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OBSERVATION ON THE AMBROSIA FUNGUS, *AMBROSIELLA* SP., GROWING IN THE GALLERY OF *SCOLYTOPLATYPUS SHOGUN* BLANDFORD (COLEOPTERA : SCOLYTIDAE) AND ON THE CONCURRENT DAMAGE OF WOOD TISSUE

Toshio NAKASHIMA*

Department of Agricultural Biology, Faculty of Agriculture,
Hokkaido University, Sapporo, 060, Japan

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Introduction

In 1982 and '87, the author reported about a specific ambrosia fungus, *Ambrosiella* sp., isolated from both the mycetangia and the galleries of *Scolytoplatypus shogun* Blandford. In the present study, observation was done to clarify the growing phases on the fungus in the galleries and the rotting phases of the wood tissues surrounding the galleries.

Materials and Methods

Pinholed beech logs (*Fagus crenata* Blume) were collected at the Hiyama Forest Experiment Station of Hokkaido University. In June and July, new galleries of *S. shogun* were aseptically cut from the logs and the exposed walls of the galleries were fixed by 2% OsO_4 vapor, then coated with carbon and gold. Observation was done by a scanning electron microscope.

Result and Discussion

Fig. 1 shows a cross section of a mother gallery cut at the location of an egg cradle. The egg has been removed. The mother gallery, the egg cradle full of fungus, and the place at which the egg had been attached are shown by the marks (a), (b) and (c) respectively. Mark 2 in Fig. 1 shows the surface of the fungus mass at the entrance of the egg cradle, and the magnified detail of this part is shown by Fig. 2. Area 3 in Fig. 1. shows the bottom part of the egg cradle, and its magnified detail is shown by Fig. 3.

At the entrance of the egg cradle, the fungus mass consists of pure cultural

* Emeritus Professor of Hokkaido University

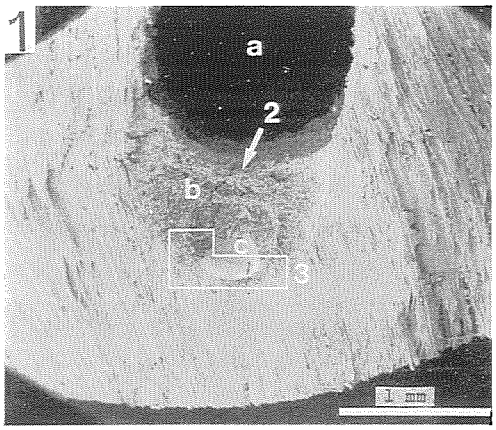


Fig. 1. Cross section of a mother gallery.
a ···Mother gallery.
b ···Fungus full egg cradle.
c ···Trace on which an egg had been attached.
2 ···Surface of fungus mass (magnified detail is shown by Fig. 2).
3 ···Bottom of the egg cradle (magnified detail is shown by Fig. 3).

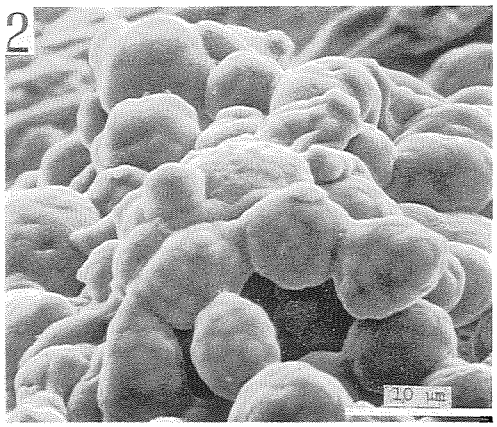


Fig. 2. The surface of the fungus mass at the entrance of the egg cradle. (Magnified detail of area 2 in Fig. 1)

