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SOME TREMATODES OF REPTILES FROM LAOS

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Abstract. In 51 reptiles of 17 species from Vientiane province in Laos, three species of trematodes, *Paradistomum geckonum, Encyclometra bungara,* and *Postorchigenes majeedi* were recorded for the first time. The snake *Enhydris plumbea* represents a new definitive host of *E. bungara;* this parasite has hitherto been recorded only in India. *Mabuya multifasciata* is a new definitive host of *P. geckonum; Gekko gecko, Hemidactylus frenatus* and *Cosymbotus platyurus* of *P. majeedi.* The study of *P. geckonum* specimens from different hosts revealed great morphological and metrical variability within this species, particularly in the shape and size of body. These morphological characters seems to be influenced not only by the state of maturation of helminths and host species but also by the size of individual hosts. The species *Postorchigenes indicus* Agrawal, 1968, and *P. rishikeshii* Lal et Prasad, 1979 are considered as synonyms of *P. majeedi.*

During a short stay in Laos in 1989*, some reptiles were examined for the presence of helminths. Since no data on parasitic worms of these animals are available from Laos, the present paper gives the first information on reptile trematodes from that country. Helminths of other groups (Cestoda, Nematoda, Acanthocephala) found in reptiles will be evaluated in other papers.

MATERIALS AND METHODS

A total of 51 reptiles of the following 17 species, originated from Vientiane province in central Laos, were dissected: *Gekko gecko* (Linnaeus) (7 specimens examined), *Cosymbotus platyurus* (Schneider) (11), *Hemidactylus frenatus* Duméril et Bibron (8), *Phyllodactylus siamensis* (?) Boulanger (1) (Gekkonidae); *Calotes versicolor* (Daudin) (2) (Agamidae); *Varanus salvator* (Laurenti) (1) (Varanidae); *Mabuya multifasciata* (Kuhl) (7), *Riopa* sp. (1) (Scincidae); *Python reticulatus* (Schneider) (2) (Pythonidae); *Amphiesma stolata* (Linnaeus) (3), *Dendrelaphis pictus* (Gmelin) (1), *Enhydris enhydris* (Schneider) (1), *Enhydris plumbea* (Boie) (1), *Ptyas mucosus* (Linnaeus) (1), *Xenochrophis piscator* (Schneider) (2) (Colubridae); *Xenopeltis unicolor* Reinwardt (1) (Xenopeltidae), *Boiga multomaculata* (Boie) (1) (Boigidae). Reptiles were identified by Dr. I. Rehák, Czechoslovak Society of Herpetologists, Prague. Trematodes were fixed with 4 % formaldehyde under slight cover glass pressure, stained with Schuberg's carmine and, after dehydration in alcohol series, mounted in Canada balsam. All specimens are deposited in the helminthological collections of the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice. All measurements are in millimetres (mm).

* Helminth material was obtained during bilateral scientific and technical co-operation between Czechoslovakia and Laos.

SURVEY OF SPECIES

Family **Dicrocoeliidae** Odhner, 1911

1. ***Paradistomum geckonum*** Bhalerao, 1929 Figs. 1, 2B, C; Plts. I, II

Description (measurements given in Table 1): body lanceolate or broadly oval, with maximum width mostly in posterior half of body. Body surface lacking spines; in forebody, including area around ventral sucker, with distinct tegumental folds (Pl. I). Oval or nearly spherical oral sucker situated subterminally. Prepharynx absent. Pharynx small, oval. Oesophagus of different length, in some specimens nearly lacking. Intestinal caeca very wide in gravid specimens, reaching near posterior extremity. Ventral sucker mostly spherical, feebly musculed. Two oval testes situated somewhat behind ventral sucker, lying ventral to intestinal caeca at the same distance from anterior body end. Cirrus sac oval, localized near mid-line of body; genital pore usually near intestinal bifurcation. Ovary post-testicular, oval or nearly round, lying slightly lateral to median line of body. Small oval seminal receptacle close to ovary, located somewhat medially to it. Several dozen vitelline follicles arranged in two laterally situated bands; bands starting anteriorly from level of ventral sucker, reaching backward into posterior half of body. Uterus very long, forming narrow, strongly coiled uterine loops filling more than two thirds of body of gravid specimens – from the level of anterior margin of ventral sucker to posterior extremity. Eggs oval, operculated, possessing small knob on abopercular pole; operculum large, well-developed, 0.012–0.014 wide.

