

Revue d'Actualité — Overzichtsartikel — Review Article

THE DIGENETIC TREMATODES, *FASCIOLOPSIS BUSKI*,
GASTRODISCOIDES HOMINIS AND *ARTYFECHINOSTOMUM MALAYANUM*,
AS ZOONOTIC INFECTIONS IN SOUTH ASIAN COUNTRIES

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Summary — An account of the geographical distribution, prevalence, life-history and pathogenicity of three digenetic trematodes of man and pig, viz., *Fasciolopsis buski*, *Gastrodiscoides hominis* and *Artyfechinostomum malayanum*, is given and the relevant literature is cited. The morphology of these trematodes is briefly described and illustrated through photographs of *in-toto* preparations.

KEYWORDS : Digenetic trematodes; Zoonoses; Intestinal parasites; Pig reservoirs; South Asian countries.

Few of the digenetic trematodes parasitizing the pigs of South Asian countries constitute zoonoses and may sporadically threaten human health. Among these, *Fasciolopsis buski*, *Gastrodiscoides hominis* and *Artyfechinostomum malayanum* are reported to occur in the intestine of pig and man and rank high for consideration. While pigs serve as the reservoirs of these infections in nature, the frequency of infection in human is regulated by the prevalent sanitary and economic conditions and the food habits of the population. These three infections seem to have a restricted geographical distribution and, as far as is known, are typically the parasites of the Orient. These rather lesser known and geographically confined zoonotic infections are briefly reviewed in this paper.

Fasciolopsis buski

(Lankester, 1857) Odhner, 1802 (Fasciolidae : Trematoda)

Pigs and human are reported to harbour *F. buski* infection in many of the South Asian countries. Chandler, as quoted by Buckley (1939), found that six per cent of the 100 human subjects examined in Manipur Valley, Assam harboured *F. buski* infection. Buckley's (*loc. cit.*) own observations further substantiated that 59.7 per cent of the individuals in Kamrup, Assam carried this infection.

Manning and Ratanarat (1970) had shown that the pigs are the reservoir host of *F. buski* in the central Thailand where an estimated 100,000 persons were infected with this trematode. 30 per cent of the pigs in Uttar Pradesh, India harboured *F. buski* (Tripathi *et al.*, 1973) while the incidence of human infection in this province was 22.4 per cent (Chandra, 1976). A sample of slaughter pigs examined by Hsu (1964) in Kwangtung, China showed that ten per cent were infected. In two villages near Dacca, Bangladesh, 39.2 and 8.6 per cent of the children harboured this infection (Muttalib and Islam, 1975) and in southern Taiwan, 19 per cent of the children from seven villages were infected. In one of these villages an infection rate as high as 61 per cent was recorded (Lee, 1972). Newer endemic foci of *F. buski* infection in human were detected in Thailand (Soavakontha *et al.*, 1966) and in Maharashtra, India (Manjarumkar and Shah, 1972).

