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A BAIT ATTRACTANT STUDY OF THE NITIDULIDAE (COLEOPTERA) AT SHAWNEE STATE FOREST IN SOUTHERN OHIO

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ABSTRACT

Four baits were tested for efficacy in attracting sap beetles (Nitidulidae) at two sites in the Shawnee State Forest over two collection periods in 1992. Species taken were categorized into three groups: abundant, moderate, and uncommon. At Site 1, nitidulids displayed a strong preference for whole wheat bread dough, followed by fermenting brown sugar, and fermenting malt/molasses solution, and vinegar, respectively. Site 2 collections showed a similar trend to Site 1, but the order of preference was switched for brown sugar and malt/molasses solution. Of the 20 species collected, six species were abundant, seven species were moderate, and seven species were locally uncommon.

Two sites in Shawnee State Forest (extreme southern Ohio) were used to test efficacy of four trap baits for Nitidulidae (Coleoptera) during the 1992 season. The baits tested included whole wheat bread dough (WWBD), fermenting brown sugar, a mixture of fermenting malt/molasses and vinegar. WWBD has been our preferred nitidulid bait since we began using it in the late 1970's as it was found to be quite successful in luring *Stelidota geminata* (Say) (Miller and Williams, 1982). Frost and Dietrich (1929), who reported the other three baits as successful nitidulid attractants, caught nineteen species of nitidulids within nine genera in both fermenting sugar and molasses traps. After achieving good results with these baits in a survey in Portage County, Ohio (Williams et al. 1992), we decided to systematically compare efficacy of these four baits for attractancy to the nitidulid complex in the Shawnee State Forest.

MATERIALS AND METHODS

The trapping sites were located within 8 km of the Ohio River in the south central area of the 24,000 ha Shawnee State Forest in Nile Township (Scioto Co.). The four treatments (baits) were replicated four times at each location in a randomized block. Site 1 was in a low ravine about 6.5 km from State Route 52 just off of State Forest Road 1 near Pond Run, while Site 2 was located about 140 m higher on a ridge about 3.2 km NNW of the first site, near State Forest Road 2. Spacing between traps was 10 m. Treatments consisted of fermenting malt/molasses solution, fermenting brown sugar solution, vinegar and WWBD.

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The malt/molasses solution was prepared using liquid Maltsupex® malt soup extract (Wallace Laboratories Division of Carter-Wallace Inc., Cranbury, NJ) and livestock feed molasses obtained from a local feed company. The preparation of the malt/molasses solution was as follows: 45 ml of Maltsupex®, 45 ml of molasses, 35 g of granulated sugar and a pinch of active dry yeast per liter of warm water. One hundred fifty ml of the above solution of malt/molasses were placed in each trap.

The brown sugar solution was prepared using approximately 340 g of brown sugar and a pinch of active dry yeast per liter of warm water. About 150 ml of this mixture was used in each brown sugar trap.

The vinegar traps were baited with 150 ml of apple cider vinegar per trap. The WWBD was made by mixing 450 g of whole wheat flour, 15 ml of sugar, 300 ml of warm water and a 7 g package of dry active yeast. A small piece of dough (ca. 30 g) was rolled into a ball and wrapped in a piece of fiberglass screen to prevent beetles from becoming imbedded in the dough. This screen-covered ball was then placed in the trap.

The trap chosen for this study was the nitidulid inventory technique (NIT) trap (Williams et al. 1993), which is a modification of the trap used by Skalbeck (1976). The NIT trap consists of a 1-liter wide-mouth canning jar with a plastic cone (a tapered drinking cup with bottom removed) inserted in the mouth of the jar and held in place by the canning band. A 15 cm square of Masonite (6.5 mm thick) was attached about 2 cm above the mouth of the jar as a rain cover. A golf course cup cutter was used to dig a hole deep enough to hold the entire jar. The top edge of the jar remained slightly above the soil surface. Once the traps were set in the ground, they were covered with a 0.6 m square piece of "chicken wire", which was anchored to the ground using 25 cm landscaping spikes. This prevented pilfering by raccoons and other mammals.

Four collections were made: two early season and two late season. The early season traps were set out on 18 April and collected on 25 April and 2 May. The late season traps were set out on 1 August and collected on 8 and 15 August. After collection, contents of jars were placed in plastic bags and frozen. They were thawed at a later time, separated from the bait, and preserved in 70% ethyl alcohol. Data were analysed using the Wilcoxon rank sum test (SAS Institute 1985) at a level of ($P < 0.05$).