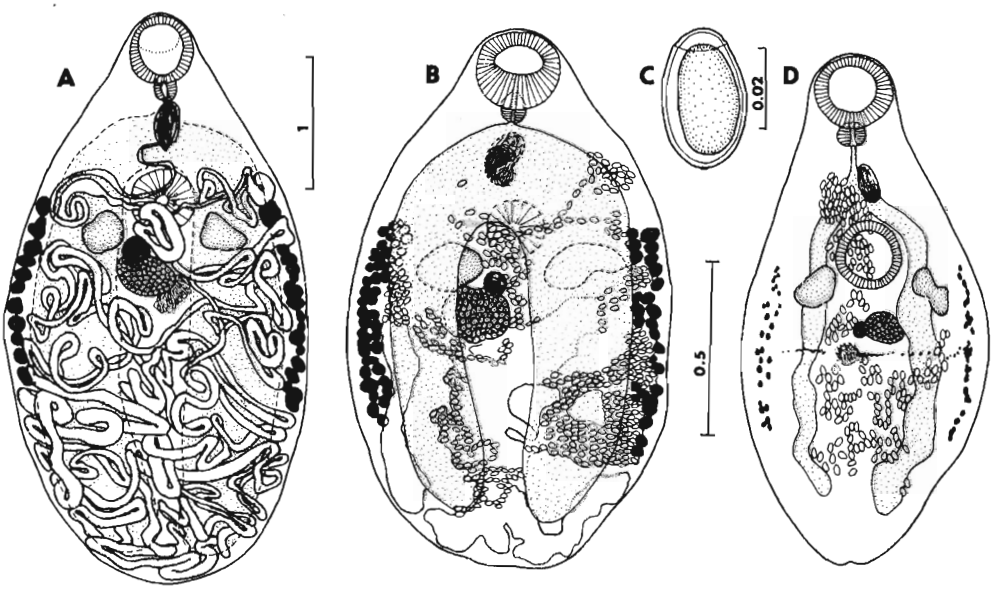

Fig. 1. *Paradistomum geckonum* Bhalerao, 1929 from *Cosymbotus platyurus*. A, B – dorsal view, C – egg, D – ventral view (in Fig. 1A, dorsally situated intestine is figured only schematically).

Hosts and locality: *Mabuya multifasciata* (infected 1 specimen, intensity of infection 5 trematodes; locality Thinkeo (Keo-Oudom district) – 1. 8. 89), *Cosymbotus platyurus* (5 infected – mean intensity of infection 6 (range 3–8); Vientiane – 16. 6., 18. 7., 19. 7. 89), *Hemidactylus frenatus* (2–4 (1–6); Vientiane – 16. 6. 89).

Localization: gall bladder and bile ducts; 1 specimen in the intestine of *H. frenatus*.

Comments: Specimens from Laos correspond well to trematodes of the species *Paradistomoides gregarium* (Tubangui, 1929), described and illustrated in papers by Skryabin and Evranova (1952), and Fischthal and Kuntz (1964, 1965, 1967a). However, Killick and Beverley–Burton (1982), having evaluated extensive material of trematodes found in lizards from Indonesia and museum specimens of *Paradistomum* and *Paradistomoides* species, synonymized *P. gregarium* (as *P. gregarinum*) with the species *P. geckonum*. They also agreed with Arora et al. (1962) that *Paradistomoides* Travassos, 1944 is synonymous with *Paradistomum* Kossack, 1910. We accept the opinion of Killick and Beverley–Burton (1982) and designate specimens from Laos as *Paradistomum geckonum* Bhalerao, 1929.