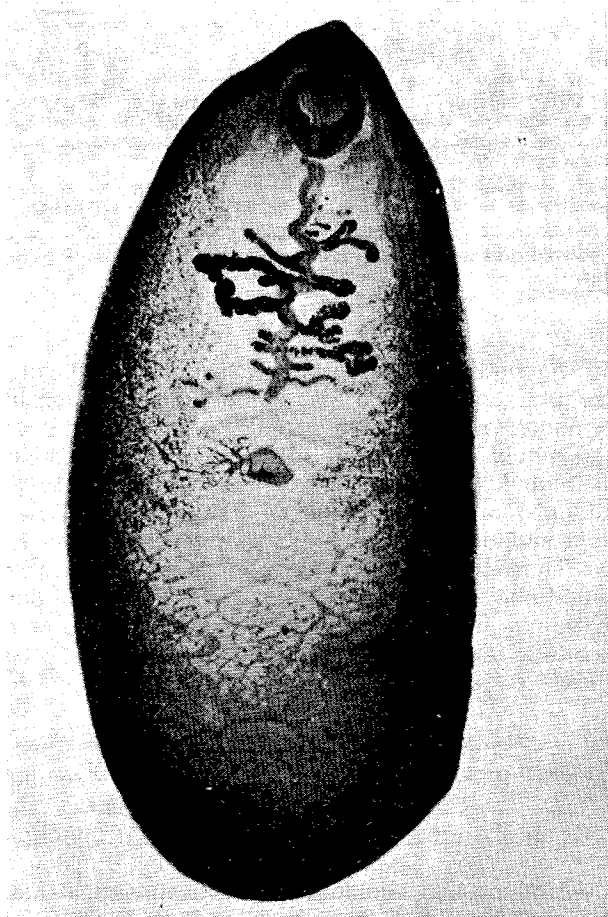


Figure 1.

Fasciolopsis buski, ventral view. The worm was compressed for *in-toto* mounting. Acetic acid-alum-carmin staining. Mag. $\times 4.2$.

The fluke is about two mm thick and flesh coloured when fresh. It is one of the largest parasitic trematode of man and pig and measures 20.0-75.0 mm long and 8.0-20.0 mm wide (Fig. 1). The subterminal oral sucker is small and about one-fourth the size of the ventral sucker situated not far behind the former. An oval pharynx is present and the short oesophagus leads to the caeca which are unbranched and terminate near the posterior end of the worm. The two testes are highly branched, tandem and situated in the posterior half of the body. The branched ovary is pretesticular situated in the middle of the body slightly to the right of the midline. The genital pore is situated anterior to the ventral sucker. The vitelline glands are extensive and extend from the level of the ventral sucker along the lateral field and these glands of both the sides meet at the posterior end of the body. The eggs measure 0.130-0.140 mm long and 0.080-0.085 mm wide. The parasites occur in the small intestine of pig and man.

The life-cycle of *F. buski* is known and the snails *Segmentina (Polypylis) hemisphaerula*, *S. (Trochorbis) trochoideus* and *Gyraulus chinensis* serve as the intermediate-hosts in Thailand (Manning and Ratanarat, 1970; Nguen Tkhi Le, 1978), *S. calathus*, *Hippeutis cantori* and *G. convexiusculus* serve in China (Hsu, 1964; Wang *et al.*, 1977) while *Helicorbis coenosus* has been demonstrated to serve as the intermediate-host under experimental conditions in India (Tripathi *et al.*, 1973). The cercariae emerging from these snails encyst on aquatic plants like *Ipomoea*, *Trapa*, *Nymphaea* etc. Pigs and human acquire infection by ingesting these aquatic plants containing metacercariae.

The pathogenic effects of *F. buski* infection in man is not clearly known. Although Plaut *et al.* (1969) have speculated that the trematode in less than massive number may not be responsible for overt clinical disease, Areekul *et al.* (1979) have found a significant lowering in the serum vitamin B₁₂ content in 100 infected children than that of 60 normal controls and the absorption of this vitamin was impaired in three of the nine patients studied. Further, Chandra (1976) has pointed out that anaemia was more frequently encountered among infected individuals and about 85 per cent of the infected cases showed an eosinophil count of more than five per cent. The pathogenicity of fasciolopsiasis, in any case, is influenced by the intensity of infection of the host and a massive worm burden would almost certainly result in adverse effects. The piperazine compounds, niclosamide and tetrachlorethylene have been tried for the treatment of *F. buski* infection with varying degrees of success (Suntharasamai *et al.*, 1974; Chandra, 1976). Niclosamide is reported to produce fewer and less severe side effects than tetrachlorethylene.

Gastrodiscoides hominis

(Lewis & McConnell, 1876) Leiper, 1913 (Paramphistomidae : Trematoda)

G. hominis infection of pig and man is reported from the northern states of India, Phillipines, Burma and Thailand and is believed to have a wider geographical range. Buckley (1939) reported a very high infection rate in human at Kamrup, Assam where about 41 per cent of the 221 stool samples, mostly from children, were positive for the infection. He, in the year 1964, further emphasised that man is a natural host of *G. hominis*

since the infection at Kamrup was maintained in human population in the absence of a reservoir animal host. There are records to show that *G. hominis* occurs in monkeys and apes as well (Pester and Keymer, 1968; Herman, 1976).

