length of barbels on infections by *Dactylogyrus legionensis*

Stretch of Esla River	Age group	infection %	r	t	Mean	r	t	Length group (cm)	infection %	r	t	Mean	r	t	
															r
Valencia de Don Juan	2	29.41			8.88			18.95	26.66			4.25			
	3	23.45			5.73			22.95	26.59			7.16			
	4	27.58	0.7889	2.5680	9.56	0.8449	3.1644	26.95	25.39	0.8773	3.1671	12.75	0.9972	23.1906	
	5	43.58			9.00			30.95	53.33			16.06			
	6	69.23			22.66			34.95				22.00			
	7	50.00			36.85			38.95	60.00						
															P < 0.001
Villanorrate	2 & 3	14.28			4.33			18.95 &	0			0			
	4	15.38			13.00			26.95	37.51			21.60		2.6685	
	5	33.33	0.8242	2.0600	55.55	0.7001	1.3888	30.95 &	28.57	0.7571	1.1592	26.00	0.9364		
	6	28.57			31.00			34.95							1.0 < P < 0.2
	2	29.41			8.88			18.95	26.66			4.25			
	3	21.56			5.54			22.95	22.12			7.16			
	4	25.35			9.94			26.95	27.27			14.85		11.8066	
TOTAL	5	42.22	0.8533	0.02 < P < 0.05	13.89	0.9027	0.01 < P < 0.02	30.95 &	45.45	0.8339	0.05 < P < 0.1	18.05	0.9894	0.001 < P < 0.01	
	6	55.00			24.18			34.95 &	60.00			22.00			
	7	50.00			36.85			38.95							

TABLE II. Influence of sex of barbels on infections by *Dactylogyrus legionensis*

Stretch of Esla River	Age group	Males			Females			$\chi^2$	Mean		t
		No. of fish examined	No. of fish parasitized	%	No. of fish examined	No. of fish parasitized	%		Males	Females	
Valencia de Don Juan	2&3	71	20	28.16	27	4	14.81	1.2333	6.45	6.00	0.0900
	4	36	8	22.22	21	7	33.33	0.3686	7.50	13.14	0.3 < P < 0.4
	5	20	9	45.00	19	8	42.10	0.0198	4.77	13.75	0.2 < P < 0.3
	6&7	5	3	60.00	23	14	60.86	0.2200	23.33	28.07	0.1631
Total		132	40	30.30	90	33	36.66	0.7147	7.55	18.75	0.001 < P < 0.01
Villanate	2&3	19	3	15.78	2	—	—	—	4.33	—	—
	4	8	1	12.50	5	1	20.00	0.1809	2.00	24.00	0.5 < P < 0.7
	5	—	—	—	6	2	33.33	—	—	55.55	—
	6&7	1	—	—	6	2	33.33	—	—	31.00	—
Total		28	4	14.28	19	5	26.31	0.4237	3.75	39.40	6.1596
TOTAL		160	44	27.50	109	38	34.86	1.3291	7.20	21.47	3.8045
								0.2 < P < 0.3			P < 0.001
								0.5 < P < 0.7			P < 0.001





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