Notes on the Mycetangia of the Ambrosia Beetles, *Platypus*
severini BLANDFORD and *P. calamus* BLANDFORD
(Coleoptera: Platypodidae)

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The mycetangia of *Platypus severini* BLANDFORD and *P. calamus* BLANDFORD are described. The female adults both species have several hundred of integumentary pit-type mycetangia on the pronotum. The male adults in contrast have but a few pits of the same type. The main mycetangia of the male adult of *P. severini* are the enlarged forecoxal and mesocoxal cavities, whereas the mycetangia of this type are not found in the female adult of this species.

INTRODUCTION

The mycetangia, that is, specialized structures or repositories for carrying symbiotic fungi, found in the members of the genus *Platypus*, have been described by some authors. In *P. hintzi* a pair of tiny hollows on the pronotum of the female serves as storage for the symbiotic fungus and in *P. oxyurus* and *P. wilsoni* very small pores in an indefinite number on the pronotum of the female serve as mycetangia (FARRIS & FUNK, 1965; FRANCKE-GROSMANN, 1966). In the present report the mycetangia of *Platypus severini* BLANDFORD and *P. calamus* BLANDFORD are described.

MATERIALS AND METHODS

The adult beetles of *P. severini* and *P. calamus* were collected from pinholed beech logs (*Fagus crenata* BLUME of about 20–35 cm in diameter, selected from a beech stand at Kaminokuni, Hokkaido, in the autumn of 1970) in late July, 1971, and kill-fixed in AFT solution. For histological studies, specimens were double embedded in Celloidin-Paraffin, and the 15 μ thin sections cut from the entire beetle were stained by a modified GRAM-WEIGERT procedure, especially for the purpose of staining fungus deposits selectively. In scanning electron microscopy, specimens were coated with carbon and gold, and scanned with a scanning electron microscope, Type JSM-SI, JEOL Inc. X-ray observations were made by a super soft X-ray apparatus, Type CMR, Softex Co. Ltd.

RESULTS

Platypus severini BLANDFORD

Female: Examination of the sagittal sections of the female adult stained with the modified GRAM-WEIGERT stain showed that integumentary pits situated at the punctate

Fig. 1. Sagittal section, 15 μ , of *Platypus severini* ♀ stained with a modified GRAM-WEIGERT stain. MA, mycetangial area.

Fig. 2. Pit-type mycetangia of *Platypus severini* ♀. M, mycetangia; G, glands.

area of the pronotum contain densely packed gram-positive material, and that gland-like cells are seen below the pits (Figs. 1, 2). Fungus material and gland-like cells were not found anywhere outside the punctate area in the female adult. Because of the presence of the fungus material and of the gland-like cells, it is evident that these integumentary pits serve as mycetangia. The mycetangia of the present species are very similar to those of *P. wilsoni* described by FARRIS and FUNK (1965).

The surface structure of the mycetangia, observed in scanning electron microscopy, is shown in Figs. 3–8. The mycetangia somewhat resemble the feathers of an arrow in distribution (Fig. 4). The punctate area is about 0.7 mm in length, about 0.17 mm in width at the anterior end and about 0.25 mm in width at the posterior end. The number of the pits or the mycetangial openings is about 600. Each opening is oval in shape and is about $11\text{--}13\ \mu \times 9\text{--}11\ \mu$ in size. The mycetangia situated in the anterior one-fourth of the punctate area are slightly larger than those situated posteriorly. Inside the opening, on the posterior margin, a forward directed and globular-headed pillar, about $3\ \mu$ in length and about $2\ \mu$ in width, is found (Figs. 6, 7). On the posterior wall of the opening, 1 or $2\ \mu$ below the surface of the integument, a few very small holes, $0.5\text{--}1.5\ \mu$ in diameter, are observed (Fig. 8). Deep in the opening is found an irregularly shaped lump the surface of which is tuberculate with many half-spheroidal projections, $0.4\text{--}0.6\ \mu$ in diameter.

Male: On the pronotum of the male adult, a few small holes were observed (Figs. 9–14). The number of the holes varied from 2 to 14 (Figs. 10, 13). These holes are quite similar in shape to the mycetangia of the female, while some of them are very small. Histological examinations with $15\ \mu$ thick paraffin sections of male adults, however, showed neither fungus materials nor gland-like cells in the pronotum. On the other hand, blue-colored globular fungi were found in the enlarged forecoxal and mesocoxal cavities (Figs. 15–19). Gland-like cell layers are present around the cavities. The metacoxal cavities are not enlarged and fungi were not found. On account of the presence of the fungi and gland-like cell layers, it is evident that these enlarged forecoxal and mesocoxal cavities are mycetangia. No mycetangia of this type were found in the female.

