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INSECTA MATSUMURANA

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NOTES ON THE TIME WHEN THE NEW FEMALE ADULTS OF THE AMBROSIA BEETLE CROSSOTARSUS NIPONICUS BLANDFORD (COLEOPTERA: PLATYPODIDAE) HARVEST THEIR SYMBIOTIC FUNGI INTO THEIR MYCETANGIA

By TOSHIO NAKASHIMA

Abstract

NAKASHIMA, T. 1979. Notes on the time when the new female adults of the ambrosia beetle *Crossotarsus niponicus* Blandford (Coleoptera: Platypodidae) harvest their symbiotic fungi into their mycetangia. *Ins. matsum. n. s.* 17: 19 pp., 25 figs. (6 pls.).

The time was examined in which the new female adults of *Crossotarsus niponicus* Blandford harvest their symbiotic fungi into their fungus repositories or mycetangia. The glands associated with the mycetangia are recognized from a very early period when the body-color of the new female adults is still light yellow. From the stage when the body-color is reddish brown, the sphere-shaped tissues, 0.2 mm in diameter and situated at the back of the preoral cavity, are distinctly identified. When the females are still found in the gallery but already dark brown, no fungus spores can be discerned in the mycetangium. In the flight season, however, great many spores are recognized in the mycetangium. It is therefore reasonable to consider that the female adults harvest the symbiotic fungus spores in their mycetangia just before their appearance.

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Introduction

In spring or early summer, when the new adults of ambrosia beetles start their galleries, their mycetangia are fully stored with symbiotic fungi. It is not well known, however, when the beetles harvest their symbiotic fungi into their mycetangia. In the present study I tried to determine the time of harvest in the ambrosia beetle *Crossotarsus niponicus* Blandford. This species belongs to one of the groups in which the female has a mycetangium at the back of the preoral cavity; however, the male has no mycetangium (Nakashima, 1971, '75) (Figs. 1–10, 24, 25).

Materials and methods

Pinholed beech logs (*Fagus crenata* Blume) of about 20–35 cm in diameter were selected from a beech stand at Kaminokuni, in the southern part of Hokkaidô, in the middle of October, 1976. Half the logs were broken into small pieces to collect the adults of *C. niponicus* from the galleries directly, and the other half were allowed to lie throughout the winter under snow on the Hokkaidô University Campus in Sapporo. Next spring, from March to May, these logs were broken into small pieces to collect the beetles remaining in the galleries. In both cases, old adults (parents), new adults and larvae were staying in the galleries together. The parents are distinguishable from the new adults by lacking tarsi. The new adults were classified into 5 stages according to the depth of their body-color as follows:

a) Adults just after emergence. The body-color is light yellow. The exuviated skin still sticks to the head.

b) Adults reddish brown.

c) Adults dark brown. Much the same as the mature ones in color, but without mucus in the mouth.

d) Adults dark brown, with pale yellowish mucus in the mouth.

e) Adults 12–24 hr after appearance from the host logs.

The specimens belonging to the stages a to d were collected from the galleries directly. These female adult beetles were kill-fixed in AFT solution (a mixture of ethyl alcohol, formalin and trichloroacetic acid), and embedded in celloidin-paraffin. They were sectioned at 15 μ, and stained with a modified Gram-Weigert stain (Leach, 1940).

Results

Stage a (Figs. 11, 12). The proventriculus and ventriculus are full of fungus material. The spongelike tissues (or glands), which will be associated with the mycetangium later, are in evidence. However, the sphere-shaped tissue is not found at this stage.

Stage b (Figs. 13, 14). Fungus material is found in the proventriculus and rectum. The spongelike tissues are clearer than at stage a. The sphere-shaped tissue is found at the back of the preoral cavity and somewhat distorted. This tissue, however, is not stained blue but pink at this stage.

Stage c (Figs. 15, 16). The crop is full of fungus material. The spongelike tissues are clearly recognizable, though they are not stained blue. The sphere-shaped tissue is clearer than that at stage b, though it is not stained blue. Several

grown eggs can be recognized in the abdomen.