RESULTS AND DISCUSSION

Nitidulids taken in these collections were separated into three abundance categories. The categories were defined as: abundant = > 80 specimens collected during the season; moderate = between 8 and 80 specimens; and uncommon = 7 specimens or fewer.

Abundant species were *Carpophilus lugubris* Murray, *Epuraea helvola* Erichson, *Glischrochilus fasciatus* (Olivier), *G. quadrisignatus* (Say), *Stelidota geminata* (Say) and *S. octomaculata* (Say) (Table 1). All except *E. helvola* are pests that are quite common throughout Ohio. *E. helvola* is primarily a woodland dweller in northern and southern Ohio.

Species caught in moderate numbers were *Colopterus* sp., *Cychramus adustus* Erichson, *Epuraea alternata* Parsons, *E. peltoides* Horn, *E. rufa* (Say), *Glischrochilus sanguinolentus* (Olivier) and *Pallodes pallidus* (Beauvois) (Table 1). In this group, all are woodland insects which congregate at sap flows (Connell 1956), with the possible exceptions of *Cychramus adustus* and *Pallodes pallidus*. The latter two species are primarily fungus feeders which were encountered less frequently in a similar 1991 study (Keeney et al. 1994).

Uncommonly collected species were: *Carpophilus corticinus* Erichson, *C.*

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Table 1. Total number of nitidulid beetles collected per replicate at two locations in Shawnee Forest, Scioto Co., near Portsmouth, Ohio, 1992.

SPECIES CAUGHT	SITE 1*					SITE 2*					GRAND TOTAL
	WWBD	BS	M/M	VIN	TOT	WWBD	BS	M/M	VIN	TOT	
Carpophilus corticinus	0	0	0	0	0	4	3	0	0	7	7
Carpophilus freemani	0	0	0	0	0	1	0	0	0	1	1
Carpophilus lugubris	0	0	0	1	1	288	119	12	5	424	425
Carpophilus sp.	0	0	0	0	0	0	1	0	0	1	1
Colopterus sp.	1	1	0	0	2	30	8	4	2	44	46
Cychramus adustus	5	0	0	1	6	1	1	0	1	3	9
Epuraea alternata	5	0	0	1	6	21	10	3	1	35	41
Epuraea helvola	1	3	2	0	6	99	107	57	15	278	284
Epuraea peltoides	5	1	2	0	8	21	13	3	0	37	45
Epuraea rufa	3	0	1	4	8	0	2	1	1	4	12
Epuraea sp.	0	0	0	0	0	1	0	0	1	2	2
Glischrochilus fasciatus	32	19	23	3	77	25	7	3	2	37	114
Glischrochilus quadrisignatus	28	13	22	6	69	10	4	5	4	3	92
Glischrochilus sanguinolentus	1	0	0	0	1	7	0	0	0	7	8
Glischrochilus obtusus	0	0	0	0	0	2	2	0	0	4	4
Pallodes pallidus	2	0	0	0	2	5	0	1	0	6	8
Phenolia grossa	0	0	1	0	1	0	0	0	0	0	1
Stelidota ferruginea	1	0	0	0	1	1	2	0	0	3	4
Stelidota geminata	374	162	223	113	872	506	297	179	139	1,121	1,993
Stelidota octomaculata	20	20	39	43	122	54	42	22	70	188	310
Total Species:	**13**	**7**	**8**	**8**	**15**	**17**	**15**	**11**	**11**	**19**	**20**
Total Specimens:	**478**	**219**	**313**	**172**	**1,182**	**1,076**	**618**	**290**	**241**	**3,407**	**4,589**

* For each site:
WWBD = Whole Wheat Bread Dough.
BS = Brown Sugar.
M/M = Malt/Molasses.
VIN = Vinegar.
TOT = Individual Site Totals.

