

## Occurrence of *Sciadicleithrum mexicanum* Kritsky, Vidal-Martinez et Rodríguez-Canul, 1994 (Monogenea: Dactylogyridae) in the Cichlid *Cichlasoma urophthalmus* from a Flooded Quarry in Yucatan, Mexico

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*Cichlids, Cichlasoma urophthalmus, collected in a flooded quarry in the Yucatan Peninsula, Mexico, from January through June 1992, had high levels of infection with the ancyrocephaline Sciadicleithrum mexicanum (Monogenea: Dactylogyridae) in all monthly samples. Neither occurrence nor maturation of the worms exhibited any pronounced monthly fluctuation. The infection rate was found to be sizedependent, greater in longer fish. The worms occurred on primary lamellae of gill filaments of all arches, with lower numbers of parasites attached to the fourth gill arch. Otherwise, there was no significant site preference of worms. Only minor histopathological changes were found at the sites of attachment, and these were restricted to the epithelial cells of the primary lamellae of the gill filaments. The lack of seasonal periodicity in this tropical monogenean is compared to seasonal cycles typical of temperate species.*

Key words: Monogenea - occurrence - maturation - Ancyrocephalinae - cichlid fishes - Mexico

Very limited information is available about ecology, including seasonality in the occurrence and maturation, of monogeneans from the Neotropical Region, including Mexico (see Chubb 1977, 1988). During parasitological examination of the cichlid *Cichlasoma urophthalmus* (Günther, 1862), from a flooded quarry in the Yucatan Peninsula, Mexico, the monogenean *Sciadicleithrum mexicanum* Kritsky, Vidal-Martinez et Rodríguez-Canul, 1994 was found on the gills of these fish (Kritsky et al. 1994). Data on the occurrence and ecology of this ancyrocephaline parasite are presented in this paper.

### MATERIALS AND METHODS

The study site was a flooded quarry in the Mitza limestone factory, 30 km north of Merida, Yucatan (21°15'N, 89°40'W). The total area of water body is 9.3 ha and average depth of the water is 5.2m, with a maximum depth of 8.5m (Flores-Nava 1990). The only helminth recorded from the gills of *C. urophthalmus* was *S. mexicanum*.

A total of 104 fish was sampled, using a cast net from January to June 1992, i.e. during the dry season. Intervals between individual samples fluctuated from 6 to 25 days, and number of specimens in individual months varied from 6 to 36 (Table I). The fishes were transported live to the laboratory, where they were kept together in aerated swamp water in 1000 l aquaria. Over the following 1-3 days, they were killed, their gills removed and placed in Berland solution and immediately transferred to petri dish with 70% alcohol. After fixation, each gill arch was examined separately under a dissecting microscope and the number of worms was counted. Data were analyzed according to the parameters recommended by Margolis et al. (1982): prevalence of infection and mean intensity of infection.

To evaluate their state of maturity, worms were stained with trichrom of Gomori (modification by Salgado-Maldonado 1979) and mounted in Canada balsam as permanent preparations. They were divided into the following three categories: (1) juveniles: body length (without haptor) less than 0.10 mm; eye-spots not fully developed, with diffused margins, eye-spots of the anterior pair considerably smaller than these of posterior pair; testis, cirrus, ovary, vitellaria, vagina and uterus absent; (2) immatures: body length

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0.10-0.15 mm; eye-spots well developed, compact, eye-spots of the anterior pair the same size as those of the posterior pair; testis, ovary and vagina all fully formed; cirrus and vitellaria not fully developed; (3) adults: body larger than 0.15 mm; all sexual organs fully developed.

The specimens used in the microscopic evaluation (18,633 specimens, i.e. 83.7% of the total number collected) were those which showed clear characteristics of only one of these maturation classes; those specimens with inadequate preparation, or showing transitional morphological states were not used.

To examine the relationship between infection intensity and host body size, all fish were analyzed using correlation coefficients diagram of dispersion. Differences in numbers of helminths in individual gill arches and sides (left, right) was tested using  $\chi^2$ .

