

## Morphological and microtopographical strain variations among *Fasciolopsis buski* originating from different geographical areas

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**Abstract.** In order to reveal intra-specific strain variations, if any, morphological and SEM studies were performed on *Fasciolopsis buski* collected from *Sus scrofa domestica* in Assam and Meghalaya (India). Specimens of Assam origin showed the typical form of elongated body with unbranched simple intestinal caeca; the general body tegument both on the dorsal and ventral sur-

faces had transverse corrugations, with isolated bun-shaped, round, smooth papillae abounding on the dorsal surface only. The flukes of Meghalaya origin showed an oval body contour, and slightly diverticulated intestinal caeca; the dorsal surface of the body is finely tuberculated but the ventral surface possesses scale-like, blunt papillae with socketed bases.

### Introduction

Helminth parasites of the same species collected from the same host species coming from different geographical areas often exhibit slight morphological variations which may be regarded as an expression of intra-specific variability (De Buron et al. 1986) or strain variation. A knowledge of strain variation is important in terms of regional epidemiological significance and control measures (Vasilev 1984). Recently, biochemical means of characterization of intraspecific variants using polyacrylamide gel electrophoresis has become a popular tool in the systematics of helminth parasites (Bryant and Flockhart 1986). In addition, stereoscan studies on the surface topography in several digenean species representing various families (Kuntz et al. 1976, Eduardo 1980, Sey 1984, Tandon and Maitra 1987) revealed that surface features are species specific and thus offer an additional set of criteria of taxonomic value. However, in unravelling the intraspecific differences, the utilization of SEM is very much limited.

During a survey of digenetic trematode parasites of pigs in some North-Eastern states, *Fasciolopsis buski* (Lankester, 1857) Stiles, 1901, collected from Assam

and Meghalaya, representing two different geographical zones in India, showed some morphological differences. This giant fluke of human and swine hosts is of zoonotic importance, particularly in the present study area (Buckley 1939). Stereoscan studies on the surface topography of these flukes, representing two geographical populations, were carried out to see whether or not there exist any variations among them in respect to the fine surface morphology.

### Material and methods

The collection areas, Guwahati (91°45'45"E - 26°15'00"N 55 m ASL) and Shillong (91°45'30"E - 25°30'45"N 1524 m ASL) come under the jurisdiction of two states, namely, Assam and Meghalaya, respectively in North-East India. Guwahati experiences a tropical climate, whereas Shillong comes under the subtropical monsoonic belt with high rainfall and humidity.

Adult flukes were collected from the intestines of freshly slaughtered hosts, *Sus scrofa domestica* L. The collection from pigs of Guwahati comprised 14 specimens, while a total of 24 flukes was collected from swine reared at Shillong. Six specimens from each locality

were processed for whole mount preparation, using Mayer's carmallum staining (as modified by Gower 1939). Their measurements (in millimeters) were taken with the help of an ocular micrometer. In addition, for scanning electron microscopy, 4 specimens each from Assam and Meghalaya origins were fixed in 4% cold phosphate buffered formalin and processed following Dey et al. 1989 as described earlier (Roy and Tandon 1990).