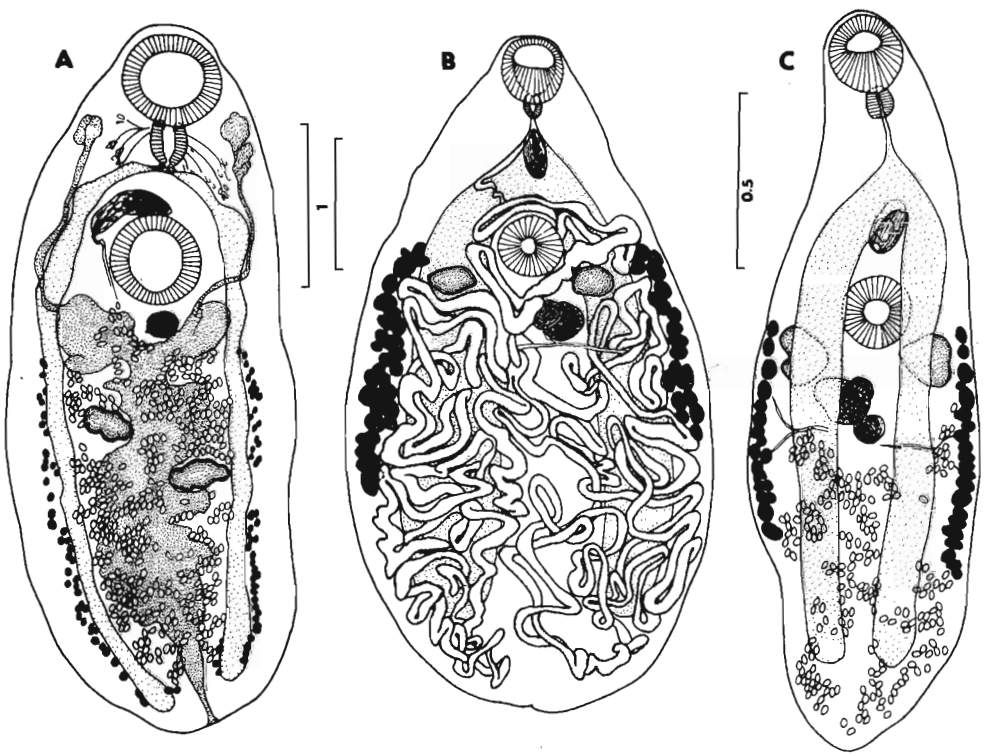

Fig. 2. *Encyclometra bungara* Srivastava et Ghosh, 1968 from *Enhydris plumbea* (A); *Paradistomum geckonum* Bhalerao, 1929 from *Mabuya multifasciata* (B) and *Hemidactylus frenatus* (C). A, B – ventral view, C – dorsal view.

We consider all specimens studied to be conspecific in spite of the fact that they differ markedly one from another in size and shape of body (Pl. II). However, all other morphological features such as shape and ratio of suckers, arrangement of testes and ovary, localization of vitellaria, egg size, etc., are nearly identical in all specimens. Similar differences in shape and size of body were observed by Rohde (1966) who studied the allometric growth of bat trematodes from Malaysia. Our morphological evaluation of flukes from one host species, *Cosymbotus platyurus*, also showed that size and shape of parasites might be influenced not only by the state of maturation but also by the size of the host individual (see Table 1). In addition, Fischthal and Kuntz (1967a) observed considerable differences in body shape among *Paradistomoides gregarium* (= *Paradistomum geckonum*) specimens from other sites. For example, worms from the bile duct and especially from the intestine were narrower than those from the gall bladder.

Table 1. Measurements of *Paradistomum geckonum* specimens from different hosts. All measurements in millimetres with the exception of egg size (in μm)

Host	*Mabuya multifasciata*	*Cosymbotus platyurus*			*Hemidactylus frenatus*
Body length	10	5.0–5.7	4.1	5.5	5.2–6.0
Localization	gall bladder	gall bladder		intestine	gall bladder
Locality	Thinkeo	Vientiane			Vientiane
N°. flukes	5	11	3	1	9
Body length	4.26–5.16	2.01–4.04	1.56–1.87	1.48	1.34–2.66
Max. width	2.23–2.80	1.00–2.47	0.79–0.93	0.71	0.63–1.46
Oral sucker	0.34–0.46	0.30–0.46	0.22	0.21	0.17–0.34
(l × w)	0.37–0.46	0.22–0.45	0.22–0.24	–	0.18–0.32
Ventral sucker	0.33–0.42	0.23–0.34	0.18–0.22	0.18	0.13–0.34
(l × w)	0.34–0.42	0.24–0.42	0.17–0.19	0.18	0.16–0.36
Suckers' ratio	1.02 : 1.00	1.18 : 1.00	1.22 : 1.00	1.14 : 1.0	1.10 : 1.00
(range)	0.93–1.10	1.13–1.29	1.13–1.27	–	0.95–1.28
Pharynx	0.14–0.18	0.10–0.15	0.06–0.08	0.07	0.06–0.13
(l × w)	0.12–0.15	0.10–0.16	0.07–0.08	0.08	0.06–0.13
Oesophagus	0.05–0.11	0–0.12	0	0	0–0.13
Testes	0.19–0.27	0.13–0.33	0.08–0.15	0.08–0.09	0.06–0.24
(l × w)	0.27–0.41	0.14–0.40	0.14–0.26	0.14	0.09–0.22
Cirrus sac	0.28–0.39	0.14–0.35	0.16–0.21	0.12	0.10–0.19
(l × w)	0.11–0.16	0.07–0.12	0.06–0.10	0.06	0.05–0.08
Length : width	2.5 : 1.0	3.0 : 1.0	2.9 : 1.0	2.0	2.5 : 1.0
ratio (range)	(2.0–3.5)	(2.6–3.4)	(2.3–3.5)	–	(2.0–3.2)
Ovary	0.21–0.37	0.18–0.33	0.13–0.17	0.10	0.08–0.17
(l × w)	0.25–0.37	0.19–0.40	0.13–0.20	0.13	0.14–0.26
Seminal	0.18–0.24	0.10–0.21	0.09–0.10	0.05	0.05–0.14
receptacle	0.13–0.18	0.06–0.19	0.07–0.10	0.04	0.05–0.10
Eggs	31–36	31–39	34–36	35–39	34–39
(l × w)	21–25	20–26	21–23	20–23	21–25

