ENDOPARASITES OF TWO SPECIES OF EDIBLE FROGS, *Limnonectes macrodon*, Boie AND *Fejervarya cancrivora*, Gravenhorst, FROM BOGOR, INDONESIA

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Abstract: Seventy five adult *Limnonectes macrodon* and 50 *Fejervarya cancrivora* collected from three subdistricts in Bogor were analysed for endoparasites. We found eleven species of parasites; seven species from the phylum Nematoda (Rhabditidia, Spirurida, Heterokiodea, Oxyurida, *Oxyuris* spp., Cosmocercoidea, Ascaridida), one species from the class Cestoda (pleurocercoid larvae) and three species from the class Trematoda (Haematoloechus, Allocreadiidae, Paramphistomidae). Most species and individual parasites were found in the frogs'digestive tracts. In all the subdistricts *F. cancrivora* was more infected than *L. macrodon*. One type of parasite (pleurocercoid) was found in the leg muscles of both species of frogs. *F. cancrivora* had ə higher prevalence of pleurocercoid infection (38%) than *L. macrodon* (5.3%). The differences of endoparasite infection is related to differences in habitat type and food.

Keywords: *Fejervarya cancrivora; Limnonectes macrodon*, edible frogs, Bogor, Indonesia, endoparasite

Endoparasit pədə dua jenis katak yang dikonsumsi, *Limnonectes macrodon*, Boie and *Fejervarya cancrivora*, Gravenhorst, dari Bogor, Indonesia

Abstrak: Penelitian mengenai endoparasit dilakukan pada 75 ekor *Limnonectes macrodon* dan 50 ekor *Fejervarya cancrivora* dewasa yang di ambil dari tiga kabupaten di Bogor (Caringin, Cimanggis` and Cibatok). Hasil penelitian menemukan sebelas spesies parasit antara lain tujuh spesies dari filum Nematoda (Rhabditidia, Spirurida, Heterokiodea, Oxyurida, *Oxyuris* spp., Cosmocercoidea, Ascaridida), satu spesies dari kelas Cestoda (larva pleurocercoid) dan tiga spesies dari kelas Trematoda (Haematoloechus, Allocreadiidae, Paramphistomidae). Umumnya parasit dijumpai di saluran pencernaan. *F. cancrivora* lebih banyak terinfeksi parasit dibandingkan *L. macrodon* di semua lokasi. Satu jenis parasit (pleurocercoid) dijumpai pada otot paha ke dua jenis katak. *F. cancrivora* memiliki prevalensi terinfeksi pleurocercoid lebih tinggi

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(38%) daripada *L. macrodon* (5,3%). Perbedaan infeksi endoparasit pada ke dua jenis katak ini diduga berhubungan dengan perbedaan habitat serta makanan

Kata kunci: *Fejervarya cancrivora; Limnonectes macrodon,* katak yang dapat dikonsumsi, Bogor, Indonesia, endoparasit

INTRODUCTION

The Giant Java Frog, *Limnonectes macrodon* and the Crab-eating Frog, *Fejervarya cancrivora* are two species commonly caught for consumption in South East Asia (Berry, 1975; Church, 1960; Iskandar, 1998). There are only three reports of parasite communities associated with *F. cancrivora,* allfrom Indonesia (Purnomo & Bangs, 1996, 1999; Sunityoso et al., 1997) and no report on *L. macrodon* parasites. The only published report on *L. macrodon* parasites is that by Fusco and Palmieri (1979) from Malaysia. In this paper, we present the result of endoparasite surveys of the two species caught in Bogor, part of West Java province (Java Island), Indonesia.

MATERIALS AND METHODS

Collection and examination of frogs

All frogs were wild frogs caught by harvesters in selected areas of the Caringin, Cibatok and Cimanggis subdistricts in Bogor (West Java province) during July to September 2002 (Figure 1).

A total of 75 *L. macrodon* (32 from Caringin, 24 from Cibatok and 19 from Cimanggis) and 50 *F. cancrivora* (25 from Caringin, 10 from Cibatok and 15 from Cimanggis) were dissected and examined in the Laboratory of Helminthology, Department of Parasitology and Pathology, Faculty of Veterinary Medicine, Bogor Agricultural University. The sizes of the frogs examined are given in Table 1.