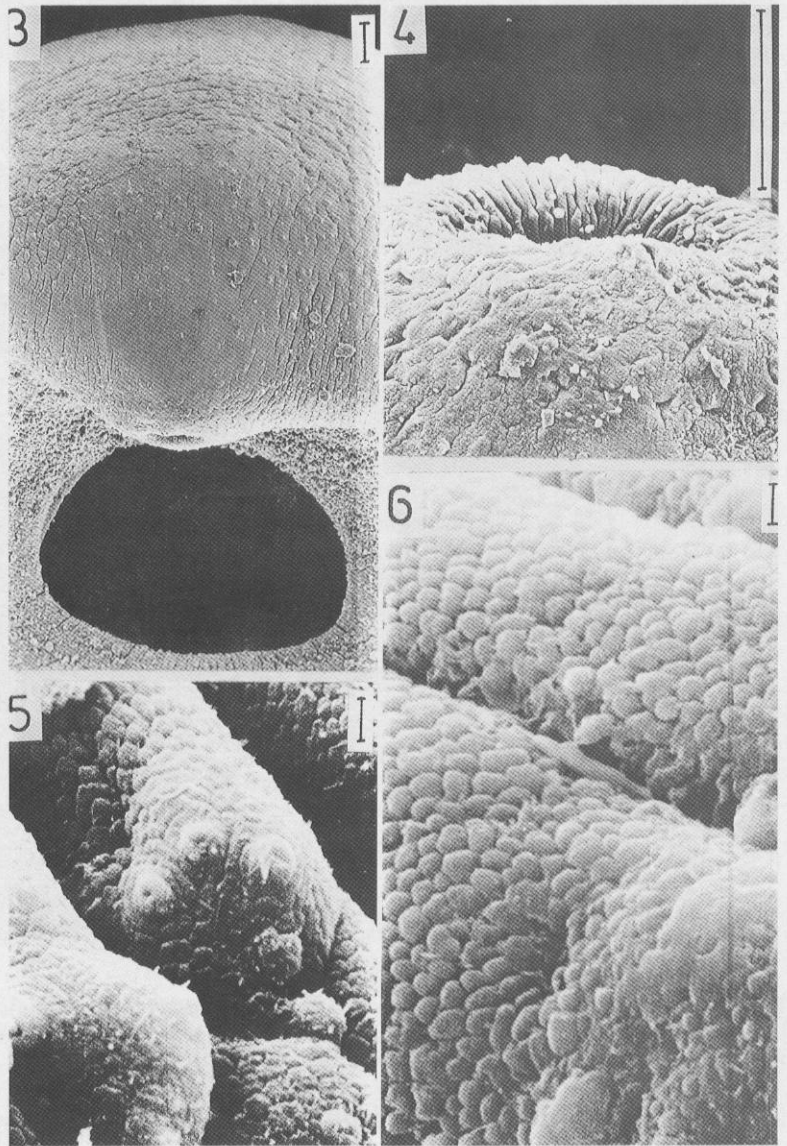
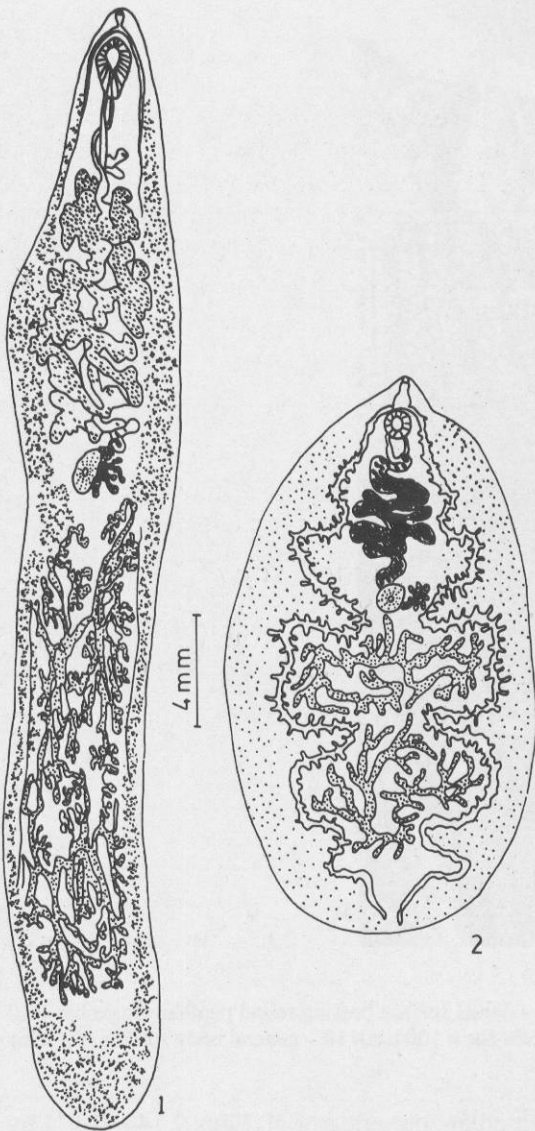
Specimens of *Fasciolopsis buski* of Assam origin (No. NEHU/Z-TM/27A) and of Meghalaya origin (No.

