SHORT COMMUNICATIONS

The Storage Organ of Symbiotic Fungus in the Ambrosia Beetle *Xyleborus rubricollis* EICHHOFF (Coleoptera: Scolytidae)¹

The specialized organ for carrying ambrosia fungus has been shown in many ambrosia beetles by various workers. FRANKE-GROSMANN (1956) firstly demonstrated in detail the structures and functions of this organ in several species of Platypodidae and Scolytidae. Subsequently, the fungal repositories in ambrosia beetles have been clarified by FERNANDO (1960), LHOSTE and ROCHE (1962), FRANKE-GROSMANN and SCHEDL (1963), BATRA (1963a), FINNEGAN (1963), FARRIS (1963), FRANKE-GROSMANN (1963), FARRIS and FUNK (1965), ABRAHAMSON and NORRIS (1965), and TAKAGI and KANEKO (1965). This report deals with the result of investigation using *Xyleborus rubricollis* EICHHOFF.

MATERIALS AND METHODS

Beetles used in the present investigation were obtained from laboratory rearing by the method of KANEKO (1965). The source of rearing materials was obtained from a chestnut-tree, *Castanea crenata* SIEB. et ZUCC. in Shimane-Pref. The collected insects were fixed in Carnoy's solution under the reduced pressure for sectioning and embedded Carbo-Wax (mp. 54°C, mw. 4,000). Serial, sagittal and frontal sections were made at 20 μ on a sliding microtome. The sections were coated with collodion film to prevent loss of specimens, and were treated with modified Gram-Weigert stain.

For studies of the symbiotic fungus, both the mandibular part of fresh females and ten-days old galleries of *X. rubricollis* obtained from the rearing conditions were examined. The fungi obtained from mycangia and galleries were placed under a highly magnifying microscope and their characteristic measured.

RESULTS AND DISCUSSIONS

The stained serial sections of female beetles

revealed that the *X. rubricollis* has a pair of sac-like pockets (mycangia) containing fungal cells, located at the basal part of the mandibles beneath the labrum (Fig. 1). This structure is absent in males. The mycangium of *X. rubricollis* is similar to those found in *X. formicatus* and *X. mascarensis* in shape, and the specialized opening to the exterior is found in preoral cavity (Fig. 2).

The inside surface of the mycangia has characteristically smooth cilia formed in scales or lines at regular intervals (Figs. 3a, 3b). The cilia are pointed or bent away from the main cavity to opening ducts, and seem to be able to move the fungus cells forward and out of the mycangia as the female beetle moves her mandibles, and probably the cilia serve the purpose of inhibiting infection of other organisms. Moreover, since the sacs of mycangia are enclosed in muscles attached mandibles, ambrosia fungus cells are probably discharged with the activity of mandibles.

It has been found in several species of ambrosia beetles that a series of gland cells which seems to relate to the function of the mycangia. Also in *X. rubricollis*, such gland-like structures covering the wall of mycangia were observed but the details could not be clarified.

The fungus spores reserved in mycangia were consisted of globose conidia and short hyphal filaments (Fig. 5). The conidia are hyaline, elongated-ellipsoidal, and are $9.5\mu \pm 1.2\mu$ in length and $3.5\mu \pm 0.5\mu$ in width on average. When the fungus spores grew on fresh potato agar plate, the resulting colonies consisted of white wooly mycelia only.

The fungi obtained from galleries were consisting of conidia and mycelia which invaded wood tissues, and the conidia distinctly differed from those found in mycangia in shape and color (Fig. 6). The conidia founded in galleries were yellowish white in color, and filamentous oidia in shape, and $11.6\mu \pm 7.5\mu$ in length and $2.3\mu \pm 0.6\mu$ in width containing several vacuoles. But when cultured on potato agar plate, there appeared wooly mycelia as observed in the case of spores of mycangia.

TAKAGI and KANEKO (1965) has described the dimorphism of the spore in *X. germanus* ambrosia fungus, and it has been divided into two types, namely a stored type (B type) and a cultivated type (A type).

