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Fischoederius cobboldi: A scanning electron microscopy investigation of surface morphology of adult rumen fluke

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ABSTRACT

Adults *Fischoederius cobboldi* are conical-shaped, concave ventrally and convex dorsally, measures about 8–10 mm in length and 4–6 mm in width across the mid section. Scanning electron microscopy (SEM) of entire body showed that the tegumental surface exhibits highly corrugation and transverse folds alternating with grooves and without spines. At higher magnification, the surface of each fold is further increased with a meshwork of ridges separated by irregular-sized pits. The ventral surface has more complex corrugations and invaginations than those of the dorsal surface of the body. Both anterior and posterior suckers have thick edges covered with transverse folds and appear spineless. The genital pore is located at the anterior one-third of the body. There are two types of sensory papillae on the surface: type 1 is bulbous in shape and nipple-like tips, measuring 10–15 μm in diameter at the base, and also type 2 is a similar shape and has short cilia on tips. These sensory papillae occur in large clusters, each having between 7 and 25 units depending on the region of the body. Clusters of papillae on the ventral surface and around the anterior suckers tend to be more abundant and larger in size. The dorsal side of the body exhibit similar surface features, but papillae appear less numerous and are smaller. Corrugations and invaginations of the dorsal aspect are also less extensive than those on the ventral surface of the body.
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1. Introduction

Paramphistomosis caused by paramphistomes in domestic and wild ruminants, include *Paramphistomum cervi*, *Gastrothylax crumenifer*, *Paramphistomum microbothrium*, *Paramphistomum ichikawai*, *Paramphistomum explanatum*, *Calicophoron calicophorum*, *Cotylophoron cotylophorum*, *Fischoederius elongatus*, and *Fischoederius cobboldi*. These parasites belong to the superfamily Paramphistomoidea (Katiyar and Grag, 1965; Horak, 1971; Brotowidjoyo and Copeman, 1979; Hanna et al., 1988; Wang et al., 2006). Their early stages are in the small intestine and then migrate up to the abomasums towards the rumen where they spend the remainder of their adult lives (Sanabria and Romero, 2008). Immature flukes cause severe enteritis, especially in young stock, which can result in dehydration, maldigestion and death. The infection affects production, since these parasites reduce nutrition conversion, a loss of weight and/or a decrease in milk production, which result in substantial economic losses (Horak, 1971; Malek, 1980; Noble and Noble, 1982; Hanna et al., 1988). It has been reported that the subclinical infection is often not diagnosed and its effect cannot be determined. Morbidity and mortality rates due to immature worms can be as high as 80–90% in domestic ruminants (Khan et al., 2008). Paramphistomosis showed highest prevalence in tropical and subtropical regions, particularly in Africa, Asia, Australia, Eastern Europe and Russia (Gupta et al., 1978; Nikitin, 1979; Hanna et al., 1988). In Thailand, the occurrence of paramphistome infection, mainly from *F. cobboldi,* has also been reported (Chethanon et al., 1985; Prasitirat et al., 1997a). Although paramphistomosis is primarily a ruminant disease, human infections have been reported. *Gastrodiscoides hominis* Leiper, 1913 (Gastrodiscidae) is a common parasite in pigs, and occasionally reported in human in Burma, China, India, Kazakhstan, the Philippines, Vietnam and Thailand (Ahluwalia, 1960; Dutt and Srivastava, 1972; Kumar, 1980; Harinasuta et al., 1987). Bithionol sulfoxide had been reported to be highly effective and recommended for the treatment of paramphistomosis in cattle, sheep and goats (Reddy and Hafeez, 1986; Rolfe and Boray, 1988; Gupta et al., 1981), although resistance of rumen flukes to this drug was reported (Prasitirat et al., 1997b). In view of the cost and possible resistance of rumen flukes