Considering the great morphological variability of specimens from Laos, particularly in body size and shape, and the above mentioned data, we agree with Fischthal and Kuntz (1964), and Killick and Beverley-Burton (1982) that many hitherto described species of the genus *Paradistomum* are invalid. Fischthal and Kuntz (1964), who mentioned a considerable variation of *Paradistomoides gregarium* (= *P. geckonum*) from *H. frenatus* in position, shape and relative size of sucker, testes, ovary and vitellaria, doubted the validity of the following taxa: *Paradistomum mutabile* (Molin, 1859), *P. gregarium, P. geckonum* Bhalerao, 1929, *P. paloensis* Tubangui, 1933, *P. excalotes* Tubangui et Masilungan, 1936, *Paradistomoides oroterminosus* (Bhalerao, 1929), *P. intestinalis* Simha, 1958, *P. lanceolatus* Simha, 1958, and *P. spatulatus* Simha, 1958. Killick and Beverly-Burton (1982) considered the following morphological features to be most stable for *P. geckonum* and thus probably important in the separation of *Paradistomum* species: length: width ratio of the cirrus sac, the size of the eggs, the relative size of the testes to each other, the position of the ovary relative to the testes and suckers' ratio. The authors synonymized species *P. gregarinum, P. oroterminosum, P. paloensis* (Nama et Khichi, 1973), *P. brevis* (Nama et Khichi, 1973), and *P. laruei* (Fischthal et Kuntz, 1975) with *P. geckonum*. They also considered that the taxonomic status of *P. ceratophorae* Dollfus, 1923, *P. excalotes* Tubangui et Masilungan, 1935, *P. intestinalis, P. lanceolatus, P. diminutus* (Nama et Khichi, 1973), *P. intermedius* (Nama et Khichi, 1973), *P. elongatus* (Nama et Khichi, 1973), and *P. hemidactylus* (Nama et Khichi, 1974) should be clarified.

We fully agree with the assumptions of the above authors since we consider such criteria as host species, parasite shape and size, size of genitalia, width of caeca, to be unsuitable for establishing new, separate species of the genus *Paradistomum*. In view of a great biometrical variability of specimens from Laos that measure up to 5.2 mm, validity of other taxa, *P. orientalis* (Narain et Das, 1929), *P. moghei* Bhalerao, 1936, and *P. banarasensis* Baugh, 1956, should be confirmed.

The species *P. geckonum* is a common parasite of lizards in Asia and it has also been recorded in *Hemidactylus frenatus* and *Cosymbotus platyurus* from Indonesia, the Philippines and North Borneo (Fischthal and Kuntz 1964, 1965, 1967b, Killick and Beverley-Burton 1982). *Mabuya multifasciata* represents a new definitive host of this parasite.

Family **Plagiorchiidae** Ward, 1917

2. ***Encyclometra bungara*** Srivastava et Ghosh, 1968 Fig. 2A

Description: body oval, measuring 4.32×1.75. Body surface smooth. Oral sucker almost spherical, 0.52×0.60 in diameter, situated subterminally. Prepharynx and oesophagus absent. Pharynx large, measuring 0.31×0.23. Intestinal caeca long, equal in length, reaching posteriorly almost posterior extremity. Ventral sucker spherical, 0.54×0.56 in size. Ratio of suckers' diameter 1:1. Two small testes slightly lobate, measuring 0.19×0.27, and 0.18×0.37. Testes oblique, nearly

symmetrical, situated in posterior body half. Cirrus sac banana-shaped, 0.67 × 0.15 in size, transverse, between intestinal bifurcation and ventral sucker. Internal seminal vesicle forming several loops. Ovary rather small, measuring 0.14 × 0.18, lying immediately behind ventral sucker, somewhat lateral to mid-line of body. Vitelline follicles lateral, forming two extracaecal bands from level of ovary to end of caeca. Seminal receptacle oval, measuring 0.13 × 0.08, localized at the level of ovary. Uterus almost exclusively intracaecal, forming numerous loops in hindbody. Genital opening lateral to anterior margin of ventral sucker. Eggs oval, 0.076–0.084 × 0.039–0.043 in size, containing formed miracidium.