Stage d (Figs. 17, 18). The sphere-shaped tissue, about 0.2 mm in diameter, is stained blue or dark blue. The spongelike tissues are stained blue. A good amount of cell-like material, stained light pink and 2–5 μ in diameter, can be seen around the sphere-shaped tissue. The preoral cavity of the female beetle is full of mucous material stained purple. This material is yellowish white in non-stained specimens and can be seen clearly through integument.

Stage e (Figs. 1–10, 19–25). This stage is different from the preceding one in that many fungus spores, stained dark blue and 5–20 μ in diameter, can be found around the sphere-shaped tissue. No fungus material can be seen in the proventriculus of the female (Fig. 1). In the male, however, the crop and proventriculus are full of fungus material (Figs. 24, 25).

Discussion

The proventriculus and ventriculus of the newly emerged adults, which are still light yellow in color, are full of fungus material (Figs. 11, 12). This fact may suggest that the newly emerged adults begin to eat at a very early period after emergence. The spongelike tissues expected to be associated with the mycetangium are already in existence (Fig. 11). The mycetangium itself, however, cannot be identified at this period.

In the stage in which the body-color is reddish brown the sphere-shaped tissue can be recognized (Fig. 14), though not stained blue and somewhat distorted in shape. This tissue is stained blue or dark blue when the body-color is dark brown; however, fungus-spores are still not visible at this stage (Figs. 17, 18).

Just after leaving the logs, the female adults, without exception, keep their mouthparts full of mucous material and cannot eat. The sections show that the crop, proventriculus and ventriculus are empty at this stage (Fig. 1). Many fungus-spores, stained dark blue, can be seen around the sphere-shaped tissue (Figs. 4–6, 19–23).

All this leads to the conclusion that the female adults stop eating only a few days before leaving their host logs. They fill their mouthparts with mucous material (Figs. 1–3), store the fungus-spores in the mycetangium, and then leave the logs. Schneider & Rudinsky (1969a) reported that the fungus of *Gnathotrichus retusus* and *G. sulcatus* is taken up when beetles start to move out of their pupal cradles.

The spores which are found around the sphere-shaped tissue of *C. niponicus* are 5–20 μ in diameter (Figs. 6, 21–23), thus approximately agreeing with the spores found in the mycetangia of diverse species of ambrosia beetles: *Xyleborus ferrugineus, Xyloterinus politus, Gnathotrichus retusus, G. sulcatus, Trypodendron lineatum, Dendroctonus adjunctus, D. frontalis, Platypus severini, P. curtus, P. shoreanus bifurcus,* and *Diapus quinquespinatus* (Baker & Norris, 1968; Abrahamson & Norris, 1969; Schneider & Rudinsky, 1969a, b; Barras & Perry, 1971, '72; Barras & Taylor, 1973; Nakashima, 1972, '75).

In my previous study on this species I supposed the sphere-shaped tissue to be the mycetangium (Nakashima, 1971, '75). But in the present study it is found that many spores are located not in the sphere-shaped tissue but around it. Moreover, these spores are wrapped together in a thin membrane. Therefore, it

can be argued that the bag made of the thin membrane is a mycetangium. The sphere-shaped tissue may be a gland associated with the mycetangium just as the spongelike tissues are.

Acknowledgements

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PLATES

Plate I

Figs. 1, 2. Sagittal section of the head of female *C. niponicus* of stage e.
Fig. 3. Longitudinal section (slightly to the right of Figs. 1 and 2).

B: Brain. C: Crop. M: Muscle. MM: Mucous material. MY: Mycetangium. PV: Proventriculus. SG: Suboesophageal ganglion. SL: Spongelike tissue. SS: Sphere-shaped tissue.

