# PARASITIC MITES (ACARI: ERYTHRAEIDAE) ON SPRUCE BUDWORM MOTHS (LEPIDOPTERA: TORTRICIDAE)[1]

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**Abstract**

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At least two species of parasitic larval mites of the erythraeid genus *Leptus* were found on male spruce budworm, *Choristoneura fumiferana* (Clem.), moths attracted to pheromone-baited traps. Mites were found on 28.5% of 2298 male moths captured during three trapping days in July 1977. Numbers of mite-infested moths were positively correlated with catch density. Percentage mite infestation increased with time. Red larval mites were also collected from both male and female free-flying budworm moths. Attachment sites include: wing veins, cervix, compound eye, femur, and abdomen. As many as four mites were collected from one female moth.

## Introduction

Protelean mites often infest moths and butterflies. The most common species on Lepidoptera include red and orange mites of the families Erythraeidae and Trombidiidae (Treat 1975). Our knowledge of mites associated with the spruce budworm, *Choristoneura fumiferana* (Clem.), is restricted largely to predators of budworm eggs. Morris (1963) reported that mites (species undetermined) were frequently observed feeding on budworm eggs in the field. Red mites were extremely abundant during the budworm egg-laying period at Green River, New Brunswick and serological tests for detecting predation showed that 22–24% of the mite population sampled had fed on budworm eggs (Loughton *et al.* 1963).

While conducting pheromone experiments in northern Maine, we discovered that many trapped spruce budworm male moths were infested with red mites. We also netted free-flying budworm moths near pheromone traps and at other localities, and found both male and female moths infested with red mites. This paper describes our observations, collections, and analysis of mites from spruce budworm adults.

## Materials and Methods

Pherocon 1CP®[6] traps were deployed as five replications of a 10×3 factorial experiment in a budworm infested spruce-fir forest near Telos Lake, 64 km northwest of Millinocket, Maine. The traps were hung from dead understory branches (following the methods of Sanders 1978) along five replicated transects with individual traps 20 m apart. The first factor consisted of 10 concentrations of *trans-cis*-11 tetradecenal (Fulure) incorporated into polyvinyl chloride lures. Lures containing 60, 70, 80, 85, 90, 92.5, 95, 97, 99, and 100% concentrations of *trans* were supplied by C.J. Sanders, Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario. The second factor consisted of trapping dates, i.e. 13, 15, and 23 of July 1977. Each trap was left in the field for 24 h. After retrieval, traps were taken to the laboratory for examination and collection of mites.

In addition to infested moths caught in pheromone traps, we also collected mite-infested moths via insect nets in July, 1977 near pheromone traps at Telos Lake; in July 1978 near Greenville, Coffeelos, and Telos, Maine (all Piscataquis County);

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[6]Mention of trade name does not imply endorsement by the University of Maine or the U.S. Department of Agriculture.

in June 1978 near Howland (Penobscot County); and, in July 1978 on the Penobscot Experimental Forest, near Bradley (Penobscot County), Maine.

Mite-infested moths were stored in situ in 70% ethanol until mites were removed for mounting on microscope slides. A sub-sample of ca. 450 mites was chosen for further examination and identification. Preparation of mites for microscopic study followed the procedures described by Treat (1975). Sticky material covering mites from pheromone traps was dissolved in a few drops of xylene prior to preparation for mounting. Family and generic descriptions of Southcott (1961) and Treat (1975) were used to make initial mite determinations; confirmations were made by Dr. Asher E. Treat. Representative slide mounts are on deposit in the arachnid collection, The American Museum of Natural History, New York.

## Results

Mites collected from *C. fumiferana* adults belong to at least two species of *Leptus* (Family Erythraeidae). Species determinations could not be made because the North American species of *Leptus* are almost completely unstudied (Treat 1975). In total, 433 larvae and one post-larval nymph were identified as *Leptus* spp. Thirty-three *Leptus* ''pupae'' (terminology of Southcott 1961) were also found on moths; identification to genus was possible when exuviae were still present.

Both male and female spruce budworm moths were found infested with erythraeid mites (Table I) in various stages of engorgement. Attachment sites on moths included: wing veins, cervix, compound eye, femur, and ventral side of abdomen. As many as four mites were collected from one female moth. Color of mites ranged from red to yellow to white. Some discoloration may have occurred due to submersion in sticky materials and ethanol.