Host and locality: *Enhydris plumbea* (1–1; Vientiane – Nong Sang Thoo suburb – 19. 8. 89)
Localization: intestine

Comments: Only three of four species of the genus *Encyclometra* Baylis et Cannon, 1924, are considered to be valid by Yeh (1958), Dollfus (1963), and Gupta and Mehrotra (1977). Of them, only the species *E. bungara* possesses testes symmetrically or obliquely symmetrically arranged (Srivastava and Ghosh 1968). Additionally, the specimen under study corresponds to *E. bungara* in other morphological features (the absence of oesophagus, small-sized ovary, equal length of intestinal caeca). There is only one considerable difference, i.e., in egg size: eggs of *E. bungara* measure according to Srivastava and Ghosh (1968) only 0.021 × 0.012 mm, while they have 0.076–0.084 × 0.039–0.043 in our material. However, we have some doubts about the correctness of the above mentioned authors' data since eggs in their drawing of *E. bungara* (Srivastava and Ghosh, 1968 – Fig. 1) are much larger (estimated length about 0.060). Moreover, eggs of other *Encyclometra* species are considerably larger than those of *E. bungara* as mentioned by Srivastava and Ghosh (1968): 0.075–0.098 × - × 0.034–0.051 in *E. colubrimurorum* (Rudolphi, 1819) and 0.094–0.097 × × 0.049 – 0.0.51 in *E. asymmetrica* Wallace, 1936 (Yeh 1958, Gupta and Mehrotra 1977). In spite of the above discrepancy, we consider the specimen from *E. plumbea* to be conspecific with *E. bungara.*

The species *E. bungara* has hitherto been found only in the banded crait (*Bungarus fasciatus* (Schneider)) from India (Srivastava and Ghosh 1968). The finding of this species in *Enhydris plumbea* in Laos represents a new host record and the first record of *E. bungara* from Southeast Asia. Fischthal and Kuntz (1965, 1967b) found the species *E. colubrimurorum,* a common parasite of reptiles in Europe and Asia, in the same host (*E. plumbea*) from North Borneo and Korea.

Family **Lecithodendriidae** Odhner, 1910

3. ***Postorchigenes majeedi*** Sinha et Hakim, 1967 Fig. 3

Description (5 spec. from *G. gecko* and 15 spec. from *H. frenatus* measured; measurements of flukes from the latter host in parentheses): body mostly lanceolate, sometimes widely oval, covered in anterior half with small spines. Numerous

parenchymal gland cells localized in forebody. Length of body 2.19–2.54 (1.28–2.66), maximum width 1.00–1.12 (0.93–1.36). Oral sucker oval, measuring 0.18–0.20 × 0.21–0.22 (0.14–0.20 × 0.16–0.19); ventral sucker considerably smaller than oral one, 0.13–0.14 × 0.14–0.15 (0.11–0.17 × 0.12–0.16) in size. Suckers' ratio 1.45:1.0 (range 1.42–1.51:1.0) (1.24:1.0 (1.13–1.36:1.0)). Prepharynx very short, pharynx small, measuring 0.070–0.077 × 0.080–0.090 (0.061–0.083 × 0.077–0.090);