To evaluate the histopathological effects of the monogeneans on the host, an additional 30 *C. urophthalmus* from Mitza were collected and each infected gill filament was cut off and immediately fixed in 10% buffered formalin. Subsequently, these were embedded in paraffin wax, and sections 5  $\mu$ m thick were taken from three levels of each block, and stained with haematoxylin-eosin (Sommerville 1982).

## RESULTS

**Infection level** - Of 104 fish examined, 99 were infected with *S. mexicanum*. A total of 22,125 worms was counted, yielding a mean intensity of infection of 223 worms/fish, with a range of 5-1334 parasites (Table I). With the exception of April, when only one of six fish was infected, all hosts harboured parasites, i.e. prevalence was 100%. Mean intensity of infection varied from 67 in January to 327 parasites/host in June (Table I; Fig. 1). There were no statistically significant differences in mean intensity values between individual sampling dates ( $P = 0.7197$ ; Fig. 1).

**Monthly variation in maturation** - A total of 5,735 worms (i.e. 31%) were juveniles, 6,177 (34%) immatures and 6,721 (36%) adults. Although the percentages of monogeneans in different maturation groups fluctuated between months (Fig. 2), there was no distinct pattern in the monthly variations, with the exception of dominant proportion (73%) of juvenil worms in sample from March (Fig. 2).

**Infection intensity-body length relationship** - Comparison of the level of infection between fish of different length groups revealed that larger fish carried heavier parasite loads (Fig. 3).

TABLE I

Occurrence of *Sciadicleithrum mexicanum* in *Cichlasoma urophthalmus* in Mitza, Yucatan, Mexico

1992 Date	Fish exam.	Fish inf.	Preva- lence	Total worms	Intensity of infection		
					mean S.D	(min. - max.)	$x/s^2$
29 Jan.	9	9	100	608	67.0 $\pm$ 59.1	16 - 131	52.44
5 Feb.	8	8	100	1751	218.8 $\pm$ 66.5	151-350	20.25
14 Feb.	9	9	100	1637	181.8 $\pm$ 128.9	15 - 348	91.40
25 Feb.	6	6	100	1454	242.3 $\pm$ 125.7	89 - 370	65.29
16 Mar.	10	10	100	1413	141.3 $\pm$ 155.2	23 - 550	170.55
23 Mar.	10	10	100	1975	197.5 $\pm$ 164.3	23 - 432	136.75
9 Apr.	6	1	17	168	168.0 $\pm$ 68.8	0 - 168	168.00
4 May	10	10	100	2447	244.6 $\pm$ 92.5	52 - 356	34.98
12 May	8	8	100	2927	367.0 $\pm$ 182.7	114 - 648	90.89
19 May	10	10	100	1193	119.3 $\pm$ 132.7	5 - 357	147.78
27 May	8	8	100	3287	410.8 $\pm$ 402.3	88 - 1334	394.12
3 Jun.	10	10	100	3265	326.5 $\pm$ 114.7	103 - 533	40.29
Total	104	99	95	22125	223.0	5-1334	