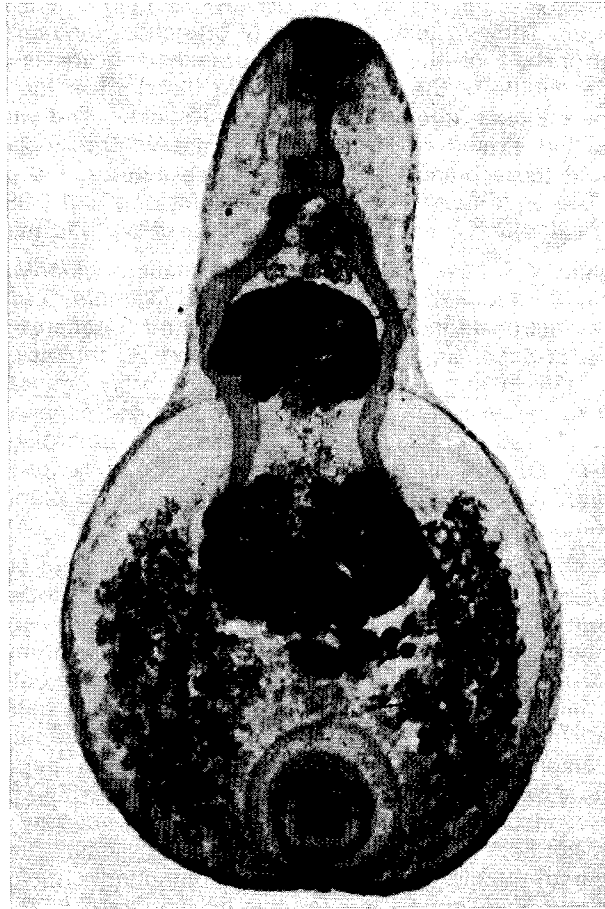


Figure 2.

Gastrodiscoides hominis, dorsal view. The worm is distorted because of the compression applied for preparing the mount. Acetic acid-alum-carminc staining. Mag. $\times 10.0$.

The worm is thick, fleshy and pink in colour when fresh. It has an anterior conical portion and a discoidal posterior portion (Fig. 2) and measures 8.0-14.0 mm long. The discoidal portion measures up to 8.0 mm wide and is excavated ventrally. The acetabulum is medium sized and ventro-terminal in position. The oral sucker is provided with a small paired diverticula and the oesophagus has a posterior bulbous swelling. The unbranched caeca are slightly winding and terminate near the anterior margin of the acetabulum. The testes are lobed, tandem and situated in the middle third of the body. The ovary is inter-caecal placed behind the

posterior testis near the centre of the discoidal portion. The uterus is inter-caecal and the genital pore is located slightly anterior to the caecal bifurcation. The vitelline glands occupy the lateral field of the discoidal portion. The eggs measure 0.150-0.170 mm long and 0.060-0.070 mm wide. This amphistome inhabits the caecum and colon of pig and man.

The life-history of *G. hominis* has been elucidated by Dutt and Srivastava (1966, 1972) and the tiny aquatic snail *Helicorbis coenosus* serves as the intermediate-host of the parasite under experimental conditions. Dutt and Srivastava (1972) have found that 27 per cent of the 233 slaughter pigs at Bareilly, India were infected with this amphistome and that in 50 per cent of the cases this infection occurred together with *F. buski*. Since *G. hominis* and *F. buski* use the same molluscan intermediate-host in India, the latter finding has an agreeable relevance. Buckley's (1939) observation on 221 human subjects showing 59.7 and 41 per cent infection rates of *F. buski* and *G. hominis* in the same population, in all probabilities, is manifestation of a similar biological coincidence.

The mollusc, *H. coenosus*, abound frequently in the water reservoirs around the pigsties where both these trematode infections are known to be endemic. Intensive search to find *H. coenosus* naturally infected with *G. hominis* or *F. buski* in these waters were, however, not successful (unpublished observations of the author).

Varma (1954) had differentiated the parasites found in man and pig as two different strains but this view is generally not accepted.

