EFFECT OF STELIDOTA OCTOMACULATA (COLEOPTERA:NITIDULIDAE) ON GERMINATING ACORNS UNDER LABORATORY CONDITIONS[1/]

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Abstract.--Stelidota octomaculata (Say), an unreported acorn pest, feeds on the radicle of germinating acorns. Ninety-nine percent of the acorns exposed to feeding from two or more S. octomaculata failed to produce seedlings while 99 percent of uninfested acorns produced seedlings. Several generations of this nitidulid have been reared continuously on acorns. Field studies have confirmed acorns as a natural host.

Key Words: Nitidulid, sap beetle, acorns, oak seed pest, Stelidota octomaculata, rearing

INTRODUCTION

Nitidulids or sap beetles injure a variety of crops, especially mature fruits and vegetables. Williams et al. (1983), Miller and Williams (1981), and Weiss and Williams (1980) have compiled extensive bibliographies on nitidulids. Nitidulids in nuts generally are considered secondary pests (Williams and Kreuger 1985), infesting split nuts or nuts damaged by other insects--especially weevils of the genus Curculio.

Krajicek (1960) in Iowa, however, noted an association of nitidulids with acorns that began germination but failed to produce seedlings. Galford (1986) reported rearing more than 3,000 Stelidota sp. larvae from 467 northern red oak, Quercus rubra L., acorns that had been "planted" in a forest in southern Ohio. This species was subsequently identified as Stelidota octomaculata (Say), which has been reported as associated with fruits and tree sap, and in leaf litter.

Also, it has been implicated as a vector of oak wilt disease, Ceratocystis fagacearum (Bretz) Hunt. Williams and Kreuger (1985) reared S. octomaculata successfully for several generations on Chinese chestnuts, Castanea mollissima Blume, after experiencing difficulties with rearing on common nitidulid diets.

In view of the earlier field study (Galford 1986) indicating impact from S. octomaculata, laboratory studies were conducted to determine potential damage from this nitidulid to acorns in the absence of other acorn insect activity.

This paper reports the results of laboratory studies on the injury of S. octomaculata to germinating acorns of northern red oak and white oak, Q. alba L.

MATERIALS AND METHODS

A laboratory culture of S. octomaculata was started from adults attracted to red oak acorns deployed in a forest in southern Ohio. The adults are sexed by the comparatively wider thorax of males. Also, males have a definite depression in the metasternum and have six abdominal segments; the last segment being very small. Females do not have the

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metasternum depression and have only five abdominal segments. Germinating red or white oak acorns (other species have also been used successfully) or mechanically opened acorns are placed on moist filter paper in any suitable container with a ventilated lid to retain the beetles. Three to five pairs of adult beetles per acorn is adequate for breeding. Ten average-size, red oak acorns will produce 300-500 larvae, which will yield 200-400 adults. A complete generation takes 35-40 days.

Mature larvae emerging from acorns in the rearing containers are collected daily with forceps. Up to 50 larvae are placed in 30-ml plastic portion cups about three-fourths full of moistened sand. The cups are capped and held at 23±2°C without lighting other than that provided by ceiling fluorescent lights during work hours. Adults appear on top of the sand in 15-20 days and are used for tests or starting new cultures. Adults used in feeding tests were allowed to feed and mature on acorns for 3 or more days prior to testing.

The tests of effects of S. octomaculata on germinating acorns were conducted as follows: 600-ml styrofoam drinking cups were filled to within 3 or 4 cm of the top with a 1:1:1 mixture of sand, peat moss, and vermiculite; 100 ml of distilled water were added to each cup. An acorn just beginning to germinate (radicle not exceeding 5-6 mm) was placed in each cup with the sprout just touching the soil. The acorns were covered completely with pieces of dead red oak leaves. After the selected number of nitidulid adults were placed in a cup, a 270-ml clear plastic cup, split lengthwise and squeezed together, was placed inside the lip of the foam cup. This "mini-greenhouse" provided ideal conditions for both insect development and acorn germination; no additional water was needed. The cups were held at 23±2°C under fluorescent lights for 8-10 hours daily.

When a single beetle was used per cup, the beetle was placed inside a 30-ml plastic portion cup and the cup inverted over the acorn. No leaves were used to cover the acorn but a black cloth was placed over the cups while the test was in progress. Leaves or the black cloth simulated forest conditions in which most acorns probably would be covered with leaves.

The following tests (Table 1) were conducted for red oak acorns: Test I: 5 cups, with 5, 10, 15, 20, or 25 adults per cup, and 5 cups without beetles (controls); Test II: 5 cups with 5 adults per cup, 5 cups with 10 adults per cup, 5 cups with 20 adults per cup, and 5 control cups; Test III: 14 cups with 5 adults per cup, 9 cups with 10 adults per cup, 4 cups with 20 adults per cup, and 9 control cups; Test IV: 10 cups with 3 adults per cup, and 10 control cups; Test V: 5 cups with 2 adults per cup, 5 cups with 5 adults per cup, and 5 control cups; Test VI: 10 cups with 1 adult per cup, and 5 control cups.