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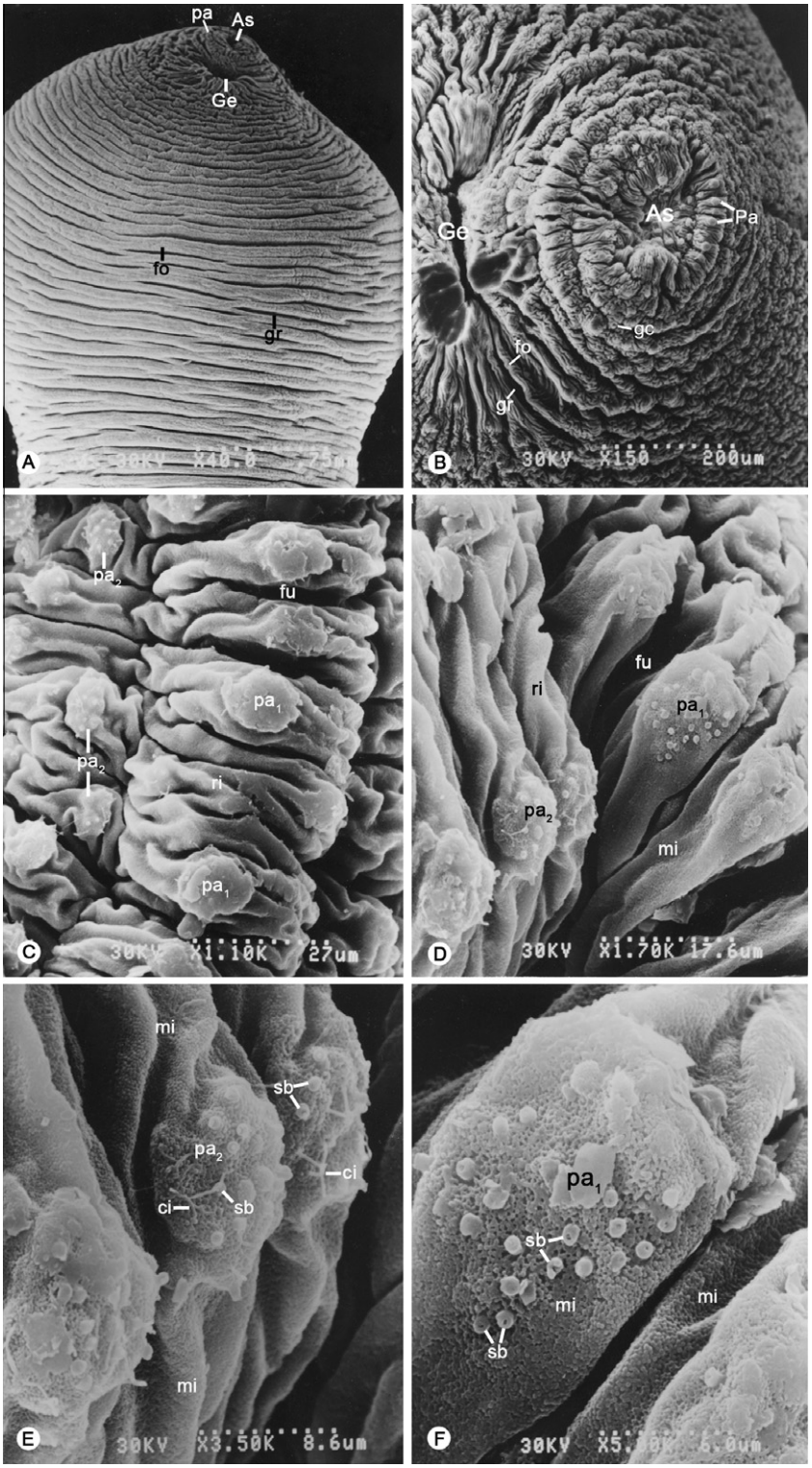

Fig. 1. (A) Anterior ventral surface of an adult *Fischoederius cobboldi* showing anterior sucker (As) surrounded by folds (fo) and grooves (gr) bearing rows of ventral papillae (pa), while spines are absent. The opening of genital canal (Ge) lies just behind the anterior sucker. (B–F) Anterior ventral surface of adult *F. cobboldi*: (B) The anterior sucker (As) surrounded by rows of papillae (pa) and pores of glands (gc), folds (fo) as well as grooves (gr). (C and D) The surface exhibits numerous clusters of papillae (pa) on a series of ridges (ri) alternated with furrows (fu). (E) Type 2 papillae (pa_2) with short cilia (ci) on the nipple-like tips surrounded by small bulbs (sb), and the surface of ridges bearing numerous microvilli (mi). (F) Type 1 papillae (pa_1) with nipple-like tips surrounded by small bulbs (sb).

to the action of drugs, a better alternative would be the development of vaccines to either completely prevent the infection or arrest the worm development at juvenile stages of their life cycle.

In trematodes, the tegument is the outermost parasite tissue layer in direct contact with the host's tissues and body fluids. It plays an important role in the absorption and exchange of nutritive and waste molecules, osmoregulation, protection against the host's digestive enzymes and immune responses, and perception of sensory stimuli. The knowledge of the structural organization of the tegument is essential in developing any rational drugs or vaccines,

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