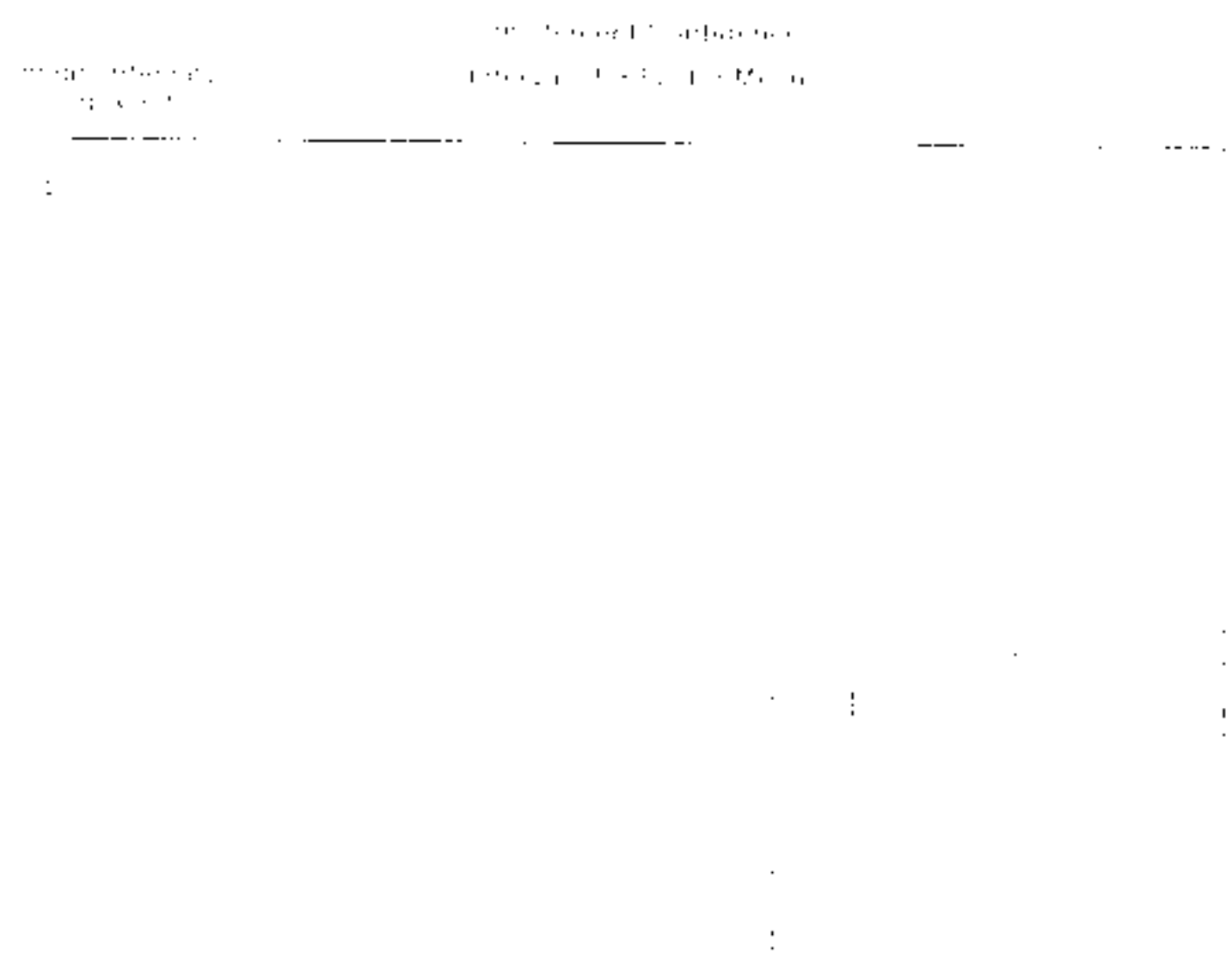


Fig. 1: seasonal variation of mean intensity and standard error of *Sciadicleithrum mexicanum* infection (expressed as log x + 1).