Mites were found on 656 (28.5%) of 2298 male budworm moths attracted to pheromone traps. Although blends containing 92.5–97% *trans* attracted the greatest numbers of mite-infested moths (Table II), the number of mite-infested moths captured in pheromone traps was positively correlated with catch density (Fig. 1)

Table I. Numbers of free-flying spruce budworm moths infested with *Leptus* spp. mites collected in Maine, 1977–78

| | | Moths examined | | | |
|---|---|---|---|---|---|
| Date | Locality | Males | % infested | Females | % infested |
| 21 July 1977 | 2.4 km S of Telos Lake, Piscataquis County | 2 | 100.0 | 3 | 100.0 |
| 30 June 1978 | Howland, Penobscot County | 22 | 0.0 | 8 | 0.0 |
| 6 July 1978 | 45 km NE of Greenville, Piscataquis County | 28 | 7.1 | 5 | 0.0 |
| 7 July 1978 | Coffeelos, Piscataquis County | 18 | 16.6 | 72 | 12.5 |
| 7 July 1978 | Penobscot Experimental Forest, Bradley, Penobscot County | 7 | 0.0 | 3 | 0.0 |
| 9 July 1978 | Penobscot Experimental Forest, Bradley, Penobscot County | 21 | 0.0[1] | 5 | 0.0 |
| 11 July 1978 | 2.4 km S of Telos Lake, Piscataquis County | 71 | 0.0[1] | 12 | 0.0 |

[1]One mite on bottom of collecting jar, not attached to moth.

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Table II. Mite-infested spruce budworm moths caught at varying percentages of *trans*-11-tetradecenal baited traps, three trapping days combined, Telos Lake, Maine, 1977

| % *trans*-isomer | Mean mite-infested moths[1] (± S.E.) | Mean percentage infested[2] (± S.E.) |
|---|---|---|
| 60 | 0.7 (± 0.3) [a] | 31.1 (± 0.1) [a] |
| 70 | 1.0 (± 0.3) [a] | 27.5 (± 0.1) [a] |
| 80 | 1.5 (± 0.6) [a] | 25.7 (± 0.1) [ab] |
| 85 | 2.9 (± 0.7) [ab] | 33.9 (± 0.1) [bc] |
| 90 | 3.7 (± 0.9) [ab] | 25.7 (± 0.0) [c] |
| 92.5 | 8.1 (± 1.3) [cd] | 33.9 (± 0.0) [de] |
| 95 | 9.1 (± 1.6) [cd] | 24.6 (± 0.0) [de] |
| 97 | 10.6 (± 1.4) [d] | 33.2 (± 0.0) [e] |
| 99 | 6.1 (± 1.0) [bc] | 28.0 (± 0.0) [d] |
| 100 | 0.1 (± 0.1) [a] | 6.7 (± 0.1) [a] |

[1]Means followed by same letter are not significantly different at $P \leq 0.05$, SNK Multiple Range Test.
[2]Means followed by same letter are not significantly different at $P \leq 0.05$, SNK Multiple Range Test; arc sin transformations were made on the percentages prior to analysis.

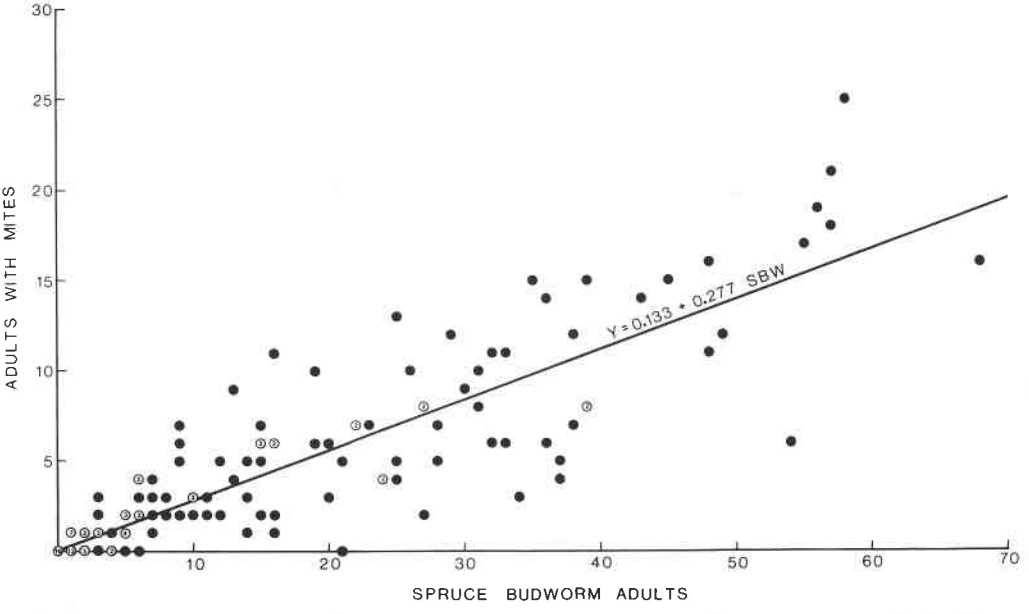


FIG. 1. Relationship of mite-infested moths attracted to pheromone-baited traps and catch density, $R^2 = 0.76$. Open circles with numerals indicate multiple observations.

for all blends and trapping days. Mean percentage infestation (Table II) was about the same for all treatments, except 100% *trans*.