Platypus calamus BLANDFORD

Female: Only one specimen was examined. The mycetangia, which are very

Figs. 3-8. Pit-type mycetangia of *Platypus severini* ♀, scanning electron microscopy.

similar in shape to that of the female of *P. severini*, were observed on the pronotum of the female (Figs. 20-22). The mycetangial area is less extensive than in *P. severini*, elongate cordate in shape, about 0.35 mm in length, and 0.25 mm in width. The

Figs. 9-14. Pit-type mycetangia of *Platypus severini* ♂ observed under a scanning electron microscope.

number of the mycetangial openings is about 250 in the specimen. Each opening is oval in shape and about $12-15\ \mu \times 7-12\ \mu$ in size. The mycetangia situated in the

Figs. 15-19. Enlarged coxal cavity-type mycetangia of *Platypus severini* ♂. 15, sagittal section, 15 μ ; 16, forecoxal cavity; 17, mesocoxal cavity; 18, 19, mycetangia of the enlarged forecoxal cavity. M, mycetangia; FS, fungus spores; G, glands.

anterior one-third of the punctate area are obviously larger than the others. In the shape of the mycetangial area and the number of the openings, this species is similar to *P. wilsoni* observed by FARRIS and FUNK (1965) rather than to *P. severini*. The projecting pillars situated on the posterior margin of the opening are somewhat flatter than those of *P. severini* (Fig. 22).

Male: Only one specimen was examined. Fifteen openings, which are very similar in type to the mycetangia of the female, were observed at the corresponding part of the pronotum (Fig. 23). The openings are oval and about $11-14 \mu \times 5-10 \mu$ in size, but are somewhat irregular in shape. Some of them are almost round and others elongated oval. Both the internal pillar and the minute holes on the posterior wall

Figs. 20-25. Pit-type mycetangia of *Platypus calamus* observed under a scanning electron microscope. 20-22, ♀; 23-25, ♂.

are distinct in the opening (Figs. 24, 25). No histological examination on paraffin sections was carried out in this species because of limited material.

DISCUSSION

It is evident that *P. severini* has two types of mycetangia, namely the integumentary pits on the pronotum of the female adult and the enlarged forecoxal and mesocoxal cavities of the male adult.

The mycetangia of the female are quite similar in type to those of the females of *P. oxyurus* and *P. wilsoni*. From the examination of the paraffin sections of *P. severini*, it seems that the pillar situated on the posterior margin of the mycetangium is made of some material comparable in hardness to the integument. The function of the pillar is not clear, but it is assumed that they may take part in transferring fungus material from the gallery-wall into the mycetangial opening in the newly emerged adult. The minute holes situated on the posterior wall of the mycetangium may be the openings of ducts, which are supposed by FARRIS and FUNK (1965) to transport secretions from the glands to the mycetangia. Generally, the fungus materials stored in mycetangia are wrapped in the secretion (FRANCKE-GROSMANN, 1956, 1967). In the present examination of the paraffin sections, the fungus materials of the female adult of *P. severini* were observed as a round lump in each integumentary pit (Fig. 2). The irregularly shaped lumps, found in the integumentary pits in the scanning electron microscope observation (Figs. 6, 7, 8, 22), may be the fungus material which had dried up and changed in shape during the handling process for microscopy.

A few openings, which are the same in type as the mycetangia of the female, are situated on the pronotum of the male adult. The number of the openings varied from two to fifteen. Some of these openings are similar in shape to the normal punctures situated over the entire surface of the pronotum. No gland-like cells associated with these openings have been found in the male in the present study. This seems to suggest that the origin of the mycetangial openings may be the usual punctures on the surface of the pronotum. In the female the openings are in full development, whereas in the male they appear to be underdeveloped.

The male adult of *P. severini* has another type of mycetangia, the enlarged forecoxal

Fig. 26. *Platypus severini* ♂ boring a tunnel at the surface of a beech log.

Figs. 27, 28. *Platypus severini* observed under a super soft X-ray apparatus. 27, ♀; 28, ♂.

and mesocoxal cavities. The mycetangia of this type are not found in the female.

Hitherto, in the family Platypodidae, true mycetangia have been found only in the female, while it is the male which attacks the host plant first (FARRIS and FUNK, 1965; FRANCKE-GROSMANN, 1967; NAKASHIMA, 1971). In the case of *P. severini*, the sex which first attacks the host plant and actively bores the galleries is the male. This is substantiated by field (Fig. 26), as well as laboratory observations, and supported by X-ray photography (Figs. 27, 28), which shows a more thickly developed muscle system of the head in the male than in the female. In the present examination, however, two different types of mycetangia were found in the male. Insofar as the author is aware, no Platypodid beetles which have mycetangia in the male adults have hitherto been reported.

The roles of both the sexes in the galleries, and the fungi associated with each sex were not clarified in the present study.

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