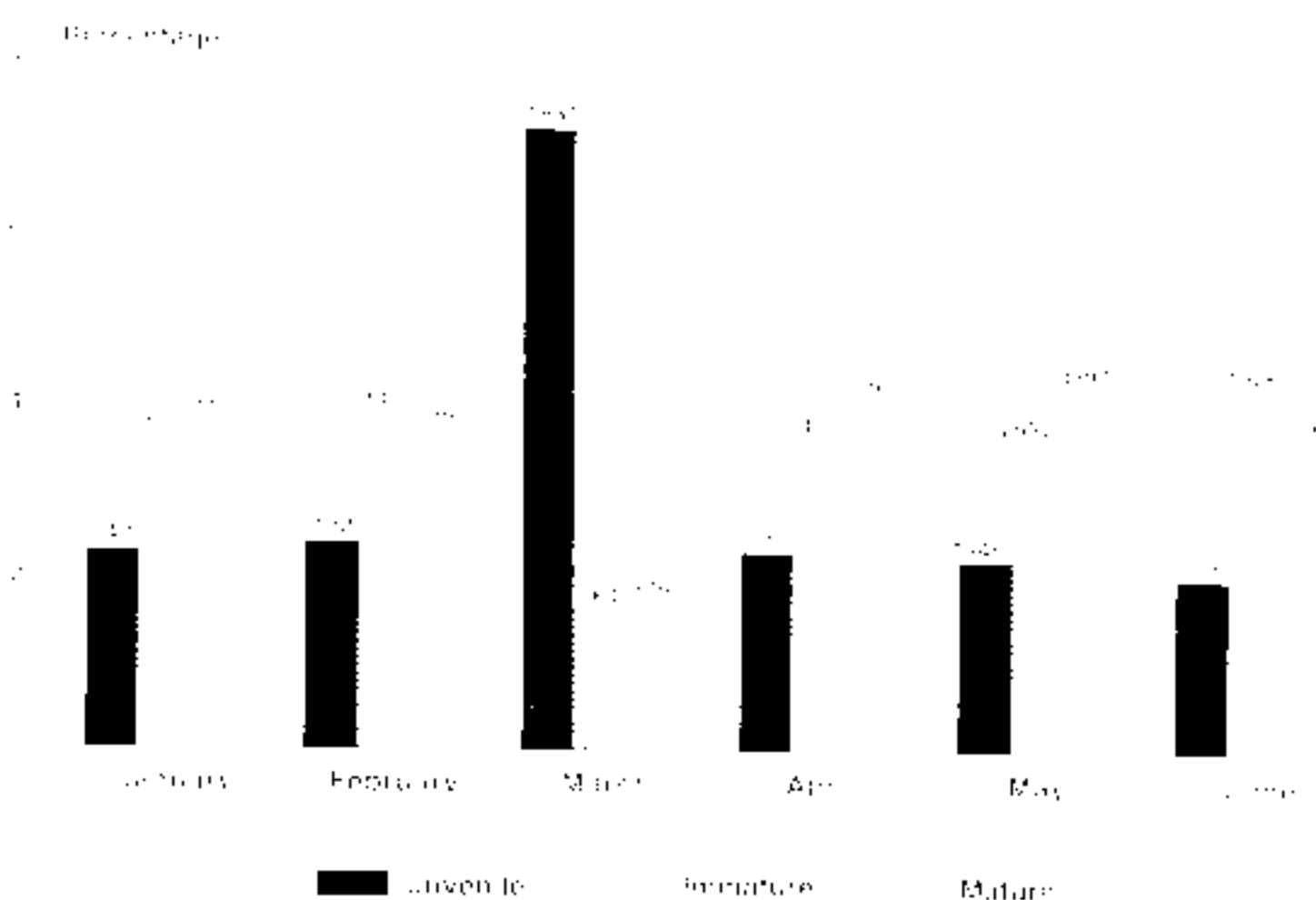


Fig. 2: distribution of *Sciadicleithrum mexicanum* of different age groups in *Cichlasoma urophthalmus* from a swamp in Mitza, Yucatan, Mexico. White-juvenile worms, stippled-immature, black-mature. Numbers above bars represent worms evaluated.

**Attachment site** - The parasites were found on primary lamellae of all gill arches (Table II), but less frequently on the fourth. There were no statistical differences between numbers of worms on gill arches I-III (Table II). On the other hand, there was a different number of worms attached on individual arches of different sides of the body (left and right) with higher values on the right side in some samples (Table II).