NEHU/Z-TM/27B) were deposited in the Helminthological Collection of Department of Zoology, North-Eastern Hill University, Shillong.

## Results

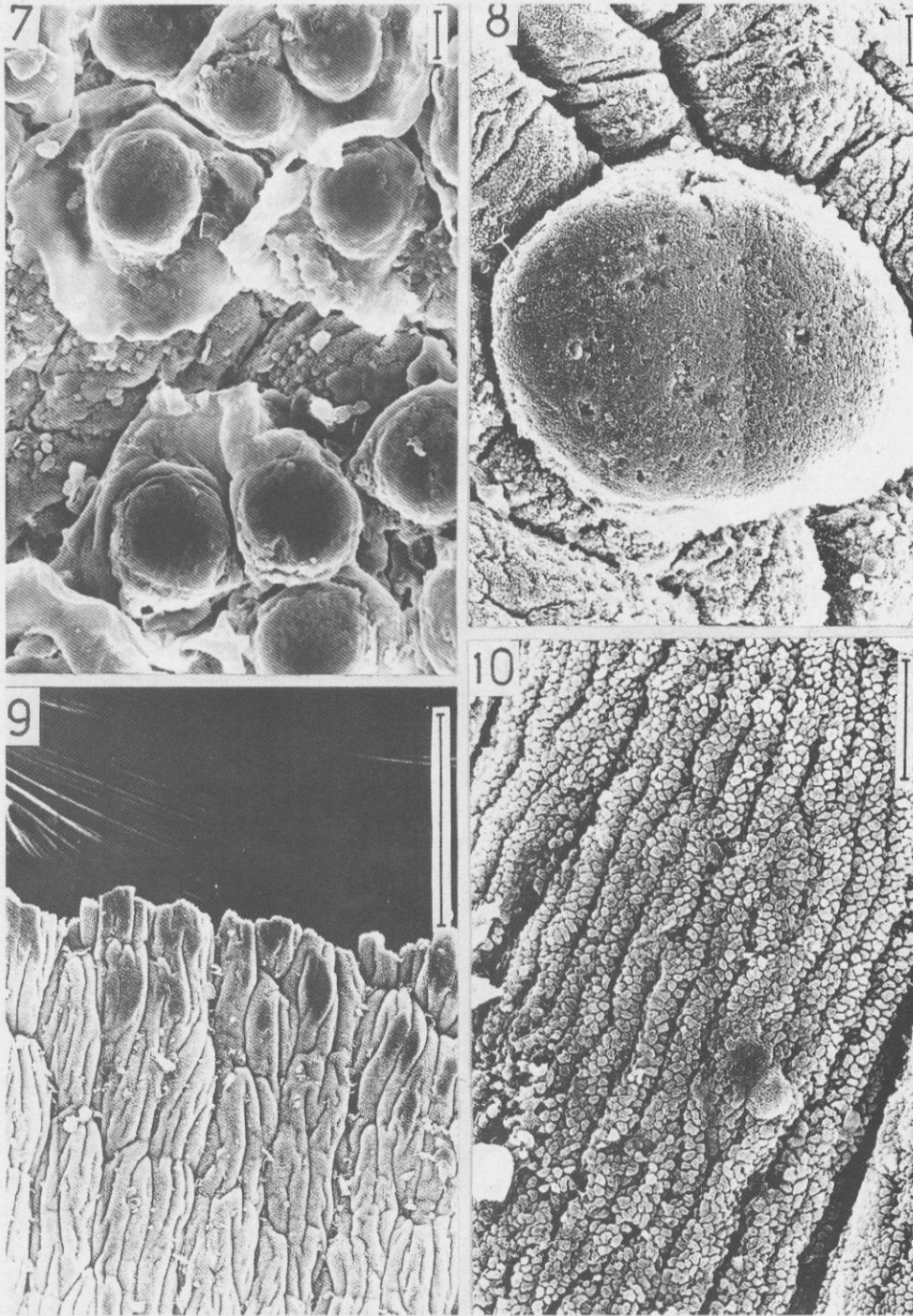
### *Fasciolopsis buski* of Assam origin