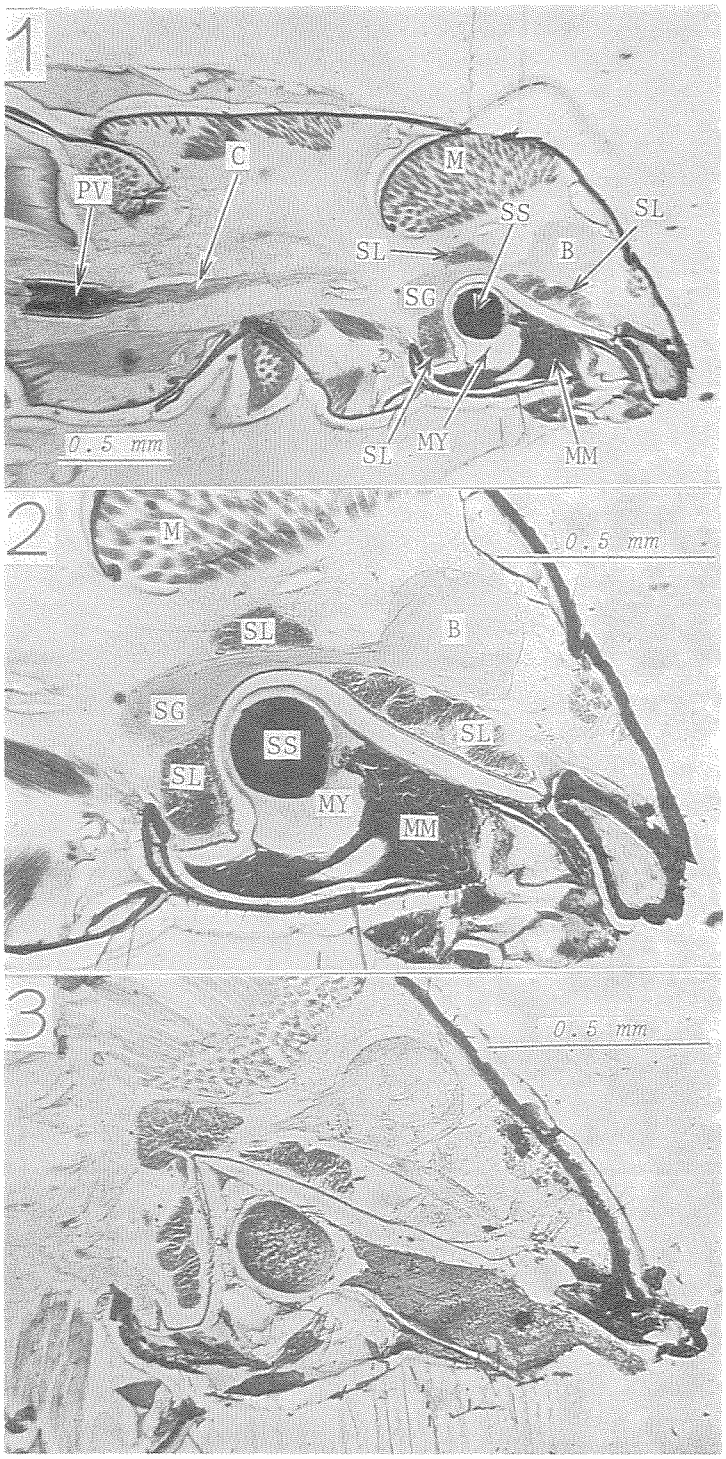
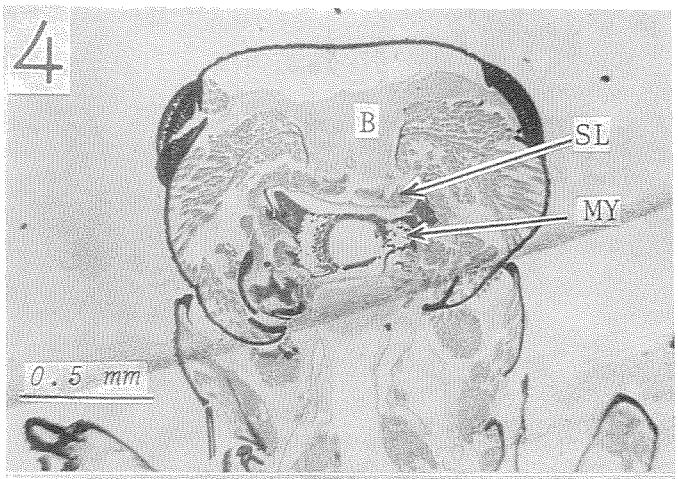