**Histopathology** - Parasites were found attached to epithelial cells of primary lamellae of

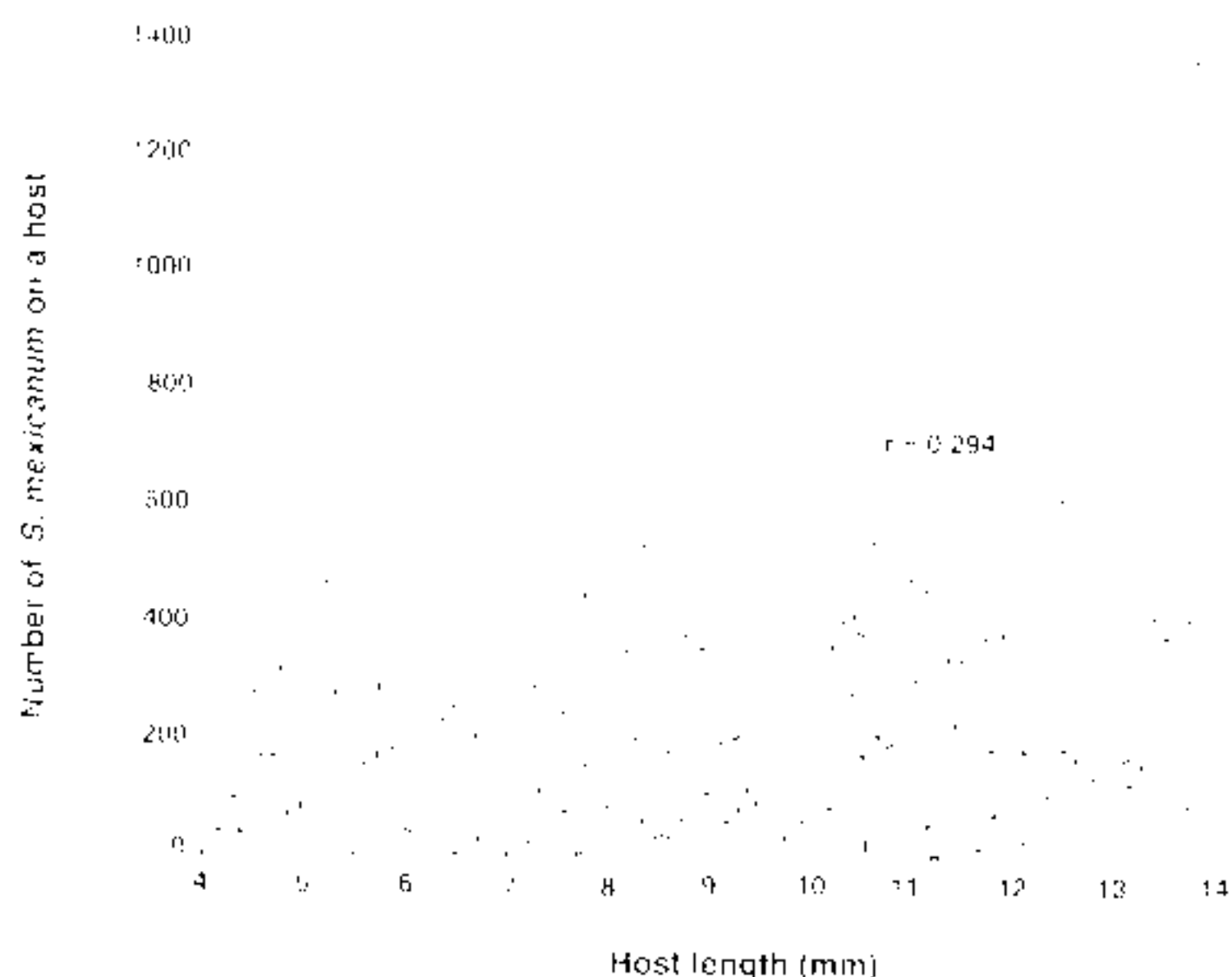


Fig. 3: relationship between standard length of *Cichlasoma urophthalmus* and mean intensity of *Sciadicleithrum mexicanum* infection.