Body elliptical or linguiform, with rounded posterior end, 33–58 long, 8–16 in greatest width; ratio of body width to body length 1:3.3–1:3.6. Ventral sucker 1.22–



**Figs. 1–2.** *Fasciolopsis buski* (camera lucida diagrams): 1 – whole worm, ventral view (Assam origin); 2 – whole worm, ventral view (Meghalaya origin)

**Figs. 3–6.** Scanning electron micrographs of *Fasciolopsis buski* (Assam origin): 3 – anterior end (scale bar = 100 µm); 4 – oral sucker (scale bar = 100 µm); 5 – a closer view of oral cavity, showing grouped pitted papillae on the tegumental folds (scale bar = 1 µm); 6 – rim of ventral sucker, magnified view (scale bar = 1 µm)



**Figs. 7–10.** Scanning electron micrographs of *Fasciolopsis buski* (Assam origin): 7 – dorsal surface bearing round papillae (scale bar = 10  $\mu$ m); 8 – a single papilla, magnified (scale bar = 10  $\mu$ m); 9 – lateral edge of body (scale bar = 100  $\mu$ m); 10 – general body surface, showing fine tubercles at higher resolution (scale bar = 10  $\mu$ m)

2.26 in greatest diameter, ratio to body length 1:25.66–1:27.04. Oral sucker smaller than ventral sucker, 0.36–0.49 in diameter, ratio to ventral sucker 1:3.38–1:4.61. Prepharynx very short; pharynx 0.36–0.63 in diameter. Oesophagus very short. Caeca lateral, simple, unbranched, more or less straight, extending to subcaudal region. Cirrus sac long, sinuous. Ovary branched; Me-

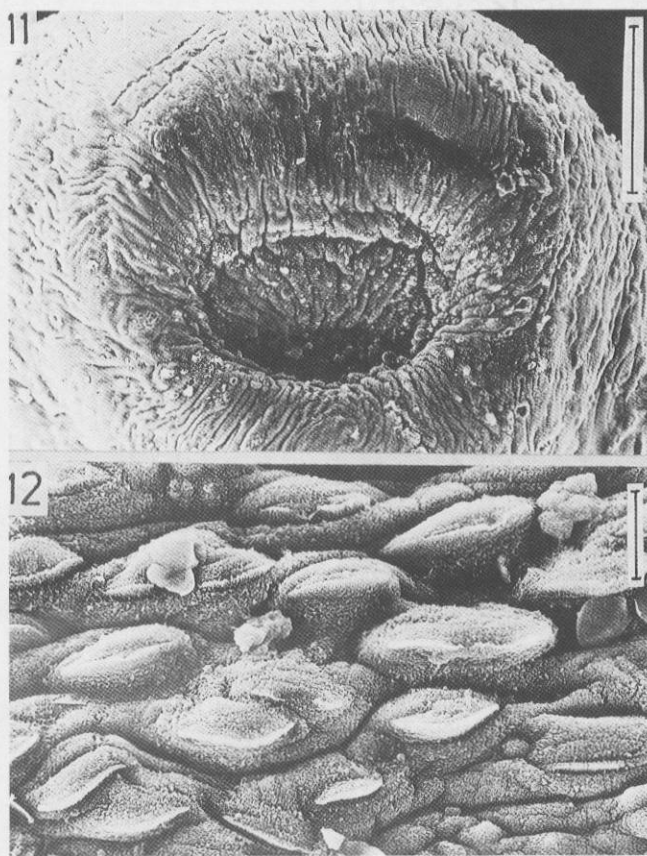
hlis' gland median, pre-equatorial. Eggs 0.144–0.171 by 0.081–0.094 (Fig. 1).

The general body tegument, both on the dorsal and ventral surfaces, shows transverse corrugations and a beaded texture formed by compactly placed tuberculations (Fig. 3). The tegumental lining of the oral cavity is also thrown into longitudinally running ridges and folds

with a tuberculated surface and provided with domed aciliate papillae in groups of 2–4 (Figs. 4 and 5). The rim of the sucker is devoid of any papillate structures (Fig. 6). However, isolated bun-shaped, round papillae with smooth surfaces are seen on the dorsal tegument (Figs. 7 and 8). The margins of the dorsal surface show a mozaic arrangement of plate-like structures formed of compactly arranged tubercles (Figs. 9 and 10).