1
PV
C
M
SS
SL
SL
B
SG
SL
MY
MM
0.5 mm
2
M
0.5 mm
SL
B
SG
SS
SL
SL
MY
MM
3
0.5 mm

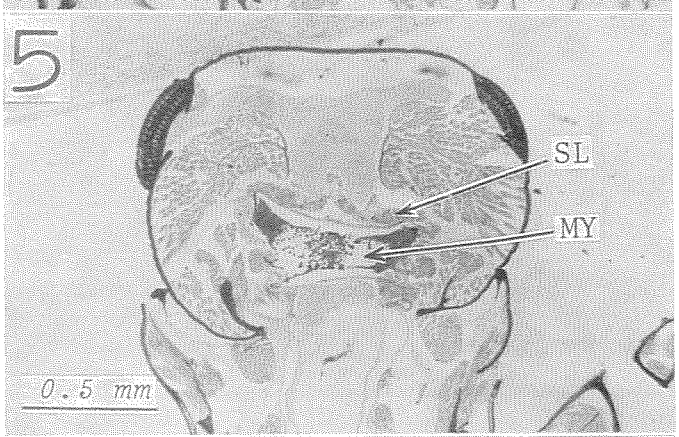
Plate II

Fig. 4. Horizontal section of the head of female of stage e (slightly above the sphere-shaped tissue).

Figs. 5, 6. Horizontal section (slightly above Fig. 4).

B: Brain. CM: Cell-like material. FS: Fungus spore. MY: Mycetangium. SL: Spongelike tissue. TM: Thin membrane.


4
B
SL
MY
0.5 mm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SL
MY
0.5 mm

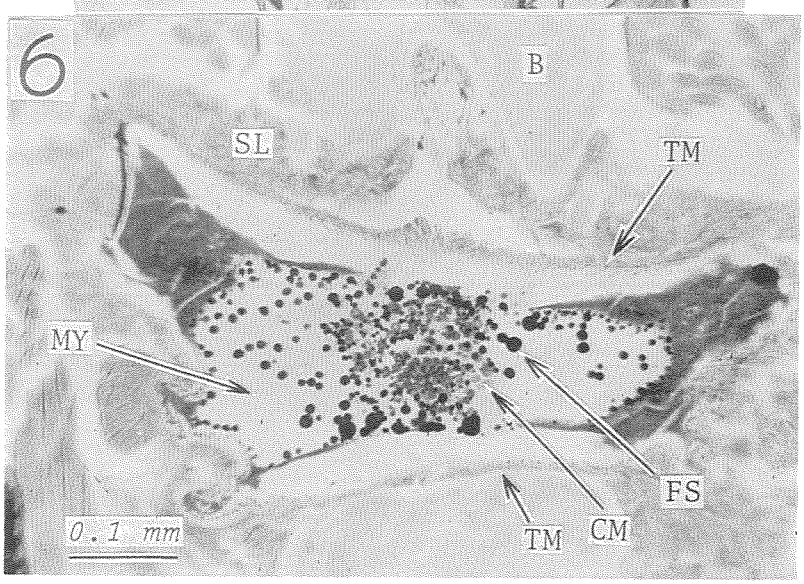
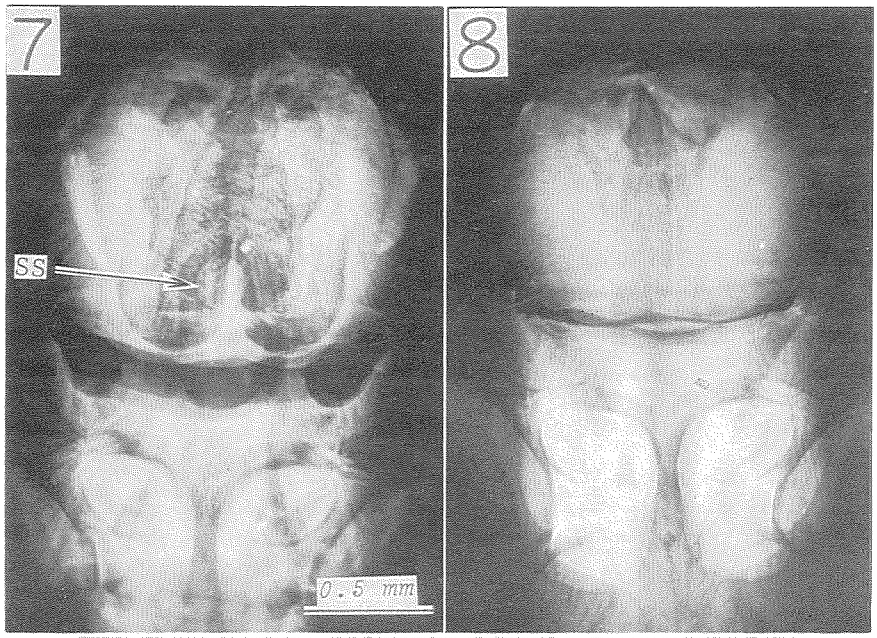

