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NYCTEOLA FRIGIDANA WALKER (NOCTUIDAE: SARROTHRIPINAE) REPORTED AT AN UNORTHODOX BAIT

Additional key words: Gadway Barrens, New York, *Salix bebbiana*, insect remains.

On 15 July 1998, while attempting to compare the efficacy of two different types of bait, I noted a commonplace occurrence. Yellow jackets (Hymenoptera: Vespidae; *Dolichovespula arenaria* (Fab.)) were feeding on the fresh spattered insect remains on the front of my vehicle. An hour later, at dusk, I hung out two 30–meter long strands of cotton clothesline rope that were soaked in different bait formulas: the more traditional beer/sugar/molasses bait (Holland 1903) was being compared to a simple bait of red wine saturated with sugar. I ran the trials through uniform jack pine/blueberry habitat on the Gadway Barrens, Clinton County, New York.

The vehicle I used for transportation was parked in a 10-meter gap between the bait trials. I would pass the front of the vehicle each time I traversed the two trials. No apparent differences in habitat existed in the immediate sample area.

Five *Nycteola frigidana* (Wlk.) were observed probing the fresh remains of insects spattered over the windshield and front of the vehicle over the course of the night. One *Caripeta piniata* (Pack.)(Geometridae) and one *Catocala gracilis* Edw. (Noctuidae) were also recorded probing the insect remains. The insect remains on the parts of the vehicle where the *N. frigidana* were observed feeding were determined to be mostly Diptera and definitely not that of Lepidoptera.

The two baited ropes produced many *Idia aemula* Hbn., *I. americalis* (Gn.), *I. lubricalis* (Gey.), *Catocala similis* Edw., *Apamea amputatrix* (Fitch), *A. lignicolora* (Gn.), *Phlogophora periculosa* Gn., *Apharetra dentata* (Grt.), *Pseudaletia unipuncta* (Haw.), *Leucania pseudargyria* Gn., *Agrotis ipsilon* (Hufn.), *Noctua pronuba* L., *Graphiphora auger* Fab. (all Noctuidae), and *Caripeta piniata* (Pack.)(Geometridae), but no *N. frigidana* or *Catocala gracilis*.

Nycteola frigidana comes poorly to both bait and light. I have taken only the occasional specimen at traditional bait on the Gadway Barrens. In June, *Nycteola* caterpillars can be found commonly on *Salix bebbiana* Sarg. (Salicaceae) at this site. Additional information on the range and systematics of *Nycteola* can be gleaned from several sources (Fletcher 1959, McDunnough 1943, Rindge 1961). It is apparent that alternative methods of sampling are possible for these difficult-to-attract moths.

As an aside, I detected no significant differences in numbers or composition of species at the two types of bait being tested.

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LITERATURE CITED

FLETCHER, D. S. 1959. Notes on North American species of *Nycteola* (Lepidoptera, Noctuidae). J. N.Y. Entomol. Soc. 67:51–53.

HOLLAND, W. J 1903. The moth book. New York: Doubleday, Page & Co. 479 pp.

MCDUNNOUGH, J. 1943. Phalaenid notes and descriptions (Lepidoptera). Can. Entomol. 75:59–62.

RINDGE, F. H. 1961. A synopsis of the genus *Nycteola* from North America, including a new species from Arizona (Lepidoptera: Noctuidae). J. N.Y. Entomol. Soc. 69:203–206.

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HEPIALUS CALIFORNICUS (HEPIALIDAE) OVIPOSITION PREFERENCE ON THE LUPINE *LUPINUS ARBOREUS*

Additional key words: dispersal, tanglefoot, aerially-dispersed eggs.

One of the consequences of complete metamorphosis in Lepidoptera is that larvae and adults experience very different environments and selective pressures. Adult Lepidoptera are far more mobile than larvae, allowing use of a larger portion of the habitat. Adults make important decisions regarding host plants and the location of oviposition sites on this larger scale, decisions that greatly affect larval survival (Setamou et al. 1999). While many Lepidoptera demonstrate specificity in host plant oviposition sites (e.g., Haribal & Renwick 1998), it is less clear whether Lepidoptera that aerially disperse their eggs are similarly selective. Falling into the latter category is the ghost moth *Hepialus californicus* (Lepidoptera: Hepialidae), a nocturnal moth native to the West Coast of the United States. Males of *H. californicus* perch on vegetation and release pheromones, forming leks at dusk and dawn to which females are attracted (Wagner 1985). Gravid females find a host plant for the larvae and release their eggs while hovering over the vegetation. Other species of Hepialidae, notably *Korscheltellus gracilis,* also exhibit similar 'hovering' oviposition behavior (Wagner et al. 1989, Wagner & Rosovsky 1991). The primary host plant for *H. californicus* at Bodega Bay is the bush lupine *Lupinus arboreus*, but larvae are polyphagous and have occasionally been found on *Eriophyllum staechadifolium*, *Helenium puberulum*, *Rumex* sp. and *Rubus* sp. (Wagner 1985).