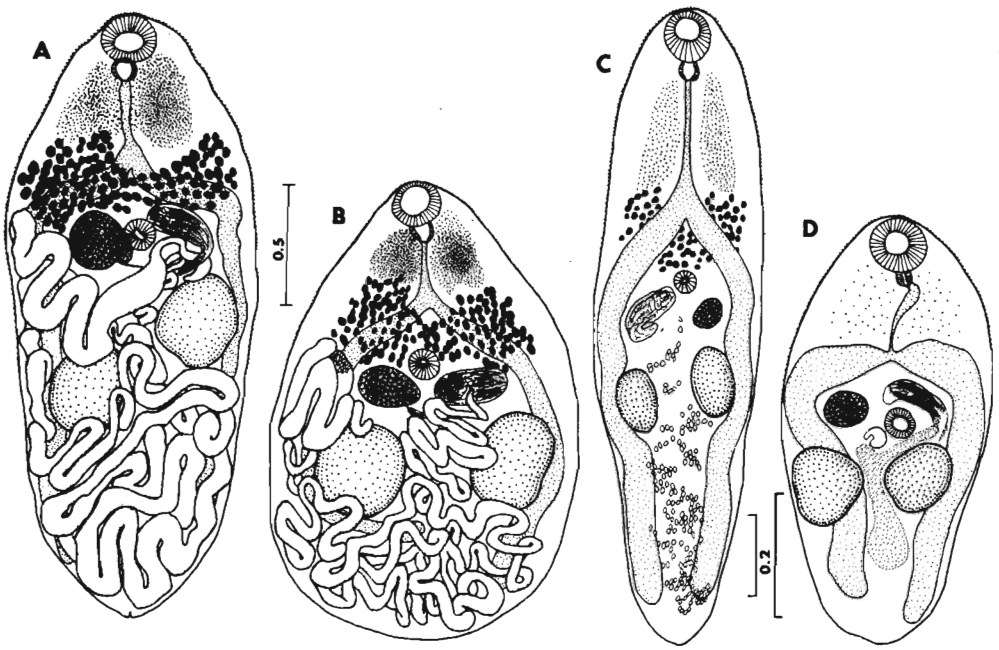

Fig. 3. *Postorchigenes majeedi* Sinha et Hakim, 1967 from *Gekko gecko* (A, C) and *Hemidactylus frenatus* (B, D). A, B, D – ventral view, C – dorsal view.

oesophagus 0.22–0.34 (0.14–0.24). Cirrus sac elongate, transversely or obliquely situated, lying at same level as ovary, mostly at level of ventral sucker (Fig. 3A) or slightly behind it (Fig. 3B, C). Vesicula seminalis interna forming several loops filling up to one half of cirrus sac. Vesicula prostatica present, surrounded by prostatic cells filling middle part of cirrus sac. Measurements of cirrus sac 0.31–0.35 × 0.12–0.15 (0.24–0.38 × 0.10–0.15). Ratio of length and width of cirrus sac 2.3:1.0 (range 2.1–2.6:1.0) (2.4:1.0 (1.9–2.9:1.0)). Two testes oval, mostly slightly obliquely situated (Fig. 3A, C, D) or sometimes practically parallel; lying in posterior half of body behind ovary and cirrus sac, intracaecally. Testes measure 0.34–0.43 × 0.31–0.50 (0.23–0.50 × 0.24–0.46). Ovary oval, measuring 0.25–0.26 × × 0.21–0.28 (0.11–0.30 × 0.12–0.28), located at level of ventral sucker (Fig. 3A, D) or somewhat behind it (Fig. 3B, C). Seminal receptacle oval or nearly spherical,

0.052–0.058 × 0.058–0.065 (0.084–0.103 × 0.045–0.059) in diameter, partly overlapping ovary. Uterus narrow, very long, forming in gravid flukes several dozen strongly coiled loops. Loops filling most of posterior half of body, reaching anteriorly slightly beyond ventral sucker. Vitelline follicles small, numerous, scattered around caecal bifurcation. Eggs operculated, rather small, measuring 0.019–0.021 × 0.012–0.013 (0.019–0.023 × 0.012–0.013).

Hosts and localities: *Gekko gecko* (1–11; Thinkeo – 31. 7. 89), *Cosymbotus platyurus* (2–6 (1–10); Vientiane – 22. 6., 18. 7. 89), *Hemidactylus frenatus* (4–26 (2–55); Vientiane – 31. 5., 14. 7., 19. 7. 89, Thinkeo – 8. 8. 89)

Localization: intestine.

Comments: Trematodes from Laotian reptiles in their morphology and measurements correspond with those described from *Hemidactylus flaviviridis* by Sinha and Hakim (1967) as *P. majeedi.*

Yamaguti (1971) mentioned four species of the genus *Postorchigenes* Tubangui, 1928: *P. ovatus* Tubangui, 1928, *P. indicus* Agrawal, 1968, *P. majeedi* Sinha et Hakim, 1967, and *P.* (syn. *Palitrema*) *macrorchis* (Gogate, 1939). However, the latter species is considered by Fischthal and Kuntz (1967b) to be a synonym of *P. ovatus.* This species differs from *P. indicus* and *P. majeedi* in length of intestinal caeca which do not extend to the posterior third of body. The last two species can be differentiated one from another by presence of nonoperculated eggs (operculated in *P. majeedi*) and by their size (only 0.010–0.0125 × 0.005–0.051 in *P. indicus,* 0.0196–0.0224 × 0.0112–0.014 in *P. majeedi*), absence (?!) of receptaculum seminis in *P. indicus,* and position of genital pore which is according to Agrawal (1968) slightly left of median line anterior to (?!) ventral sucker in *P. indicus,* whereas *P. majeedi* possesses a genital pore ventrosinistral overlying the left testis (Sinha and Hakim 1967). However, we have some doubts about the accuracy of the description of *P. indicus.* It seems to be very probable that receptaculum seminis was overlooked by the authors and figured as a posteriomedial lobe of ovary, and the cirrus sac and genital pore were erroneously described and figured in inverted position (see Agrawal 1968 – Fig. 1). Moreover, our study revealed a great morphological variability in the position of the cirrus sac and genital pore (see Fig. 3). Therefore, there are only two marked differences between the species – egg size and presence or absence of operculum. However, in view of the above very probable inaccuracies in the description of *P. indicus,* erroneous measurements and description of eggs cannot be excluded. This assumption is supported by the fact that eggs of other representatives of the genus *Postorchigenes* are operculated and measure 0.0195–0.024 × 0.0112–0.014 mm (Skarbilovich 1948, Sinha and Hakim 1967, Yamaguti 1971). Consequently, we consider the species *P. indicus* to be a synonym of *P. majeedi* Sinha et Hakim, 1967.