#### *Fasciolopsis buski* of Meghalaya origin

Body oval, 17–22 long, 11–14 wide, ratio of body width to body length 1:1.42–1:1.54. Ventral sucker 1.8–2.48 in diameter, ratio to body length 1:8.06–1:9.44. Oral sucker smaller than ventral sucker, 0.45–0.72 in diameter, ratio to ventral sucker 1:4.59–1:5.0. Prepharynx short; pharynx 0.58–0.72 in diameter. Oesophagus absent. Caeca running sinuously with 4–5 loose coils, showing lateral diverticulations. Cirrus sac tubular, short, opening anterior to ventral sucker. Ovary branched, lying right of midline. Mehlis' gland median, pre-equatorial. Vitellaria loose follicles occupying lateral fields. Uterus coiled transversely in intercaecal field. Eggs 0.113–0.135 by 0.094–0.094 (Fig. 2).



**Figs. 11–12.** Scanning electron micrographs of *Fasciolopsis buski* (Meghalaya origin): **11** – oral extremity (scale bar = 100  $\mu$ m); **12** – tegument of the region between the suckers, showing elliptical papillae (scale bar = 10  $\mu$ m)

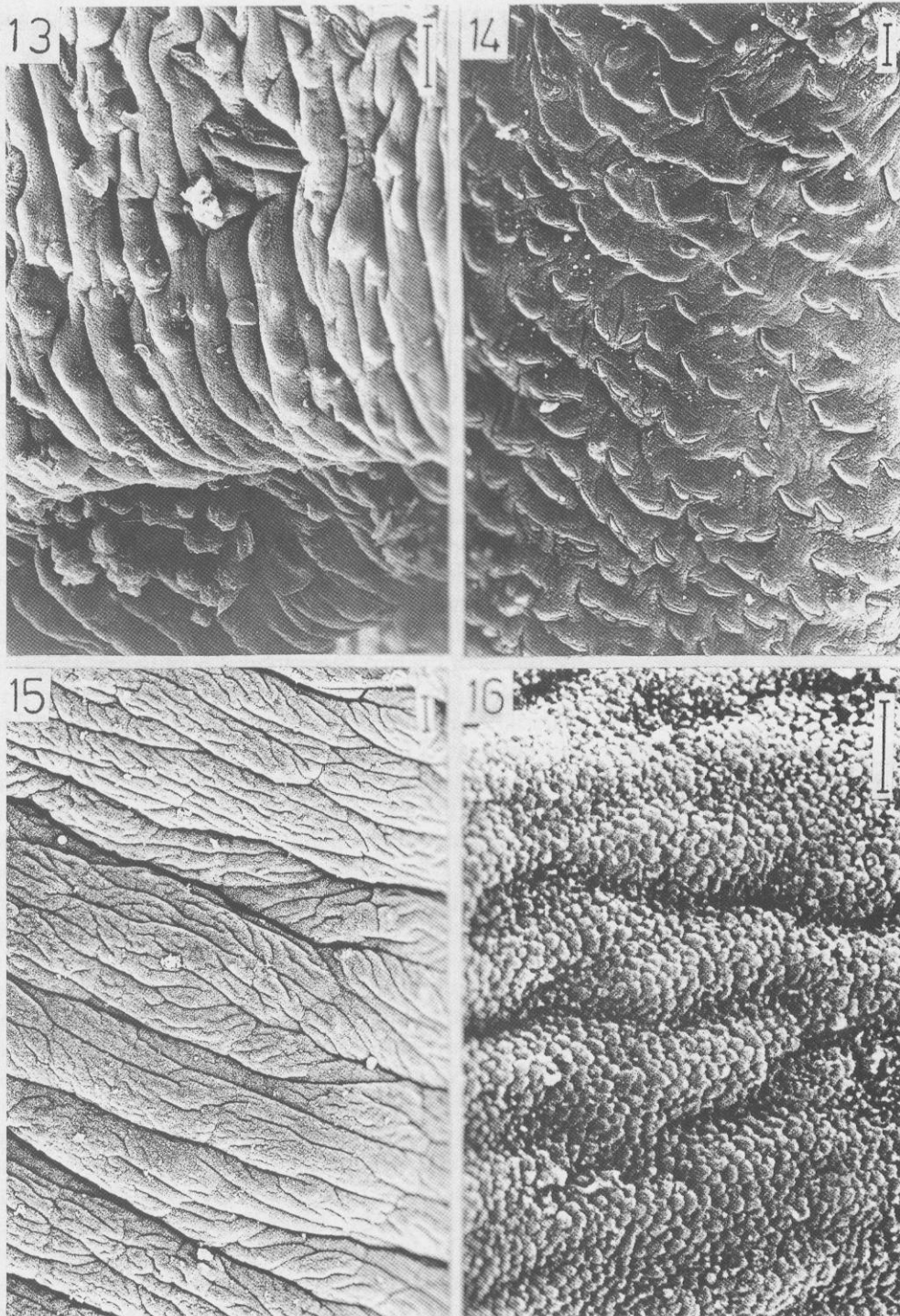
The dorsal surface of the body is provided with transverse ridges and is of a finely tuberculated nature (Figs. 15 and 16). The rim of the suckers is radially corrugated (Figs. 11 and 13). The ventral surface, in the region between the two suckers, is provided with leaf-like papillae (Fig. 12); however, at other places it revealed the presence of conspicuous scale-like, blunt papillae, the latter emerging from sockets between the tegumental corrugations (Fig. 14).