The pathology and symptomatology of *G. hominis* infection is uncertain. It is stated that in man the parasite causes inflammation of the mucosa of caecum and ascending colon and diarrhoea. Deaths among untreated patients, especially the children, have been attributed to this infection. Ahluwalia (1960) has described a subacute inflammation of the caecum of pigs where the parasite caused desquamation of the mucosa and infiltration with eosinophils, lymphocytes and plasma cells. He has ascribed these lesions to the continual impact of the discoidal region of the parasite on the mucosa of the caecum. Specific treatment of *G. hominis* infection is not known.

Artyfechinostomum malayanum

(Leiper, 1911) Mendheim, 1943 (Echinostomatidae : Trematoda)

Leiper (1911) described an echinostome trematode from man in the then Federal Malay State under the name *Euparyphium malayanum*. Four years later, Lane (1915) reported another echinostome, *Artyfechinostomum sufrartyfex*, from a girl in Assam, India. Many of the workers consider these two parasites identical as *A. malayanum* and Mohandas (1971), based on life-history studies and the ensuing evidences, has proved this. *A. malayanum* also occurs in the small intestine of pigs in these two countries and has been recorded in man in Thailand and Sumatra. Two outbreaks of *Paryphostomum sufrartyfex* (= *A. malayanum*) infection among pigs with mortalities among piglets have been reported in Bengal (Bhattacharyya *et al.*, 1972). Rarely dogs and rats are infected with this parasite.

The taxonomic position of *A. malayanum* has aroused considerable controversy for a long time. Mukherjee and Ghosh (1968) and Mohandas (1974) have rejected the validity of the genus *Artyfechinostomum* in favour

of *Echinostoma* and have considered *A. sufrartifex* a synonym of *Echinostoma malayanum*. Premvati and Pande (1974) have, however, retained the validity of then genus *Artyfechinostomum* but suppressed, *intèr alia*, its type species, *A. sufrartifex*, in favour of *A. malayanum*. They have considered the latter as the type species of the genus and *A. mehrai* a synonym of *A. malayanum*. In the literature *A. malayanum* is also referred to as *Paryphostomum sufrartifex*.

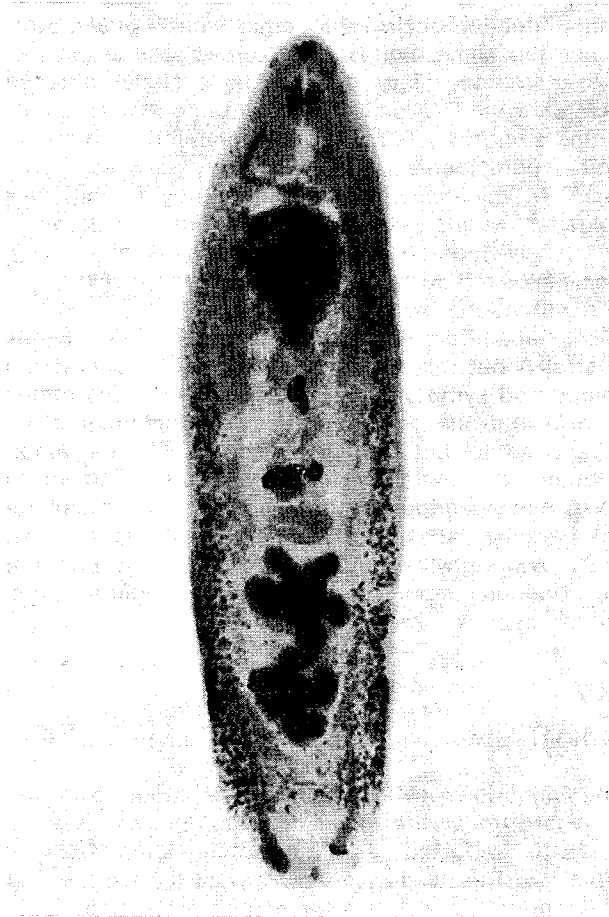


Figure 3.

Artyfechinostomum malayanum, dorsal view. Acetic acid-alum-carminé staining. Mag. $\times 28.2$.