Positive slopes are evident for each day, for selected blends (92.5, 95, 97, and 99% *trans*) which attracted high moth densities (Fig. 2). For these selected blends, the percentage of moths infested with mites increased with time (Fig. 3). Although significantly more moths and mite-infested moths were caught on 15 July ($\bar{X}$ = 42.7 and 12.6) than on 13 July or 23 July, the percentage of infested moths increased by days; from 21% to 30% to 35% ($P$ = 0.0001). This indicates that a greater percentage of late-flying spruce budworm moths are infested with red mites than are early-flying moths. Unfortunately, we know little about the habits and life cycle synchronies of these parasitic mites with their budworm host.

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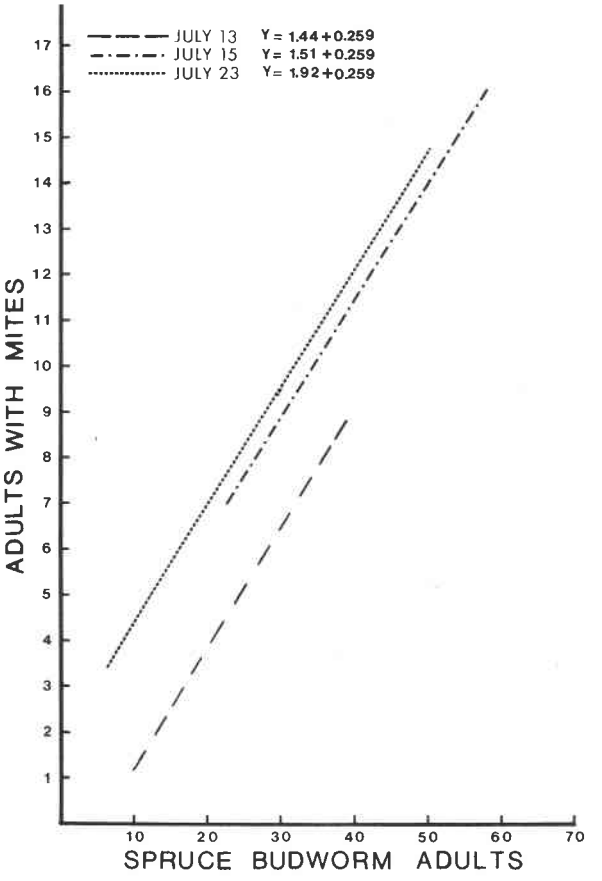


FIG. 2. Regression lines for mite-infested moths attracted to selected pheromone blends (92.5, 95, 97, and 99% *trans*) by catch density for individual days.

## Discussion

Treat (1975) has observed numerous adult Lepidoptera, chiefly Noctuidae, infested with larvae of *Leptus* spp. Our collections of larval *Leptus* spp. from *Choristoneura fumiferana* are the first reported records of these mites for this host species. However, it is not known if these parasitic mites are of the same species, genus of even family previously observed feeding on spruce budworm eggs (Morris 1963). Only the larvae of erythraeids are parasitic; deutonymphs and adults are free-living predators, while protonymphs and tritonymphs are inactive calyptostases, as is typical of parasitengone mites (Treat 1975; Krantz 1978). Many species of *Leptus* are known only from larvae, but others only from nymphs or adults. Few erythraeid life histories are known, and very few larval and post-larval instars have been correlated by rearing or otherwise.

Parasitism by erythraeid mites could conceivably affect moth flight behavior of both sexes, and fecundity of females. These adversities could, in turn, affect budworm population quality and perhaps serve as indicators of population trends. However, much more basic research is needed to ascertain the habits of these mites, their host associations and their possible regulatory effects on spruce budworm.

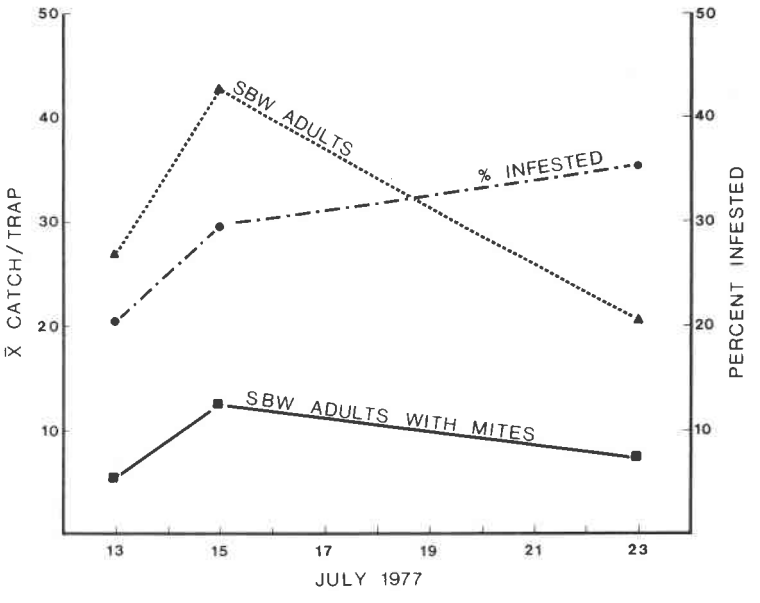


FIG. 3. Mean catch of spruce budworm adults, adults with mites, and percentage infested by dates; pheromone-baited traps (selected blends).

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