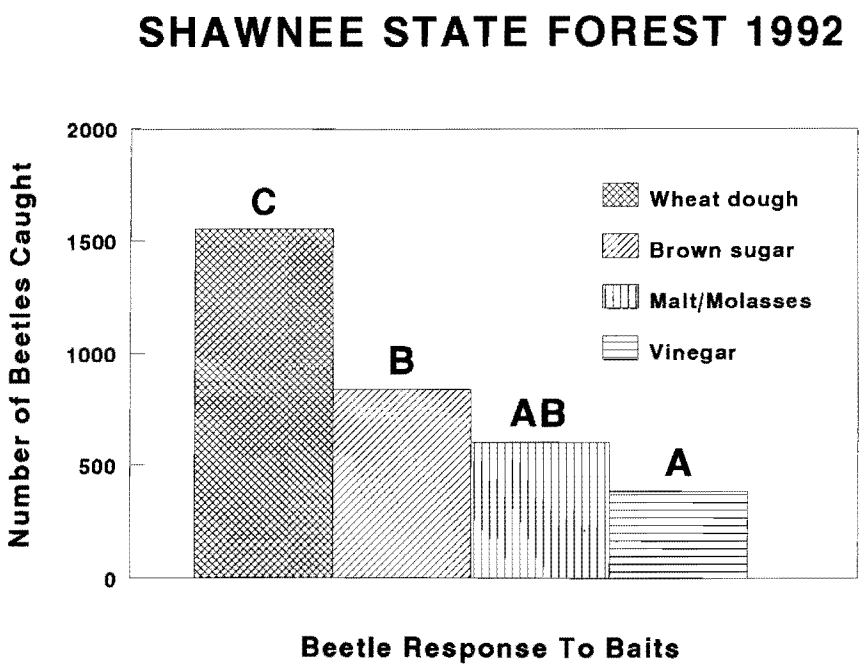

Figure 1. Response of all nitidulid species to four attractants using NIT traps in Shawnee State Forest, Scioto County, Ohio, over the entire season. Letters are used to indicate statistical separation.

freemani Dobson, *Carpophilus* sp., *Epuraea* sp., *Glischrochilus obtusus* (Say), *Phenolia grossa* (F.), and *Stelidota ferruginea* Reitter (Table 1). In a 1991 study of this area, 137 specimens of *Glischrochilus obtusus* were taken during June 2–6 in brown sugar traps (Keeney et al. 1994). In that study, traps were located 1 m above the ground, whereas in our current study traps were at ground level. Furthermore, the 1991 collections were made a month earlier than in 1992. Location and timing may have reduced the number of *G. obtusus* collected. *Stelidota ferruginea* was unexpected in this study. This species is an invader of acorns in southeast U. S. (Galford et al. 1991a), and although it has been reported as far north as Wisconsin and Michigan, Galford et al. (1991a) did not report it in southern Ohio during five years of extensive studies. We concur with Galford et al. (1991a) suggestion that these northern encounters appear to be limited migrations. Several specimens were collected from our traps in the Cleveland area in 1993. The other uncommon species, though frequently found in northern Ohio's agricultural habitats, were also uncommon in our earlier study of Shawnee State Forest (Keeney et al. 1994).

In all, 20 species in nine genera were taken over the season. Species are listed in Table 1 with their respective baits and locations. A great majority of the nitidulid species responded more strongly to WWBD rather than the other three baits. Brown sugar, malt/molasses solution, and vinegar followed in descending order, as shown in Figure 1. Individually, most of the nitidulid

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species followed the same pattern of attraction to the baits, with the exception of: *E. helvola*, *E. rufa* and *S. octomaculata*; the most significant being in *Stelidota octomaculata* Say. This species was first reported in red oak acorns in Illinois by Winston (1956). More recently it has been deemed a pest of red oak in northeastern North America. The beetles are attracted to red oak acorns and hinder red oak regeneration (Galford et al. 1991b). At both sites, this species showed a preference for the vinegar bait, after which *S. octomaculata* responded to the remaining three baits differently at each site. At Site 1, the second preference of this species was the malt/molasses bait followed by an equal representation in the WWBD and brown sugar bait. Based on numbers caught in descending order at Site 2, *S. octomaculata* chose WWBD, brown sugar, and malt/molasses, respectively.

Another species which deviated from the common bait response is *Epuraea helvola*. Little is known of the biology of this species, although it was reported by Skalbeck (1976), along with *E. peltoides*, as the most prevalent *Epuraea* species found in his Minnesota forest collections. We have encountered this species in extreme northeastern Ohio (Williams, unpub. data). However, this species has not been taken in Wayne, Crawford, or Knox counties using similar collecting methods. *E. helvola* appeared to favor the brown sugar followed by WWBD, malt/molasses, and vinegar, respectively.

Although not statistically significant, 12 specimens of *Epuraea rufa* were captured with baits in a manner similar to *S. octomaculata*. This species has been reported in leaf litter, at sap and in fungi, and has also been reared on the fallen seeds of sugar maple, *Acer saccharum* (Parsons 1943).

As shown in Table 1, several species were represented differently at each trapping site. However, *Carpophilus lugubris*, *Colopterus* sp., and *Epuraea helvola* were the only species collected in significantly higher numbers at Site 2 than at Site 1 ($P < 0.05$). Although worthy of note, no direct conclusions can be drawn from these differences due to the complexity of the many factors involved (i.e. elevation, vegetation, weather conditions, etc.).

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