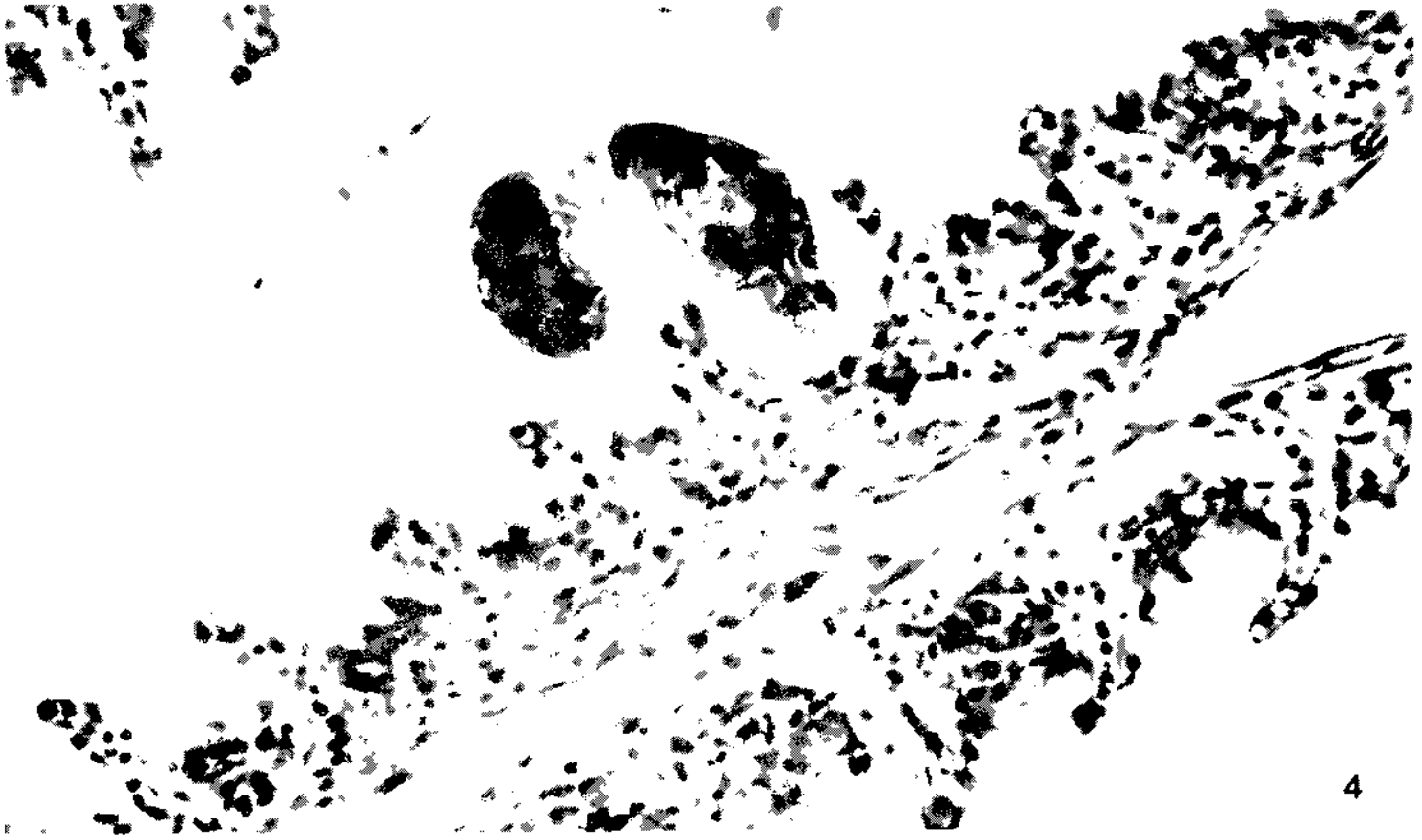
gill filaments, where they caused slight necrosis of these cells due to both the attachment of their opisthaptor (Fig. 4) and penetration of their median hooks (anchors; Fig. 5).

**DISCUSSION**

Since the review of Chubb (1977), in which a shortage of studies on monogeneans in the tropics was mentioned, only two papers dealing with the ecology and development of ancycrocephaline monogeneans in South and Middle America have been published (Suriano 1989a,b). Her results showed a heavy infection of the fish host, *Corydoras paleatus*, with *Philocorydoras platensis* (Suriano 1989b), and distinct seasonality in both the occurrence and maturation of this worm, with new infections restricted to December and to July (Suriano 1989b).

