

Seasonal dynamics of the occurrence and maturation of *Rhabdochona canadensis* in its definitive host, *Notropis boucardi*, of the Chalma River, State of Morelos, Mexico

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Summary

Data on the seasonal variations in the occurrence and maturation of *Rhabdochona canadensis* in its definitive host *Notropis boucardi* are provided, based on samples of fish collected every two months from January to November 2002. A total of 90 fish were examined, collected in the Chalma River, locality "El Platanar", near the village of Palpan in the State of Morelos, Mexico. The nematode occurred in fish throughout the study period, with the highest values of prevalence and mean intensity in May and January, respectively. Gravid female nematodes with mature eggs were present throughout the period of study.

Key words: *Rhabdochona canadensis*; *Notropis boucardi*; seasonal dynamics; Chalma River; Mexico; Morelos

Introduction

Notropis boucardi (Günther, 1868) belongs to the Cyprinidae and it is an endemic fish of Central Mexico in the Balsas River drainage system.

According to Caspeta-Mandujano (2003) 8 species of *Rhabdochona* have so far been reported from freshwaters in Mexico: *R. ahuehuellensis* Mejía-Madrid et Pérez-Ponce de León, 2003, *R. canadensis* Moravec et Arai, 1971, *R. guerreroensis* Caspeta-Mandujano, Aguiler-Aguilar et Salgado-Maldonado, 2002, *R. kidderi* Pearse, 1936, *R. lichtenfelsi* Sánchez-Alvarez, García-Prieto et Pérez-Ponce de León, *R. mexicana* Caspeta-Mandujano, Moravec et Salgado-Maldonado, 2000, *R. salgadoi* Caspeta-Mandujano et Moravec, 2000, and *R. xiphophori* Caspeta-Mandujano, Moravec et Salgado-Maldonado, 2001. However, only in one of these species, *R. kidderi*, the seasonal maturation cycle has been studied in two definitive hosts, *Cichlasoma*

nigrofasciatum (Günther, 1867) and *Rhamdia guatemalensis* (Günther, 1964) by Caspeta-Mandujano *et al.* (2000) and Moravec *et al.* (2002).

Materials and Methods

The population dynamics of *R. canadensis* (Moravec et Arai, 1971) was followed in *Notropis boucardi* (Günther, 1868) (Cyprinidae, Cypriniformes) from the Chalma River in the locality "El Platanar", near the village of Palpan, State of Morelos, which opens into the Amacuzac River and belongs to the Balsas River drainage system. Every two months, fish samples were taken from the locality by using an electric fishing machine from January to November 2002. Fish were examined for helminth parasites at the laboratory of the Centre for Biological Research, University of Morelos, within 24 hours after being caught. A total of 90 specimens of *N. boucardi* were examined. In addition, occasional examinations of 10 *Heterandria bimaculata* (Heckel, 1848) from the same locality were examined. The nematodes were fixed in hot 4 % formaldehyde and stored in 70 % ethanol. The specimens have been deposited in the National Parasitological Collection of the Autonomous University of Morelos State, Mexico. The scientific names of fishes are according to Fish Base.

Results

Definitive host of Rhabdochona canadensis and its feeding habits

In the locality of study, *N. boucardi* is the only definitive host of the nematode because it is the only cyprinid present in the river. Definitive host specificity of *R. canadensis* in

Cyprinella lutrensis (Cyprinidae) in Nebraska, USA has been demonstrated by Barger and Janovy (1994). In addition, the first author has observed that the nematode species occurs only in *N. boucardi* in localities where it was found along the Balsas River drainage system.

The stomach contents of *N. boucardi* is being studied by the joint author (H. Mejía-Mojica), who has observed that there are almost no changes in the composition of items ingested by the fish throughout the period studied (1 year). Its food includes larvae of aquatic insects, ephemeropterans, trichopterans and dipterans (personal communication). It is important, from a parasitological point of view that ephemeropterans and trichopterans, which probably are the source of *R. canadensis* infection for *N. boucardi*, formed a significant component of the diet of the host throughout the year. The life cycle of *R. canadensis* is unknown.

considered were present almost all over the year. The larvae and females without eggs have the highest percentages in January and June and the lowest in March with their absence in November. Egg-producing females were found throughout the study period. Their lowest value of proportion, 10 %, was found in July, coinciding with the rainy season (June – September), their proportion increase gradually in September reaching the maximum value in November, the same pattern is observed in males.

The numbers of individual developmental stages of *R. canadensis* in *N. boucardi* on every two months samples are shown in Fig. 2. The data of every two months changes of the mean numbers of specimens of individual stages confirm that the highest number of larvae and juvenile females occurs in January (4.4), with their absence in November (Fig. 2), when the maximum numbers of *R. canadensis* males and females with mature eggs were present.

Table 1. Survey of *Notropis boucardi* examined from the Chalma River and its infection with *Rhabdochona canadensis*

Year and month	No. of <i>N. boucardi</i> examined	Fish length (mm) (mean-range)	No. of <i>N. boucardi</i> infected	Prevalence (%)	Intensity of infection (mean-range)	No. of specimens in sample
2002						
January	15	68 (52 – 79)	13	86	10.5 (1 – 45)	137
March	15	67 (53 – 78)	8	53	6.6 (1 – 14)	53
May	15	66 (42 – 75)	15	100	3.9 (1 – 16)	59
July	15	66 (49 – 80)	13	87	4.0 (1 – 20)	52
September	15	63 (40 – 78)	6	40	2.0 (1 – 4)	12
November	15	69 (55 – 75)	15	100	5.4 (1 – 10)	45
Total	90	67 (49 – 77)	70	78	5.0 (1 – 45)	313

Occurrence of *Rhabdochona canadensis* in fish host

Of the 90 specimens of *N. boucardi* examined, 55 (prevalence 61 %) were infected with *R. canadensis*, and the intensity of infection was 1 – 45 (mean 5) nematodes per fish.