Table 1. Weight and Length (Snout Vent Length/SVL) of frogs examined

Location	*L. macrodon* (mean ± SD)		*F. cancrivora* (mean ± SD)	
	SVL (cm)	mass (gr)	SVL (cm)	mass (gr)
Caringin	7.69 ± 0.69	49.88 ± 14.00	7.76 ± 1.16	50.76 ± 24.24
Cimanggis	7.87 ± 0.84	51.22 ± 13.88	8.04 ± 0.71	56.36± 14.43
Cibatok	9.34 ± 1.16	75.89 ± 22.52	7.55 ± 0.83	42.04± 12.30

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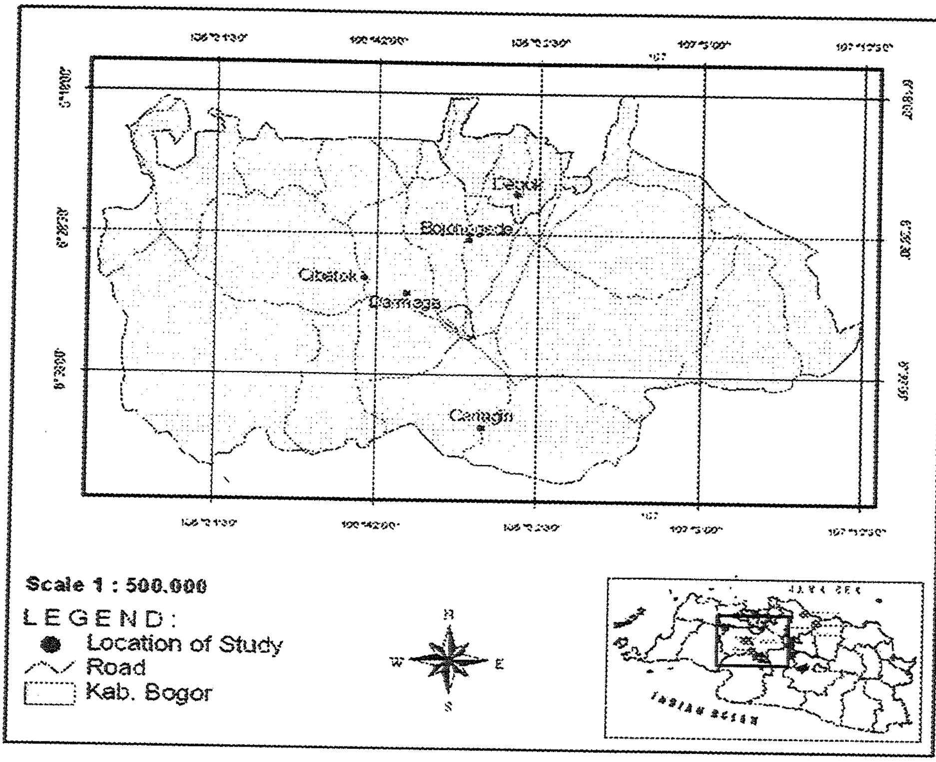

Figure 1. Location of study in Bogor, West Java province, Indonesia

Collection and preservation of parasites was carried out according to methods outlined by Pritchard and Kruse (1982). The frogs were killed and then weighed and skinned. The body cavity of each frog was opened and the viscera (liver, lungs, heart and digestive tract) were subsequently removed and placed in individual plastic containers with saline solution. Each organ was then torn open or cut apart with scissors to allow exposure of parasites. Digestive tract contents were then placed in individual petri dishes and examined for parasites, using a stereo microscope. Worms found in each organ were washed in saline solution and allowed to relax overnight in saline solution at 10°C, before being fixed and stored in 70% ethanol. We also examined the leg muscles of each frog for plerocercoids.

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The parasites found from each organ were examined using a compound microscope to determine the parasite's order, family and genus. Trematode specimens were stained with Mayer's carmalum to display their internal organs for identification (Pritchard and Kruse, 1982). Identification was made based on those used by Smyth and Smyth (1980) and Yamaguti (1961).

We calculated prevalence (percentage of hosts infected with the parasites) and parasite abundance (number of parasites per examined host). Differences between the number of frogs infected between location and between species were tested using a chi-square test. For female *F. cancrivora* the relationship between intensity of infections and host snout vent length (SVL) was determined by correlation analysis and tested using one way ANOVA for Oxyurida, Paramphistomidae and Pleurocercoid.. No tests on the relationships between intensity of infections and host SVL were made for male *F. cancrivora* because of lack of sample size (n=4), nor for *L. macrodon* since the frequency of infection was too small to allow statistical analysis .