6
B
SL
TM
MY
FS
TM
CM
0.1 mm

Plate III

Figs. 7, 8. Horizontal view of the head of stage e under a super soft X-ray apparatus (Fig. 7; ♀. Fig. 8: ♂).

Figs. 9, 10. Transverse section of the head of female of stage e.

CM: Cell-like material. FS: Fungus spore. MY: Mycentagium. SS: Sphere-shaped tissue. TM: Thin membrane.


7
SS
0.5 mm
8

9
SS
MY
0.5 mm

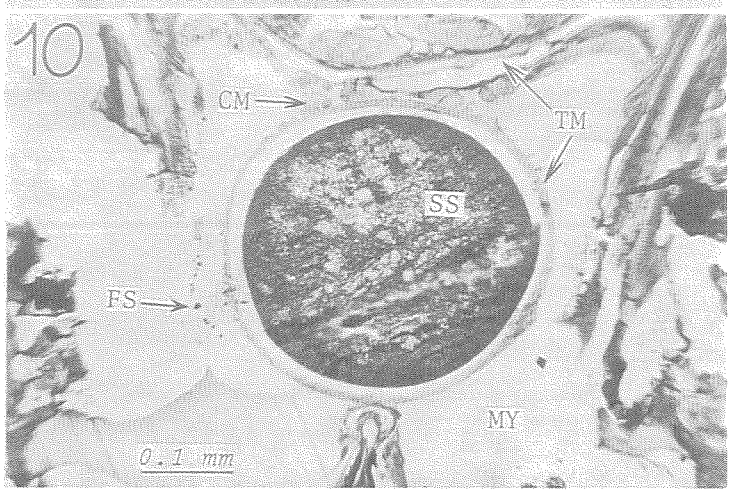

10
CM
TM
SS
FS
MY
0.1 mm

Plate IV

Figs. 11, 12. Sagittal section of female of stage a.
Fig. 13. Sagittal section of the head of female of stage b.
Fig. 14. Sagittal section of female of stage b.

B: Brain. FM: Fungus material. PV: Proventriculus. SL: Spongelike tissue. SS: Sphere-shaped tissue. V: Ventriculus.