In contrast, during the present study, no pronounced monthly variations in the occurrence or maturation of *S. mexicanum* were recorded and juveniles as well as mature specimens were found in all months sampled. This fact might indicate a continuous recruitment of the parasite during this period of the dry season. Nevertheless, it must be pointed out that the present observations were limited to six months, while Suriano's study (1989b) lasted one year. In addition, Suriano (1989a,b) studies were in a subtropical zone 2b after Chubb (1977), where pronounced fluctuations of temperature and seasons occur, whereas the present observation was performed in the tropical zone 1b during the dry season, typified by relatively stable climatic conditions with only slightly increasing mean temperatures from January to May (Carta Hidrologica de Climmas 1981).

The life-span of dactylogyrid monogeneans parasitizing fishes in temperate zones is reported to be from two to six months (Euzebey 1966). Results of the present study, even though prelimi-



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Section through gill filaments with attached *Sciadicleithrum mexicanum* worm; hematoxylin-eosin. Magnification: Fig. 4: 40 x. Fig. 5: 25 x.

nary, seem to tally with this statement, indicating a relatively short life-span of the parasites. Although a short period of the study did not enable to estimate precisely the seasonality of the occurrence and maturation of *S. mexicanum*, the pres-

ence of juvenile worms in all samples indicated that the recruitment occurred continuously, without any pronounced seasonality. However, considerably higher proportion of juvenile worms compared to that of immature and adult parasites

TABLE II

Number of parasites on hemibranches (left - L, right - R) on different gills arches of *Cichlasoma urophthalmus* from Mitza

Arch	1		2		3		4		Total No. worms
	R	L	R	L	R	L	R	L	
Jan.	68	63	66	79	99	95	85	53	608
Feb.	641	655	729 <sup>a</sup>	575 <sup>b</sup>	596	637	519	490	4842
Mar.	532	538	502	450	451 <sup>a</sup>	302 <sup>b</sup>	342	271	3388
Apr.	16	24	19	24	23	25	17	20	168
May	1544	1461	1442 <sup>a</sup>	1314 <sup>b</sup>	1427 <sup>a</sup>	1129 <sup>b</sup>	803	734	9854
Jun.	582 <sup>a</sup>	478 <sup>b</sup>	433	392	451	368	260	301	3265
Total	3383 <sup>a</sup>	3219 <sup>b</sup>	3191 <sup>a</sup>	2834 <sup>b</sup>	3047 <sup>a</sup>	2556 <sup>b</sup>	2026 <sup>a</sup>	1869 <sup>b</sup>	22,125
	6602		6025		5603		3895		

<sup>a, b</sup> = significant difference ( $P < 0.05$ ;  $\chi^2$ )

in March might indicate quantitative differences in recruitment rate between individual months of the study.

The present study also revealed that larger fish harboured significantly higher numbers of monogeneans, but differences in infection rates between fish of individual size groups were not so markedly pronounced as in other species of monogeneans (see, e.g., Chubb 1977, Buchmann 1989, Suriano 1989b).

Evaluation of attachment sites revealed lower numbers of worms on the fourth gill arch, similar to results of Mackenzie (1970). Otherwise no differences were found in the site of attachment of *S. mexicanum* on other gill arches of *C. urophthalmus*. As indicated by some authors (Mackenzie 1970, Rohde 1981, Buchmann 1988), this site preference could be explained by smaller size (surface) of the fourth arch and, consequently, smaller area available for attachment. Higher numbers of *S. mexicanum* attached to gill arches on the right side compared to that on the left side can hardly be explained. Rohde (1979) mentioned different sides of gills as possibly niches for attachment of ectoparasites, but no details have been provided about this. Suriano (1989b) did not report any differences in microhabitat of *Philocorydoras platensis* on the gills of its fish host.

There are several studies on the effects of monogeneans to their fish hosts (Paperna & Steinitz 1980, Wells & Cone 1990). However, almost all of these have been performed in temperate areas. Histological evaluation showed that *S.*

*mexicanum* damaged tissues of the gills of *C. urophthalmus* almost exclusively at the site of attachment and this damage was recorded only in epithelial cells. Consequently, the pathogenic effect of attached worms was found to be only slight.

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