The number of *N. boucardi* examined and their infection with *R. canadensis* is given in Table 1. The nematodes occurred in all sizes of *N. boucardi* examined.

Seasonal changes in the occurrence of *Rhabdochona canadensis* in *N. boucardi*

A survey of every two months prevalence and mean intensity of *R. canadensis* in *N. boucardi* is shown in Table 1. *R. canadensis* was recorded from *N. boucardi* during the whole period studied. Prevalence was high almost all the year round, except in September with (40 %), with the highest value in May and November (100 %). The highest mean intensity values were observed in January, followed by a gradual decrease, reaching the minimum in September and increasing again in November.

Seasonal changes in the maturation of *Rhabdochona canadensis*

The states of maturation of *R. canadensis* in individual samples made every two months from *N. boucardi* are shown in Figs. 1 and 2. The fourth stages of maturation

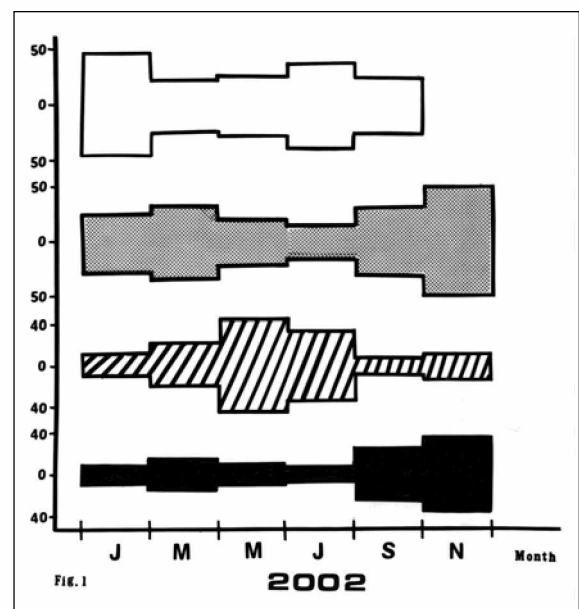


Fig. 1. Every two months changes in the occurrence and state of maturation of *Rhabdochona canadensis* in *Notropis boucardi* from the locality "El Platanar" from January to November 2002. The data are expressed as percentages of the total number of nematodes found per month: larvae and females without eggs (unshed), males (stippled), females with immature eggs in uteri (obliquely hatched) and gravid females with mature eggs in uteri (blackened)

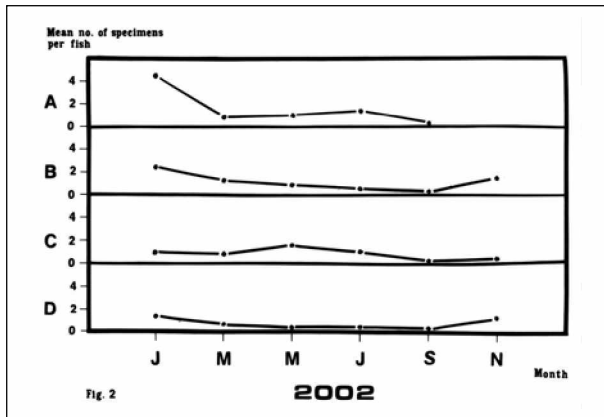


Fig. 2. Every two months changes in mean numbers of specimens of individual stages of *Rhabdochona canadensis* per fish
A – larvae and females without eggs; B – males; C – females with immature eggs; D – females with mature eggs

Discussion

In the Americas, only two papers have been published dealing with the seasonal occurrence and maturation of a rhabdochoniid species, both from Mexico and from the same species, *R. kidderi*, but from different hosts and localities. One of them treats *R. kidderi* in *Cichlasoma nigrofasciatum* of the Amacuzac River in the State of Morelos (Central Mexico) (Caspeta-Mandujano *et al.*, 2000), whereas the other deals with *R. kidderi* in *Rhamdia guatemalensis* from the cenote (= sinkhole) Ixin-há in the State of Yucatán, Southeastern Mexico (Moravec *et al.*, 2002).

The prevalence and intensity of infection of the nematode *R. canadensis* in the host were high all the year round. Females producing eggs occurred throughout the year with the lowest occurrence of both males and females during the rainy season, which occurs from June to October in central Mexico and makes drastic changes in water bodies, mainly in rivers. Apparently, most aquatic insects emerge before this period, i.e. during April and May. Similar pattern of occurrence in *R. kidderi* was reported by Caspeta-Mandujano *et al.* (2000) in *C. nigrofasciatum* of the Amacuzac River in the State of Morelos and Moravec *et al.* (2002) in *R. guatemalensis* from the cenote Ixin-há in the State of Yucatán. An indistinct patterns of occurrence and seasonal maturation cycles have been reported in the European species *R. denudata* from the Czech Republic (Moravec, 1989), *R. anguillae* and *R. gnedini* from Portugal (Saraiva *et al.*, 2002a,b), and in the Japanese species *R. zacconis* (Moravec *et al.*, 1998).

The life cycle of *R. kidderi* was study by Moravec and Huffman (2001) in Texas, USA; they reported the nymphs

of ephemeropterans (*Tricorythodes curvatus*) to be the natural intermediate host of *R. kidderi* in Texas. Although in Mexico nothing is known about the life cycle of any species of *Rhabdochona*, it is possible to assume that ephemeropterans are the intermediate hosts of *R. canadensis*, because their nymphs are one of the main components of the diet of *N. boucardy* in the Chalma River.

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