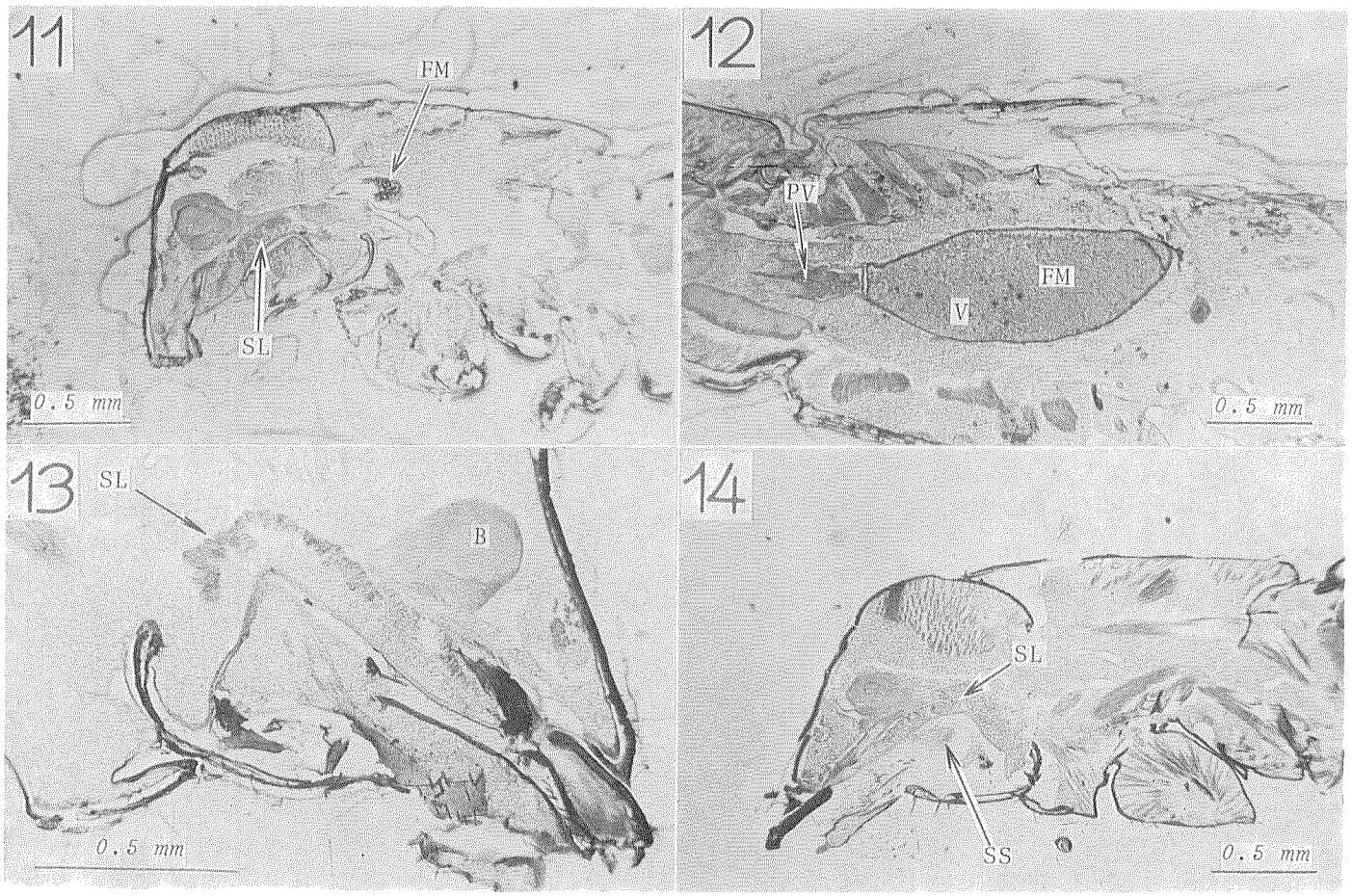

11
FM
SL
0.5 mm
12
PV
FM
V
0.5 mm
13
SL
B
0.5 mm
14
SL
SS
0.5 mm

Plate V

Figs. 15, 16. Sagittal section of female of stage c.
Figs. 17, 18. Sagittal section of female of stage d at the sphere-shaped tissue.

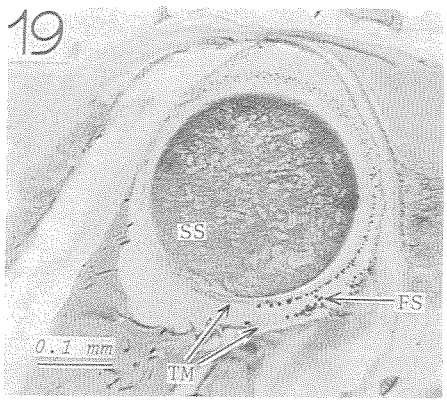
B: Brain. CM: Cell-like material. E: Egg. FM: Fungus material. M: Muscle. MM: Mucous material. SG: Suboesophageal ganglion. SL: Spongelike tissue. SS: Sphere-shaped tissue.