RESULT

Eleven species of parasites, including seven species from the phylum Nematoda (Rhabditidia, Spirurida, Heterakiodea, Oxyurida, *Oxyuris* spp., Cosmocercoidea, Ascaridida), one species from the class Cestoda (pleurocercoid larvae) and three species from the class Trematoda (Haematoloechus, Allocreadidae, Paramphistomidae) were recovered.

A total of seven species of nematode were found in *L. macrodon* and *F. cancrivora*. All seven were found in *L. macrodon*, but Ascaridida and *Oxyuris* spp were not found in *F. cancrivora*. Pleuroceroid larvae were found in both *L. macrodon* and *F. cancrivora*, as were all three species of trematode (Haematoloechus, Allocreadidae, Paramphistomidae).

Table 2 shows the infection prevalence of parasites in both species. Oxyurida and Heterakoidea were the most common species found in *L.*

macrodon, while pleurecercoid larvae and Oxyurida were the most common parasites found in *F. cancrivora*.

Table 2. Prevalence, mean intensity ± standard deviation and maximum intensity of parasite infection on *L. macrodon* (75) and *F. cancrivora* (50) from Bogor , Indonesia caught between July-September 2002

Type of Parasite	Site of infect-ion	*L. macrodon*			*F. cancrivora*		
		Prevalen-ce (%)	Mean Intensity	Max Intensity	Prevalen-ce (%)	Mean Intensity	Max Intensity
Nematoda							
Rhabditidia	DT	13.33	6.58 ± 1.30	13	16	12.75 ± 5.42	45
Spirurida	DT	1.33	2.00 ± 0.00	2	6	19.00 ± 4.00	23
Heterakoi-dea	DT	17.33	6.31 ± 1.88	20	12	19.00 ± 10.61	60
Oxyurida	DT, LV	17.33	6.58 ± 1.58	17	32	23.56 ± 9.46	155
Oxyuris sp		3.99	9.00 ± 1.73	12	0	0	0
Cosmocer-coidea	DT	9.33	8.71 ± 4.05	27	8	11.75 ± 5.14	24
Ascaridida	HR	1.67	1.00 ± 0.00	1	0	0	0
Cestoda							
Pleurocer-coids larvae	LM	10.67	1.71 ± 0.18	2	40	2.8 ± 0.92	20
Trematoda							
Haemato-loechus	LU	1.33	1.00 ± 0.00	1	22	1.00 ± 0.00	1
Allocreadi-dae	DT	2.67	7.00 ± 5.00	12	6	10.33 ± 7.84	26
Paramphis-tomidae	DT	4	7.67 ± 4.18	16	30	23.53 ± 7.05	104

DT= digestive tract, HR = Heart, LU = Lung, LM = Leg muscle, LV = liver

Most of the parasites were found in the digestive tract. More than two third (69%) of infected *L. macrodon* were infected in one body part, under one third (28.57%) were infected in two body parts and a small number (2.38%) were infected in three parts. Just over half (53%) of infected *F. cancrivora* were infected in one body part, just under a third (31%) were infected in two body parts, and 16% were infected in three body parts. Most frogs (55.8% for *L. macrodon* and 44.4% for *F. cancrivora*) were only infected by one species of parasite, approximately a third (34.8% for *L. macrodon* and 28.9% for *F. cancrivora*) were infected by two species of parasite and only a small number (~9% for *L. macrodon* and ~28% for *F.*

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cancrivora) were infected with three or four species of parasite (Figures 2, 3, and 4).

The difference in infection rates between species of frogs is highly significant (Pearson Chiquare test, df = 1, P < 0.001). The difference in infection rates for *L. macrodon* and *F. cancrivora* between locations is also significant (Pearson Chisquare test, df = 1, P <0.05). Figure 2 shows the infection rates for each species in the different locations.

The difference in parasite infection between the sexes of each species is not significant (Pearson Chiquare test, df = 1, P > 0.5). However, the difference in parasite infection between female *L. macrodon* and *F. cancrivora* is highly significant (Pearson Chiquare test, df = 1, P < 0.001). No test were made for between female *F.* cancrivora and male *F. cancrivora* because of the lack of sample size for male (n=4) .