¹ Appl. Ent. Zool. 2 (3) : 168—170 (1967)

Figs. 1—6. Mycangia of *Xyleborus rubricollis* EICHHOFF and spores of *X. rubricollis* ambrosia fungus. Fig. 1. Frontal section through the head of female *X. rubricollis* adult, showing the paired sac-like mycangia. Fig. 2. Mycangia and opening duct (arrow). Fig. 3. Inside surface of the mycangia, a: cilia formed in scales, b: cilia formed in lines. Fig. 4. Higher magnifications of the mycangia and the spore mass. Fig. 5. Stored spores of *X. rubricollis* ambrosia fungus. Fig. 6. Cultivated spores of *X. rubricollis* ambrosia fungus.

Moreover, BATRA (1966) described that the ambrosia propagules in mycangia were observed neither in culture nor in tunnels so far as about 48 species of ambrosia beetles were examined. Thus, it was assumed that the ambrosia fungus may be fated to form two types of the spore in its life cycle.

REFERENCES

- ABRAHAMSON L. P. and D. M. NORRIS (1966) *Ann. ent. Soc. Am.* **59** : 877-880.
- BATRA, L. R. (1963a) *Trans. Kansas Acad. Sci.* **66** : 213-236.
- BATRA, L. R. (1966) *Science* **153** : 193-195.
- FARRIS, S. H. (1962) *Can. Ent.* **95** : 257-259.
- FARRIS, S. H. and A. FUNK. (1965) *Can. Ent.* **97** : 527-532.
- FERNANDO, E. F. (1960) *Tea Quart.* **34** : 38-41.
- FINNEGAN, R. J. (1963) *Can. Ent.* **95** : 137-139.
- FRANCKE-GROSMANN, H. (1956a) *Z. Morph. Ökol. Tiere* **45** : 275-308.
- FRANCKE-GROSMANN, H. (1963) *Ann. Rev. Ent.* **8** : 415-438.
- FRANCKE-GROSMANN, H. and W. SCHEDL (1963) *Naturwiss.* **47** : 405.
- KANEKO, T. (1965) *Jap. J. appl. Ent. Zool.* **9** : 211-216.
- LHOSTE, J. and A. ROCHE (1962) *XI. Int. Kongr. Entomol. Wien 1960* **1** : 375-387.
- TAKAGI, K. and T. KANEKO (1965a) *Jap. J. appl. Ent. Zool.* **9** : 247-248.
- TAKAGI, K. and T. KANEKO (1965b) *Jap. J. appl. Ent. Zool.* **9** : 298-300.

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Effect of Disulfoton [O, O-diethyl S-2 (ethylthio)ethyl phosphorodithioate] Granular on the Large 28-Spotted Lady Beetle, *Epilachna vigintioctomaculata* MOTSCHULSKY¹

Soil application of disulfoton (Dissyton®) granular has been known as an effective method for eradicating aphids on potatoes (SCHWARTZ et al., 1961). However, it has not been investigated so far whether this method is also effective for killing chewing type insects. During the course of soil application tests of disulfoton (Disyston®) 5% granular against various insects conducted in 1964, the author found it effective in controlling both adults and larvae of the large 28-spotted lady beetle, *Epilachna vigintioctomaculata* MOTSCHULSKY, which is an important pest of solanaceous crops in Japan.

Various dosages of disulfoton 5% granular were mixed with the soil of Wagner pots (1/5,000 a) at the time of the plantation of potatoes or eggplants. Twenty-seven days after application in potato plants, 15 overwintered adult beetles were released in a wire-netting cylindrical cage (15cm in diameter

and 35cm in height) covering the plant in each pot and mortalities of beetles were examined after 6 days from release. While in eggplant, newly-emerged adults, were released in the same manner as potato plant after 57 days from application and their mortalities were examined after 13 days (Table 1).

Larvae of different instars were fed on leaves cut from the potato plants applied with disulfoton granular by the similar method mentioned above, and their mortalities after 24 hr were examined in laboratory under the temperature of 25-27°C (Table 2).

In each test, ten larvae were used with the exception of 15 larvae in 4th-instar larvae test.

In potato field tests, the larval population and the potato yield were examined in the field designed as a randomized block having two replicates of 16 m²-plot (Table 3). Also the effect of application time of disulfoton on the larval population was investigated (Table 4).

As shown in Table 1, disulfoton 5% granular gave high mortalities to both overwintered and newly-emerged adults. It must be worthy to note that disulfoton still had the insecticidal effect against newly-emerged adults 70 days after the

¹ Appl. Ent. Zool. **2** (3) : 170-172 (1967)