15
0.5 mm
16
FM
E
0.5 mm
17
M
B
SL
SS
OS
TS
MM
0.5 mm
18
SL
CM
SS
MM
0.1 mm

Plate VI

Fig. 19. Sagittal section of female of stage e at the sphere-shaped tissue.
Fig. 20. Longitudinal section (slightly to the right of Fig. 19).
Figs. 21–23. Longitudinal section (progressively to the right of Fig. 19).
Figs. 24, 25. Sagittal section of male of stage e.

B: Brain. C: Crop. FM: Fungus material. FS: Fungus spore. MY: Mycetangium. PV: Proventriculus. SS: Sphere-shaped tissue. TM: Thin membrane.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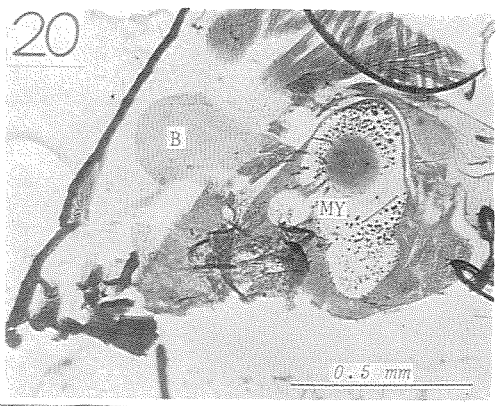
SS
FS
TM
0.1 mm


20
B
MY
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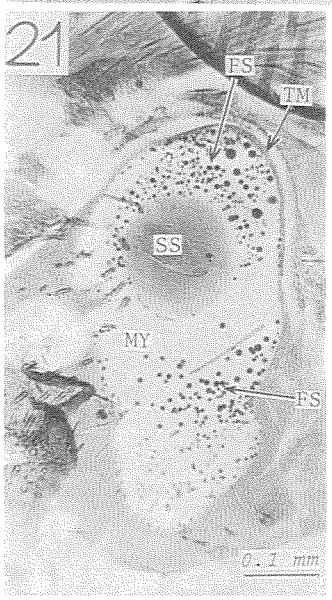
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TM
SS
MY
FS
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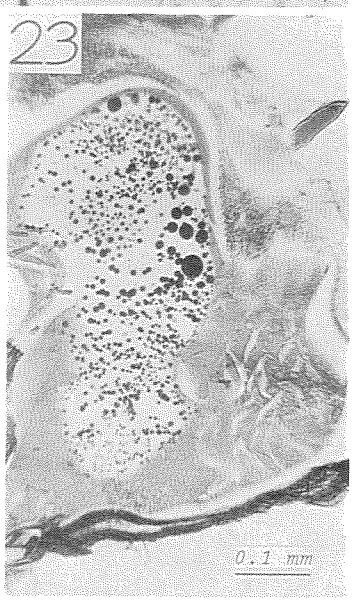
22
0.1 mm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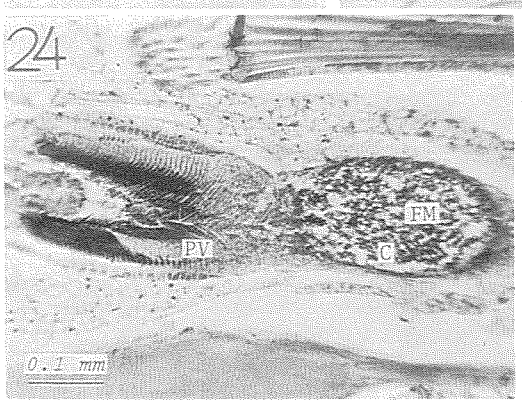
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C
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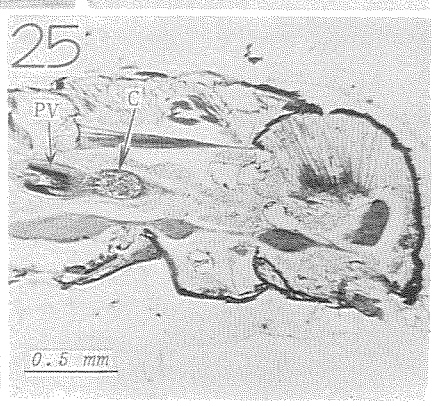
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