Wagner (1985) suggested that females scatter their eggs over a wide range of potential host plants and surfaces, an assertion bolstered by a documented case of *H. californicus* ovipositing over asphalt. Widely-dispersed egg-laying by *H. californicus* at BML is questionable in light of: (1) the larval dependence on the bush lupine host plant for survival; and (2) the ability of Lepidoptera to detect the CO_2 signal of host plants (Stange 1997). Wagner (1985) and others (Strong et al. 1995, 1996) noted that *H. californicus* eggs are deposited into the detritus underneath lupine bushes, where the larvae hatch and have to find a lupine stem or root in which to burrow. Since the larvae are small (less than 2 mm at hatching) and extremely vulnerable, and the vast majority of *H. californicus* larvae at BML are found on bush lupines, being deposited closer to the lupine's stems and roots would seem to improve the chances of larval survival. In addition, larger lupine bushes have larger stems and roots, and *H. californicus* larvae are found on the largest stems and roots within a bush (pers. obs.). In this note I present data on non-random *H. californicus* oviposition within bush lupine, along with a technique for collecting aerially-dispersed eggs.

I tested the hypothesis that *H. californicus* oviposits non-randomly and has an increased frequency of oviposition near the center of lupine bushes. I collected *H. californicus* eggs at two sites at the Bodega Marine Reserve, Bodega Bay, California, USA. One was a large patch of lupine bushes east of the marine station (Upper Draw) and one was to the west of the marine station on the lee side of a hill (Mussel Point). At each site, I identified 14 lupine bushes for sampling (28 bushes total). I measured each bushes' length, width, and height in meters. Each bush had four 22.2 cm diameter white plastic plates, covered in "tanglefoot" sticky trap, placed at ground level beneath it. The four plates were allocated to 'interior' and 'perimeter' sites as shown in Fig. 1. Initially, I also placed traps one meter outside the bushes to check for outside-bush oviposition; however, after three trapping dates there had been no eggs laid on the outside-bush plates and I concentrated on within-bush sampling. There were a total of 56 traps/site × 2 sites, for a total of 112 traps. The traps were placed under bushes before sunset (between 1730 and 1900 h, depending on date) and collected in the morning starting at 0645 h. I examined each trap for ghost moth eggs, which were removed after being counted. The numbers of eggs on the two 'perimeter' plates were added to get each bush's perimeter number of eggs, and two 'interior' plates were added to get the interior number of eggs. I sampled during the mating and oviposition period of *H. californicus* over six dates, from late March through early May, 2000.

Over six sampling dates I recovered 187 eggs: 125 eggs in interior traps and 62 in perimeter traps. This difference between the two areas was significant (chi-square: df = 1, $p < 0.001$). This trend was significant across both sites (Fig. 2) and was supported by an analysis of how many traps at each location caught eggs. Of the 23 (out of 28) traps that caught eggs, 13 had interior > perimeter eggs, 7 had perimeter > interior eggs, and 3 had equal numbers – a significant difference (chi-square: df = 2, $p < 0.01$). In comparison, an analysis of bush height, volume (length × width × height), or 'ground coverage' (length × width) on the total number of *H. californicus* eggs laid found no significant correlation (height: df = 1, 26, F = 2.19, $p < 0.15$; volume: df = 1, 26, F = 2.57, $p < 0.12$; ground coverage: df = 1, 26, F = 2.59, $p < 0.12$).

Despite variation in the numbers of eggs oviposited between sites and bushes, I did note a preference by *H. californicus* for oviposition in the center of lupine

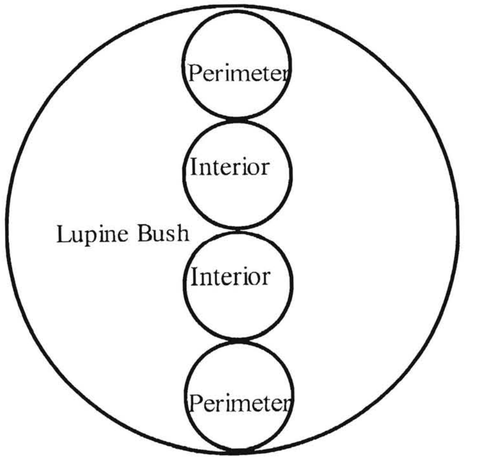

FIG. 1. Trap placement in lupine bushes. The two perimeter and interior traps are added together for the number of perimeter and interior eggs collected per date, respectively.