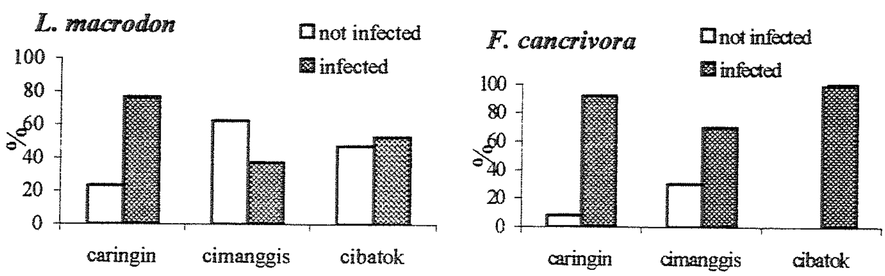

Figure 2. Parasite infection rates (%) of each species caught in three locations in Bogor between July – September 2002.

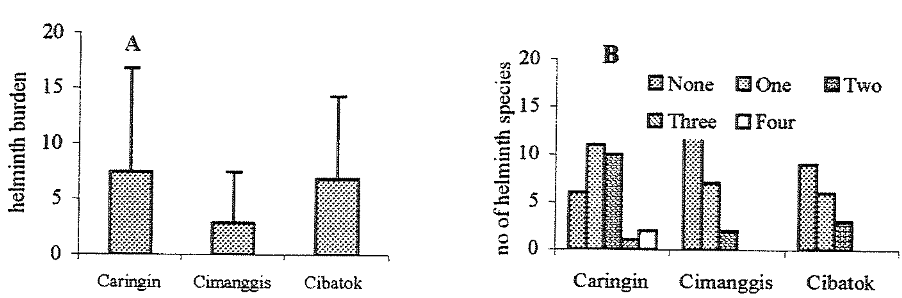

Figure 3. Mean Helminth Burden (standard error; A) and number of helminth infected (B) on *Limnonectes macrodon* in three location

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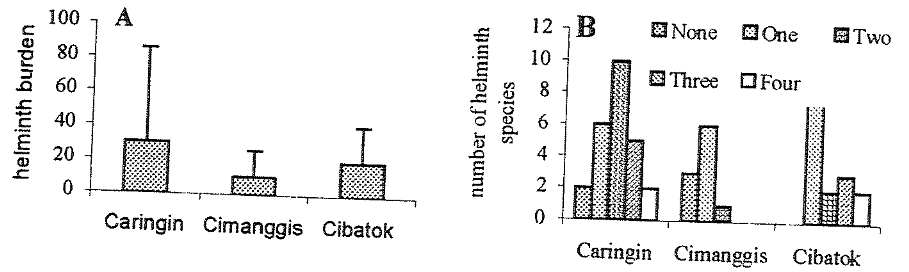

Figure 4. Mean Helminth Burden (A) and number of helminth infected (B) on *Fejervarya cancrivora* in three location

There was a significant positive correlation between female *F. cancrivora* SVL and the intensity of Oxyurida infection (r_{14}=0.52, $P<0.05$) (Figure 5). There was no significant relationship between female *F. cancrivora* SVL and intensity of pleurocercoid infection ($F_{1,16}$=0.58, P= 0.83) nor with intensity of Paramphistomidae infection ($F_{1,11}$= 1,68, P=0.22).