The trematode is elongate measuring 4.0 - 18.0 mm long and 1.2 - 6.0 mm wide (Fig. 3). The subterminal oral sucker is small. It is surrounded by a head collar with a crown of about 42 collar spines arranged in two alternate rows which are uninterrupted dorsally. The pharynx is large, a prepharynx is present and the oesophagus is short. The caeca terminate near the

posterior extremity of the body. A massive ventral sucker is situated in the anterior-fourth of the body. The testes are tandem, deeply lobed and placed in the posterior-half of the body. A long cirrus sac and eversible cirrus are present. The genital pore is situated anterior to the ventral sucker. The ovary is oval, submedian and pretesticular in position. The vitelline glands extend in the lateral field from the level of ventral sucker to the posterior extremity. These glands over-reach caeca medially and behind the posterior testis these glands of both the sides become confluent. The eggs measure 0.105-0.150 mm long and 0.063-0.087 mm wide. These trematodes parasitise the small intestine of pig, man, dog, rat etc.

The fresh-water snail, *Indoplanorbis exustus*, serves as the intermediate-host of *A. malayanum* (Lie, 1963; Dissamarn *et al.*, 1966; Mohandas, 1971). The cercaria encysts in the same snail or the other individual of the same species or the snails of the other species like *Lymnaea*, *Pila*, *Gyraulus* etc. to produce metacercariae. The frog, *Rana cyanophlyctis*, also serves as the second intermediate-host of the echinostome under experimental conditions in which case the metacercariae are found in the kidney (Nath, 1969). The definitive host acquires infection by ingestion of the snails or frogs harbouring metacercariae.

Generally isolated but grave human cases of *A. malayanum* infection are recorded in literature as case reports and no clear account on the endemism of the infection is available. Reddy and Varmah (1960) reported on a patient, native of Madras, India who died due to malnutrition and anaemia and several thousands of *P. sufrarytex* (= *A. malayanum*) were collected from the small intestine on post-mortem. A very comparable clinical picture of an autopsy finding has been presented by Reddy *et al.* (1964) on a south Indian female who harboured massive *A. mehrai* (= *A. malayanum*) infection. Lie and Virik (1963) reported *E. malayanum* (= *A. malayanum*) infection in a child who was often given *Pila* snails to eat. Kaul *et al.* (1974) mentioned of a case of intestinal perforation in man due to *A. mehrai* (= *A. malayanum*) infection and many worms were recovered in the fluid accumulated in the peritoneal cavity. This patient also ate snails habitually abounding in the paddy fields.

It can be easily conceived that the light infections of *A. malayanum* showing subclinical parasitism might be more prevalent especially in areas where the incriminated snails are habitually consumed by the population. Such cases of subclinical parasitism without well defined syndromes might easily escape detection by the clinicians. Treatment of *A. malayanum* infection is not known.

Acknowledgements — *The author is thankful to Mr. O. Vanparijs and Mr. G. Roelants for their helpful assistance.*

De digenetische trematoden, *Fasciolopsis buski*, *Gastrodiscoides hominis* en *Artytechinostomum malayanum* als zoonosen in Zuidaziatische landen.

Samenvatting — Een overzicht wordt gegeven van de relevante literatuur betreffende de geografische verspreiding, de prevalentie, de levenscyclus en de pathogeniciteit van drie digenetische trematoden die voorkomen bij de mens en het varken, n.l., *Fasciolopsis buski*, *Gastrodiscoides hominis* en *Artytechinostomum malayanum*. De morfologie van deze trematoden is kort beschreven en geïllustreerd door middel van foto's van *in-toto* preparaten.

Les trématodes digénétiques, *Fasciolopsis buski*, *Gastrodiscoides hominis* et *Artyfechinostomum malayanum* comme zoonoses en Asie du Sud.

Résumé — Une revue de la littérature est présentée sur la répartition géographique, la prévalence, le cycle vital et la pathogénicité de trois trématodes digénétiques trouvés chez l'homme et le porc : *Fasciolopsis buski*, *Gastrodiscoides hominis* et *Artyfechinostomum malayanum*. La morphologie de ces trématodes est brièvement décrite et illustrée.

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