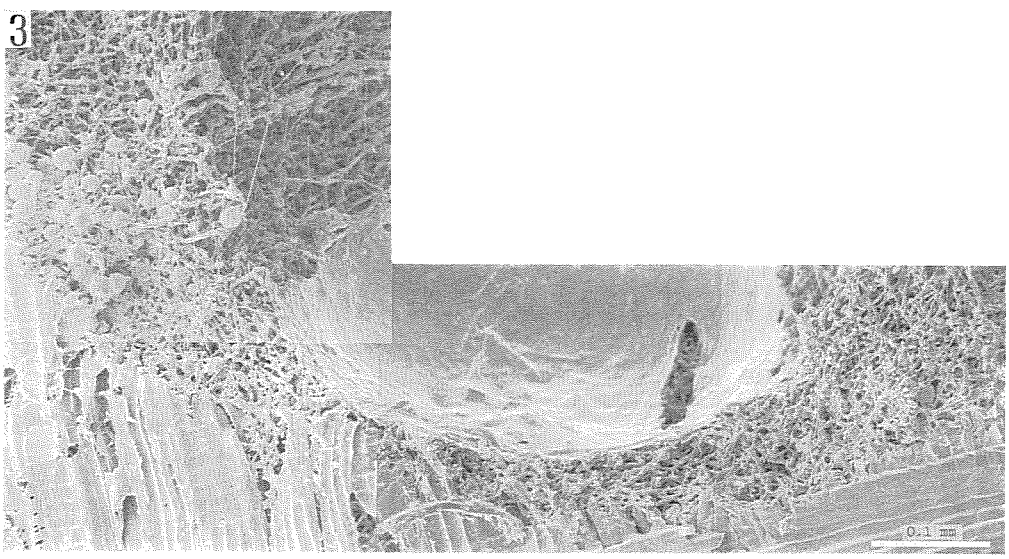


Fig. 3. The bottom part of the egg cradle. (magnified detail of area 3 in Fig. 1)

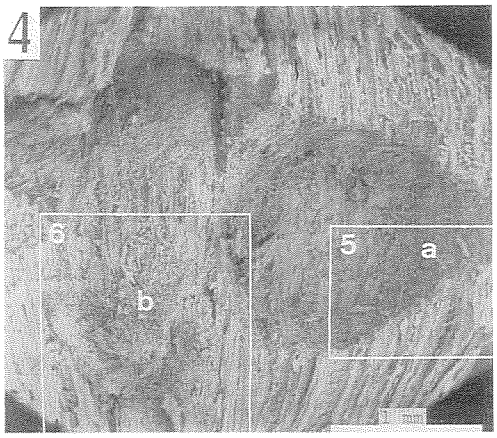


Fig. 4. A longitudinal section of the deep part of a mother gallery.
a···Innermost part of the gallery.
b···A larval cradel.
(Magnified datails of areas 5 and 6 are shown by Figs. 5 and 6 respectively)

Fig. 5. The end part of the mother gallery. (Magnified detail of area 9 is shown by Fig. 9)

ambrosial cells which have formed monilioid chains (Fig. 2). At the bottom of the egg cradle (Fig. 3), a large number of mycelia is attacking wood tissue, and few ambrosial cells are observed there.

Fig. 4 shows a longitudinal section of the deep part of a mother gallery. The innermost part of the gallery and a larval cradle are shown by (a) and (b) in Fig. 4 respectively.

The magnified detail of the area 5 in Fig. 4 (the end part of the mother gallery) is shown by Fig. 5, and the area 9 in Fig. 5 is shown by Fig. 9. As shown in Figs. 5 and 9, a large number of mycelia are attacking wood tissue in much the same way as at the bottom of the egg cradle shown by Fig. 3. The damage of wood tissue in the mother gallery is more extensive than that in the egg cradle. It appears that few ambrosial cells are growing.

Fig. 6 shows a magnified detail of the larval cradle wall (area 6 in Fig. 4). Many mycelia and many ambrosial cells are growing on the wall, and the wood tissue surrounding the cradle is hardly broken down.

The magnified details of area 7 in Fig. 6 are shown by Figs. 7 and 8. A large number of typical ambrosial cells are growing there, some of which are forming monilioid chains.