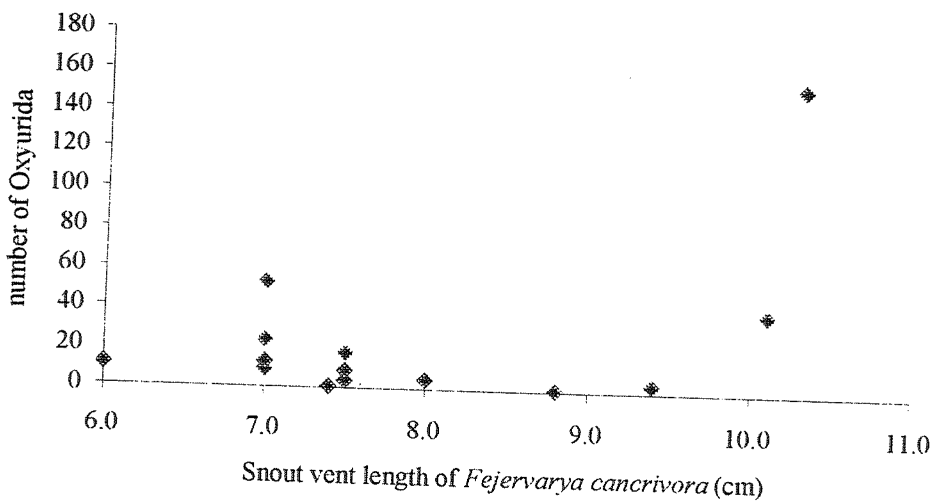

Figure 5. Relationship between number of Oxyurida and snout-vent length (cm) of female *Fejervarya cancrivora* collected from Bogor, West Java, Indonesia

DISCUSSION

Terrestrial frogs usually have a higher prevalence of nematodes infection compared to stream dwelling frogs. On the other hand, stream dwelling

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frogs are usually more susceptible to trematode infections (Smyth and Smyth, 1980). Nematode parasites of amphibian have a direct life cycle, whereas trematodes and cestodes usually have complex life cycles, which include various intermediate hosts such as snails, insects and vertebrates (Smyth and Smyth, 1980).

F. cancrivora showed a higher prevalence of parasite infection than *L. macrodon*. *Fejervarya cancrivora* is an aquatic frog, although they are most abundant in low-land rice fields (Church, 1960; Iskandar, 1998) and eat various insects, invertebrates (crustacea, myriopod, arachnid, gastropod), amphibians and fish (Nurmainis, 2000). The water level in wet rice fields was regulated according to the growth of the rice plants, and it has been suggested that the behavior of *F. cancrivora* is related to the water level in these fields. Research by Kurais (1995) in Malaysia indicated that the breeding periods of this species is related to the rice field irrigation phase. Most rice fields in our study had low water levels or no water at all during harvest time, and frogs needed to adapt to dry periods during fallow periods (personal observation). This will enable parasite growth in various intermediate hosts such as molluscs, insects, or vertebrates host, for example snakes.

Limnonectes macrodon is an endemic frog on Java island and is found mostly in streams (Iskandar, 1998). Distributional studies by one of the authors on *L. macrodon* indicate that adult frogs are not only found in the streams, but also in natural ponds in forested areas or in rice fields near densely vegetated irrigation channels. The ecology of this species is poorly understood, although the species has been known to eat various insects, invertebrates (chilopod, diplopod, arachnid, annelid), amphibians, even small birds (Sugiri, 1979).

Because humans eat the legs of both of these species of frogs, special attention needs to be focused on parasites found in the legs. *F. cancrivora* legs have shown to be more prevalent to infection by pleurocercoid larvae than those of *L. macrodon*. The prevalence of pleurocercoid infection in our study is comparable with Sunityoso et al. (1997) findings,

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which recorded infection prevalence of 42.4 % from *F. cancrivora* legs in Depok (a subdistrict of the Bogor area).

Both species of frogs from the subdistrict of Caringin showed higher infection rates compared to the other locations. One female *F. cancrivora* from Caringin was not only infected by three species of helminthes but also had the highest burden of helminthes, especially Paramphistomidae (Trematoda, n= 104) and Oxyurida (Nematoda, n= 155). Deformities have been reported in some frogs from this area (Kusrini, 2003) but no cause has as yet been investigated. Recent research has indicated that deformities are caused by various factors such as parasites, environmental pollution or traumatic injuries (Ouellet, 2000). Trematodes are linked to deformities in frogs in northern America (Kaiser, 1999; Johnson et al., 1999, Stopper et al., 2002), however parasitic copepods are also connected with *Rana chalconota* metamorph deformities in Sukabumi, another district in West Java (Leong, 2001). However, all frogs examined in this study were adults (since harvesters usually collected only big frogs), in normal condition. Future research on parasites in juvenile frogs is needed.

The differences in parasite infection between the two host in this study indicate different life habits and also the effect of their habitat. This report is the first on parasite infection in Indonesian *Limnonectes macrodon*. Although we were unable to classify parasites to species level because of specimen condition, we were able to determine the parasitic structure for *L. macrodon* and *F. cancrivora.*

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