Table 1.--Effect of S. Octomaculata on seedling establishment from red oak acorns.

Test no.	Number of Cups[a]	Number of beetles per cup	Number of established seedlings
I	1	5	0
	1	10	0
	1	15	0
	1	20	0
	1	25	0
	5	0	5
II	5	5	0
	5	10	0
	5	20	0
	5	0	5
III	14	5	0
	9	10	0
	4	20	0
	9	0	9
IV	10	3	0
	10	0	9
V	5	2	1
	5	5	0
	5	0	5
VI	10	1	3
	5	0	5

[a] One germinating red oak acorn planted in each cup.

Only a single test (Table II) was conducted with white oak acorns: Group A: 10 cups, each with a sprouting white oak acorn with an exit hole produced by a Curculio weevil and 5 nitidulid adults; Group B: 10 cups, each with a sprouting white oak acorn with a Curculio exit hole but no nitidulid adults; Group C: 10 cups, each with a sound sprouting acorn and 5 beetle adults; Group D: 10 cups, each with a sound sprouting acorn but no nitidulids (controls).

Table 2.--Effect of S. Octomaculata on seedling establishment from white oak acorns.

Test group	Number of cups[a]	Acorn condition	Number of beetles	Number established seedlings
A	10	Weevil exit hole[b]	5	0
B	10	Weevil exit hole	0	8
C	10	Sound	5	0
D	10	Sound	0	10

[a] One white oak acorn germinating in each cup.

[b] Exit hole produced by larva of Curculio sp.

In tests on both red and white oak acorns, the cups were checked in 20 to 25 days for seedling establishment.

RESULTS AND DISCUSSIONS

Only a single seedling was produced in Tests I through V where the red oak acorns were exposed to feeding from two or more S. octomaculata adults (Table 1). Seedlings were produced from all control acorns but one which "died." In Test VI, three seedlings were produced from acorns exposed to single nitidulids. Six acorns had produced lateral root shoots behind the consumed portion of the radicle and were forming top shoots, and the radicle of one acorn had been destroyed because two adults had been accidentally introduced instead of one. The five control cups in Test VI all produced seedlings (Table 1).

Results for the white oak acorns were as follows: no seedlings were produced in Group A; 8 seedlings were produced in Group B; no seedlings were produced in Group C; and 10 seedlings were produced in Group D (Table 2). Subsequently, disease developed in the nitidulid culture, causing premature adult mortality, poor feeding, and reproduction. Additional tests with white oak acorns were terminated.

Stelidota octomaculata obviously can destroy sound, germinating acorns. The adults, although small (2.5 to 3 mm long), consume large amounts of plant tissue and are especially fond of the tender radicle shoots. They also feed on the tips of developing top shoots. An attack from even one beetle in a forest situation could make an acorn more prone to desiccation unless moisture conditions were ideal for lateral root production and establishment to occur quickly. However, field observations indicate that mass attack on acorns by S. octomaculata is common; this type of feeding activity undoubtedly affects the establishment of oak seedlings.

On the basis of these results, it is suggested that S. octomaculata may be affecting oak seedling establishment and oak regeneration, either by itself or in concert with other insects. The biology of S. octomaculata is being determined and field studies indicate that acorns are the major host for this insect in the spring. To date, it has been the only nitidulid attracted to viable red oak acorns in early spring in southern Ohio forests.

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LITERATURE CITED

Galford, J. R.
1986. Primary infestation of sprouting chestnut, red, and white oak acorns by Valentinia glandulella (Lepidoptera:Blastobasidae). Entomol. News 97(3):109-112.

Krajicek, J. E.
1960. Some factors affecting oak and black walnut reproduction. Iowa State J. Sci. 34(4): 631-634.

Miller, K. V. and R. N. Williams.
1981. An annotated bibliography of the genus Glischrochilus Reitter(Coleoptera:Nitidulidae, Cryptarchinae). Ohio State Univ., Ohio Agric. Res. Dev. Cent., Res. Circ. 266. 65 pp.

Weiss, M. J. and R. N. Williams.
1980. An annotated bibliography of the genus Stelidota Erickson (Coleoptera:Nitidulidae, Nitidulinae). Ohio State Univ., Ohio Agric. Res. Dev. Cent., Res. Circ. 255. 37 pp.

Williams, R. N., D. S. Fickle, M. Kehat, D. Blumberg, and M. G. Klein.
1983. Bibliography of the genus Carpophilus Stephens (Coleoptera:Nitidulidae). Ohio State Univ., Ohio Agric. Res. Dev. Cent., Res. Circ. 278. 95 pp.

Williams, R. N. and H. R. Kreuger.
1985. Nitidulids (Coleoptera:Nitidulidae) associated with Chinese chestnuts. Entomol. News 96(5): 214-218.