Fig. 10 shows the magnified detail of the wood tissue at the bottom of the larval cradle (area 10 in Fig. 6). In this picture, the tissue has been broken down, but mycelia are not clear yet.

As seen in Figs. 3, 5 and 6, it seems that the mycelia invade wood tissue

Fig. 6. The wall of a larval cradle.

Mat-like mass of mycelia and extraordinary production of monilioid chains of *Ambrosiella* sp.
(Magnified details of areas 7 and 10 are shown by Fig. 7 and 10 respectively)

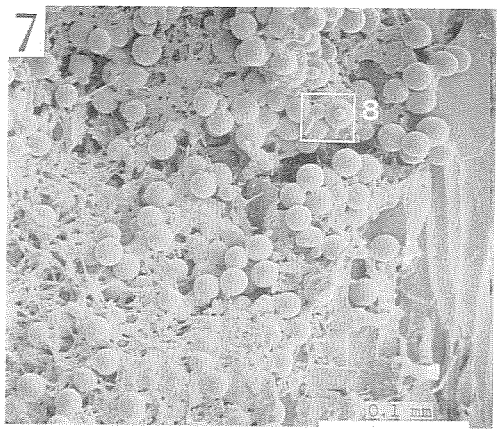


Fig. 7. Ambrosial cells and monilioid chains of *Ambrosiella* sp.
(Magnified detail of area 7 in Fig. 6)

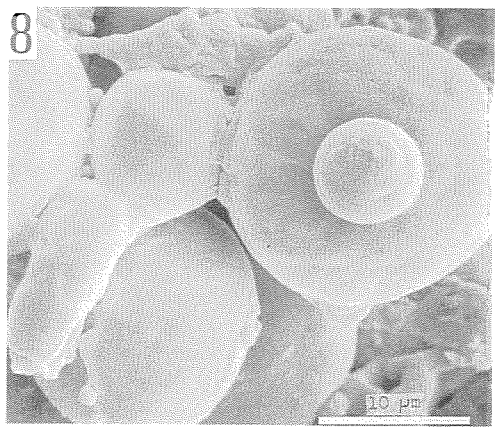


Fig. 8. Magnified detail of ambrosial cells.
(Magnified detail of area 8 in Fig. 7)

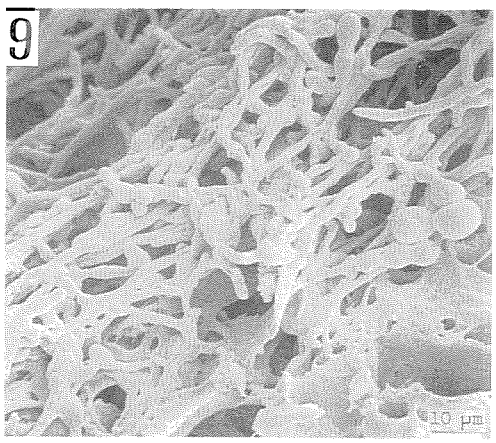


Fig. 9. The end part of the mother gallery.
(Magnified detail of area 9 in Fig. 5)