Lal and Prasad (1979) described another *Postorchigenes* species, *P. rishikeshii,* from the intestine of *Hemidactylus flaviviridis* in India. This species according to the authors closely resembles *P. majeedi,* differing from it in the nearly preacetabular position of the ovary, in the position of the cirrus sac separated from

anterior border of the ventral sucker, and in the localization of anterior (left) testis somewhat near the acetabular level (Lal and Prasad 1979). As seen from the description of *P. majeedi* from Laos and drawings of some specimens in the present paper (Figs. 3A–D), all the above "distinguishing" characters, mentioned by Lal and Prasad (1979), are rather variable and in no case can be used for establishing a new species. Therefore, we consider the species *P. rishikeshii* to be a synonym of *P. majeedi*.

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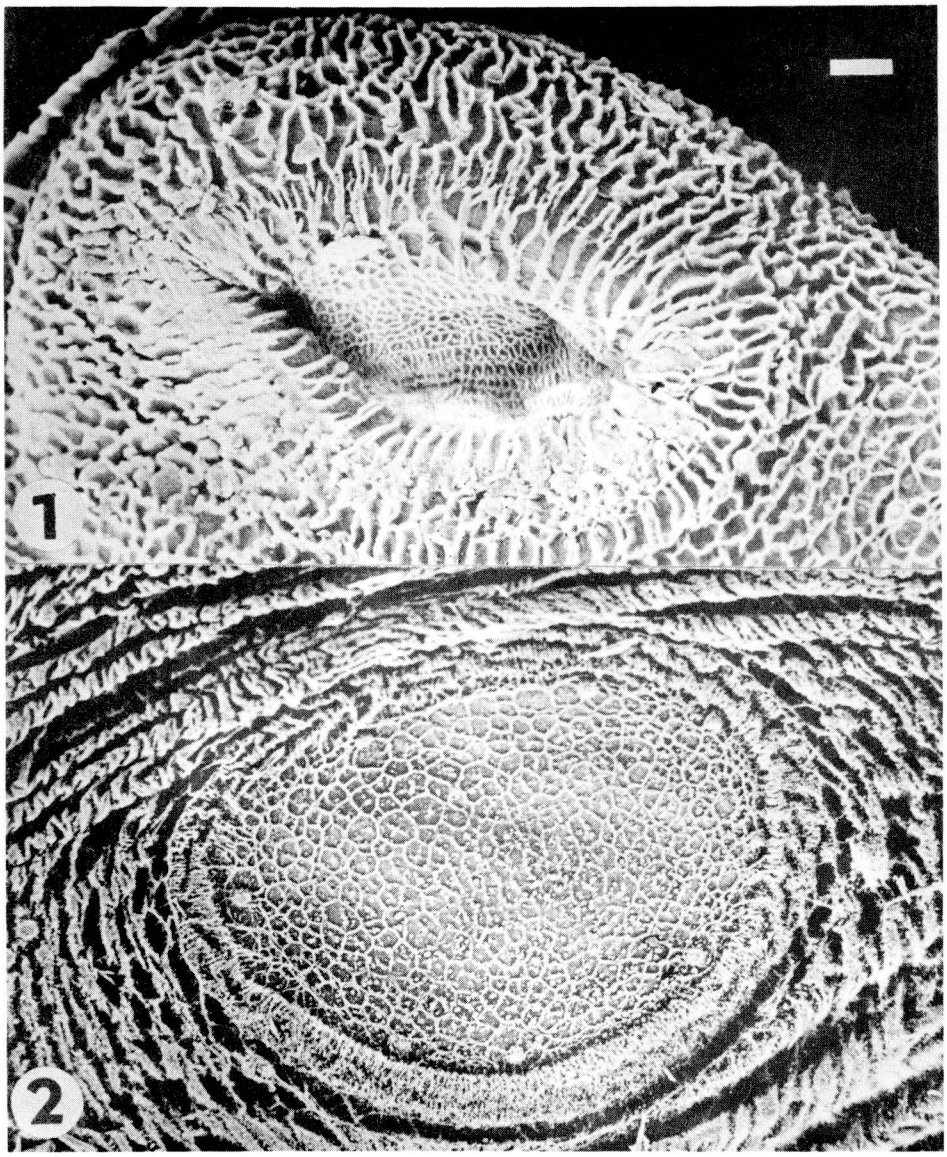
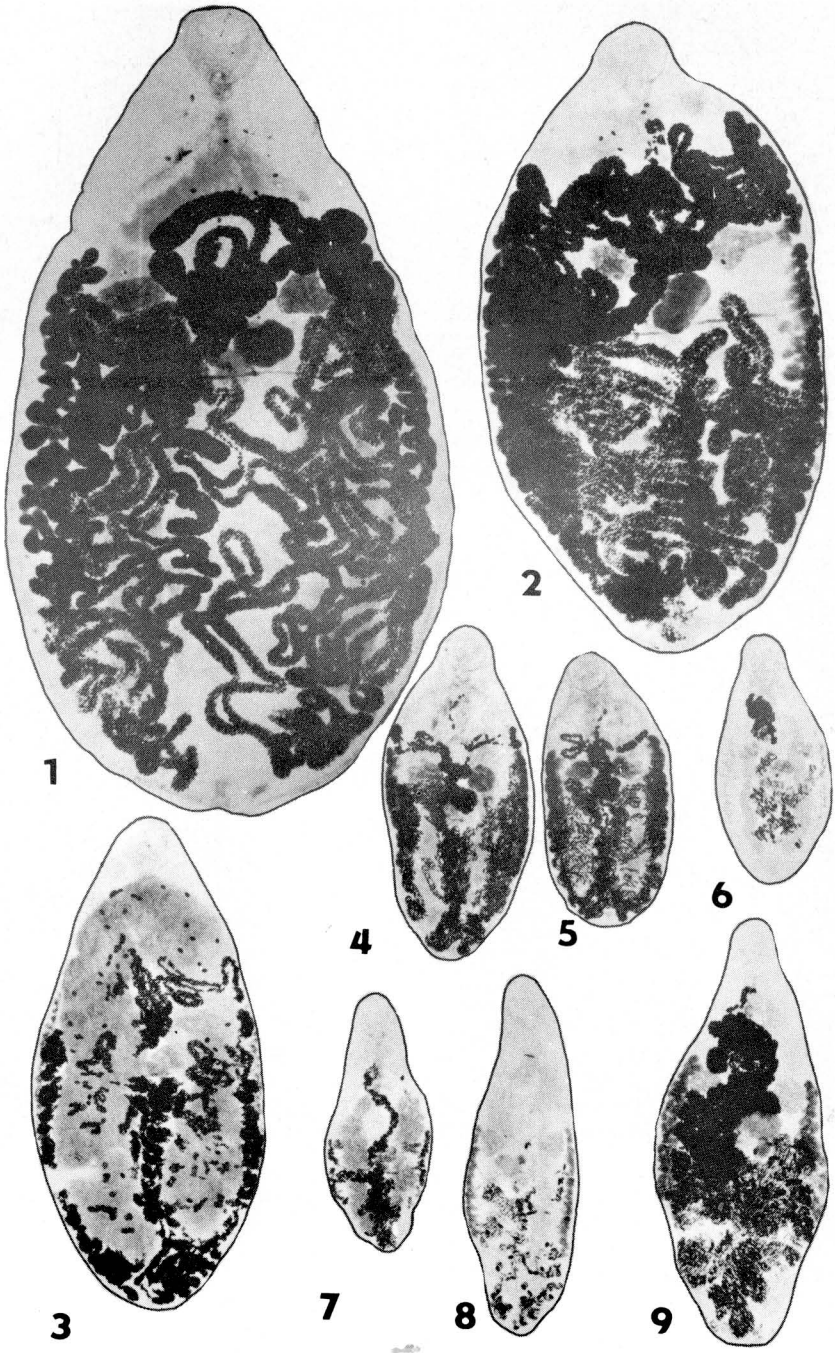


Figs. 1–2. *Paradistomum geckonum* Bhalerao, 1929. Tegumental folds around oral (Fig. 1) and ventral (Fig. 2) suckers. SEM. Scale = 0.02 mm.



Figs. 1–9. *Paradistomum geckonum* Bhalerao, 1929 from different hosts: *Mabuya multifasciata* (Fig. 1), *Cosymbotus platyurus* (Figs. 2–6), *Hemidactylus frenatus* (Figs. 7–9). Trematodes from the gall bladder and bile ducts (Figs. 1–5, 7, 9), and the intestine (Figs. 6, 8). Scale = 1 mm.