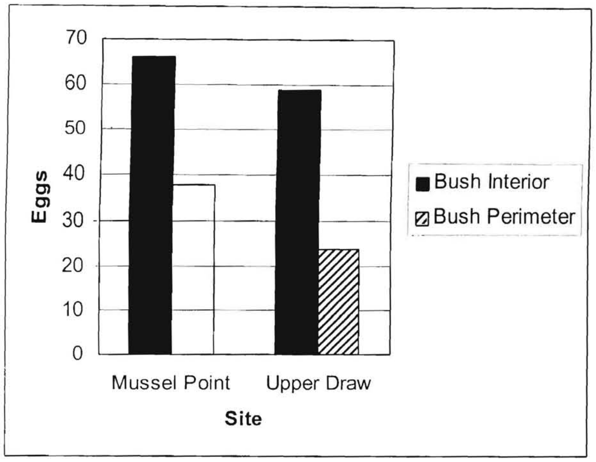

FIG. 2. Total eggs caught per site vs. placement. At both sites, more eggs were caught in interior versus perimeter traps.

bushes. This conclusion is supported by comparisons of both the total numbers of eggs laid as well as the number of bushes with more eggs in the interior than on the perimeter. This preference is reasonable given the additional risk incurred by *H. californicus* larvae that have to travel extensively through a predator-filled zone like the detritus (D. Strong pers. com.). Females capable of detecting the thickest part of a lupine bush and releasing their eggs closer to it would thus increase larval survival.

The above logic might also be applied to oviposition that depends on the size of the lupine bushes; however, there was no evidence of any correlation between oviposition and several indices of bush size. It may be that intraspecific competition for lupine stems and roots is so low due to larval mortality that bushes have approximately the same chance of supporting larvae; however, this is impossible to evaluate without quantifying larval mortality in the detritus. Wagner (1985) suggested that female moths may preferentially oviposit on the lee- versus wind-ward side of bushes, something that may be especially important given BML's strong coastal winds. This hypothesis, however, was not tested in the current study.

The sampling technique used here makes it possible to quantify the amount of 'egg rain' that lupine bushes experience due to *H. californicus*, an important factor in establishing a life-cycle model of *H. californicus* for addressing larger ecological issues. Some of the questions that could be answered by this technique in conjunction with additional experiments include: do different sites have different numbers of eggs, or at different times? Does the location of leks influence where females oviposit? What is the survival rate of eggs deposited close to roots versus at the perimeters of bushes? All of these questions could be answered with further applications of this technique, providing a better sense of the ecological and population dynamics of *Hepialus californicus*.

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LITERATURE CITED

HARIBAL, M. & J. A. RENWICK. 1998. Differential postalightment oviposition behavior of monarch butterflies on *Asclepias* species. J. Insect Beh. 11:507–538.

SETAMOU, M., F. SCHULTHESS, N. BOSQUE-PEREZ, H. POEHLING, & C. BORGEMEISTER. 1999. Bionomics of *Mussidia nigrivenella* (Lepidoptera: Pyralidae) on three host plants. Bull. Ent. Res. 89:465–471.

STANGE, G. 1997 Effects of changes in atmospheric carbon dioxide on the location of hosts by the moth, *Cactoblastis cactorum*. Oecologia (Berlin) 110:539–545.

STRONG, D. R., J. L. MARON, P. G. CONNORS, A. WHIPPLE, S. HARRISON & R. L. JEFERIES. 1995. High mortality, fluctuation in numbers, and heavy subterranean insect herbivory in bush lupine, *Lupinus arboreus*. Oecologia (Berlin). 104:85–92.

STRONG, D. R., A. V. WHIPPLE & A. L. CHILD. 1996. Notes from underground: Heavy insect herbivory and potent natural enemies. Bull. Ecol. Soc. Am. 77:429.

WAGNER, D. L. 1985 The biosystematics of *Hepialus* F. s. *lato:* with special emphasis on the californicus-hectoides species group, UC Berkeley Ph.D. thesis, 391 pp.

WAGNER, D. L. & J. ROSOVSKY. 1991. Mating systems in primitive Lepidoptera, with emphasis on the reproductive behavior of *Korscheltellus gracilis* (Hepialidae). Zool. J. Linnean Society. 102:277–304.

WAGNER, D. L., D. R. TOBI, B. L. PARKER, W. E. WALLNER & J. G. LEONARD. 1989. Immature stages and natural enemies of *Korscheltellus gracilis* (Lepidoptera: Hepialidae). Ann. Ent. Soc. Am. 82:717–724.

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