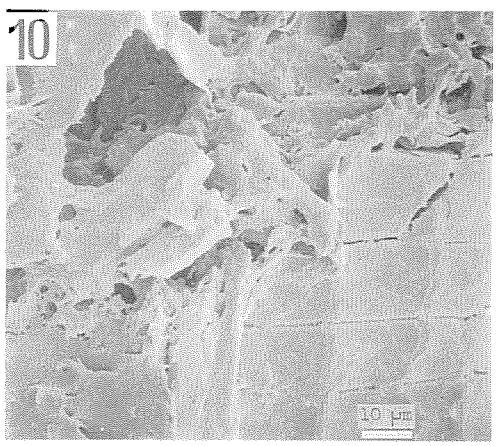
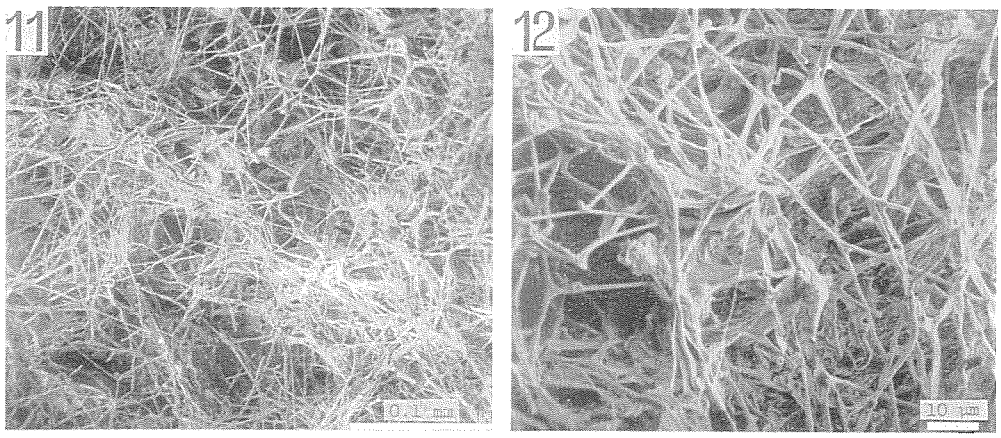


Fig. 10. The wood tissue at the bottom of the larval cradle.
(Magnified detail of area 10 in Fig. 6)

frequently along the direction of the axis of the wood, and less frequently across the grain.

The adults of *S. shogun* bore their gallery together as a pair. Before oviposition, the adult female inoculates its ambrosia fungus into the egg cradles. The fungus grows and envelopes the egg before it hatches (NAKASHIMA, 1982), therefore the larvae can eat the fungus soon after hatching.

In the egg and larval cradles, a great many ambrosial cells form monilioid chains (Figs. 2, 6, 7, 8). *Ambrosiella* spp. are characterized by the growth of ambrosial cells and monilioid chains[1,2,3,5]. These cells may be the most nourishing part of the fungi for the larvae.



Figs. 11, 12. Fungi growing in a pupal cradle in November.

At the bottom of the egg cradle (Fig. 3), however, there are no ambrosial cells, rather mycelia is invading the wood. This invasion may make it easy for the larvae to chew the wood to widen the cradle with the larval development. At the innermost part of the mother gallery (Figs. 4, 5, 9), the intertwined mycelia are invading wood tissue, and no ambrosial cells are observed.

Figs. 11 and 12 show the fungi growing in a pupal cradle in November. A new adult is hibernating in the cradle. Only thin mycelia have made an intertwined mass and no ambrosial cells are observed. These fungi are in the condition of a pure culture and no other species of fungi are observed. There is a strong possibility of that the fungi are the *Ambrosiella* sp. in its hibernating condition.

It is said that the ambrosial cells and monilioid chains grow under some stimuli of living adults and larvae[4]. In the present study, many ambrosial cells form monilioid chains only at the place where young larvae are growing. At the case of culture of this *Ambrosiella* sp. on agar plates, however, the monilioid chains grew without any stimuli of adults and larvae[6,7,8]. In addition to these facts, it was observed that there were only intertwined mycelia with no ambrosial cells at the innermost part of the mother gallery under the condition with living adults (Fig. 5). Concerning the induction factors to develop the ambrosial cells and monilioid chains, further investigation may be necessary.

Acknowledgements

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Abstract

Fungus, *Ambrosiella* sp., growing in the galleries of the ambrosia beetle, *Scolytoplatypus shogun* Blandford, and wood itssue adjacent to the galleries have been observed under a scanning electron microscope. In the galleries, the fungus has two phases, mycerial and ambrosial. Many ambrosial cells link together to form monilioid chains. In the egg cradles, there are only monilioid chains on the face of the mother gallery. At the bottom of the egg cradles, however, many mycelia are growing and wood tissue has rotted. In the larval cradles, there are mycelia forming well developed mat and a remarkable production of the monilioid chains. At the innermost part of the mother gallery, only mycelia have been observed.

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