#### Discussion

The present observations on *F. buski* specimens collected from Guwahati (Assam) tally with earlier descriptions of the species (Mehra 1980, Yamaguti 1971) in all aspects, except for minor deviation with regard to measurements of the various organs. However, the parasites collected from Shillong (Meghalaya) differ in respect of the shape and size of the body, ratio of different body parts to the length of the body, the egg size and in having laterally dendriditic caeca.

A comparison of stereoscan observations between the flukes of the two geographical populations revealed differences in their surface topography. While the material of Assam origin exhibited finely tuberculated and crenulated lateral margins of the body, clustered papillae on the luminal tegument of the oral sucker, foldings on the tegument of the ventral sucker rim, and round, aciliate smooth papillae on the dorsal surface, the flukes from Meghalaya region appeared to lack these features but possessed an additional feature of scale-like, blunt, socketed and leaf-like papillae on their ventral surface.

In the present study mature flukes (with eggs in the uterus) representing two geographical populations revealed their differences at both morphological and ultrastructural level. Since helminth parasites live in discontinuous environments, infection by a small number of parasites may not fully represent the genetic character of the whole population; thus the constraints of the environment may lead to the formation of distinct strains (Bryant and Flockhart 1986). Using biochemical means as parameters, McManus and Smyth 1978 and McManus 1981 differentiated various geographical strains of *Echinococcus granulosus* originating from the U.K., Kenya and the USA. Senft et al. 1978 observed microtopographical differences among the individuals of the same species of *Schistosoma* originating from normal and nonpermissive hosts, thus indicating the influence of different host species on the parasite's body. Thompson and Smyth 1976 are of the opinion that strains of the same species originating from different hosts may differ in their infectivity to the intermediate and definitive hosts, including man. However, in the present study the final host species is the same, though from different geographical zones. Whether or not the intermediate snail host species in-



**Figs. 13–16.** Scanning electron micrographs of *Fasciolopsis buski* (Meghalaya origin): **13** – rim of ventral sucker, enlarged (scale bar = 10  $\mu$ m); **14** – the region posterior to ventral sucker, showing scale-like structures (scale bar = 10  $\mu$ m); **15** – dorsal surface of body, showing transverse ridges (scale bar = 10  $\mu$ m); **16** – the same under higher resolution (scale bar = 1  $\mu$ m)

volved in the life cycle of *F. buski* is same in the two geographical areas needs to be investigated.

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