Although field observations indicate that *T. custator* is found on *S. emerus* only occasionally, we have yet to find it on any other hosts. Our laboratory results suggest that *S. emerus* is a suitable food for this pentatomid. We thank D. Hall for identifying the plant species, R. I. Sailer and D. A. Rider for identifying the insect species, and R. I. Sailer, D. H. Habeck andd D. A. Rider for reviewing an early draft of this note, Florida Agricultural Experiment Station Journal Series No. 6235.

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GRASSHOPPER (ORTHOPTERA: ACRIDIDAE) DAMAGE TO PINE SEEDLINGS AT NIGHT IN A SEED ORCHARD

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During a hot, dry period, grasshopper species whose social behavior was being studied seemed to be unusually sedentary during the day, because no reproductive behavior or feeding was observed. A night visit to the study site, a newly established loblolly pine (*Pinus taeda* L.) seed orchard (1982, Schenck Forest, Wake County, NC), revealed that grasshoppers were active at night. Also that three species, *Melanoplus bivittatus* (Say), *Melanoplus femurrubrum* (DeGeer), that typically feed on forbs and grass (Bailey & Mukerji 1976, Mulkern et al. 1969), and *Schistocerca americana* (Drury), known to feed on broadleaf scrubs and trees as well as weeds (Otte, 1975), were feeding on pine seedlings. From 10-VII-1983 to 22-VII-1983, the Wake County area was experiencing hot, dry weather with minimum temperatures above 18°C and maximum temperatures of 28 to 43°C. No rainfall was recorded.

During four night visits to the orchard, grasshoppers feeding on the pine seedlings were counted. Nymphs were also collected and raised to adults in the laboratory so that species identifications could be verified (Blatchley 1920, Helfer 1963). (Voucher specimens have been deposited in the insect collection, Entomol. Dept., NCSU). Five days were devoted to assessing the damage incurred by the pine seedlings. For 173 seedlings, the lengths of branch tips that bore mandibular (feeding) scars were measured. Counts

were made of damaged/undamaged needles on the top third of seedlings. The percent of lower needles damaged was estimated. For 10 trees, direct counts of lower needle damage only differed from these estimates by 0.05%. The extent of damage was correlated with the number of grasshoppers found feeding on a particular tree and is summarized in Table 1.

Although as many as 52 grasshoppers were found feeding on a single branch, fewer than five trees per visit had in excess of 100 grasshoppers; 80% had fewer than five grasshoppers. Grasshoppers fed mainly on branch tips, (in 90% of 211 feeding incidents where individuals fed at least one minute). Needles around the damaged area would eventually turn brown and break off. Seedlings less than 30 cm in height suffered no damage or damage categorized as slight (see description of Category I damage in Table 1). The most heavily damaged trees (100%, Category III and 80%, Category II, Table 1) were found in the field center.

A few reports exist of grasshoppers feeding on pine in North America (Baker 1972, Beirne 1972, Nairn & Froning 1977, Rogers 1980). Various *Melanoplus* species (including *M. bivittatus* and *M. femurrubrum*) and *Schistocerca obscura* (Fabricius) have been implicated. This present study appears to be the first report of *S. americana* feeding on pines. Since relative abundances of the species feeding on the pine seedlings did not appear to reflect relative field abundance, density estimates were made the week of 14-VII to 20-VII. During this period, adults were the prominent stage encountered, but at least grasshoppers were now active again during the day so reliable density estimates could be made. *Melonoplus femurrubrum* was the most abundant species in the orchard with 2.8 adults/m^2 yet only 31 individuals had been observed feeding on the pines. Less than 0.01 adults/m^2 were recorded for *M. bivittatus*, for which seven individuals were found at night on the pines, although only two nymphs were observed feeding. Most of the pine damage can then be attributed to *S. americana* whose density was relatively low in the orchard, 0.04 adults/m^2.

I believe that two factors contributed to the unexpected nocturnal feeding on pine seedlings observed. Hot, dry conditions favored nocturnal activity by the grasshoppers with these three species turning to the pines (on which they sometimes roost at night) for food. During night visits to the orchard in the milder summer of 1984, grasshoppers were observed only to roost, not feed, on the pines. Also, in 1983, the orchard had been mowed prior to my visits. Small tracts of unmowed grass (mainly rye and fescue) and forbs could be found at forest edge and along the roadside, but grasshopper density was concentrated in the center of the field. The scarcity of grasses and forbs here most certainly contributed to the relatively large degree of damage incurred by pine seedlings located in the field center.

TABLE 1. GRASSHOPPER DAMAGE TO PINE SEEDLINGS.

Assigned category	0	I	II	III
Grasshoppers on trees, number	0	5	6-50	51-252
Damage to branch tips, length (cms.)	0	<3	3-6	>6
Needles damaged, per cent				
(min.-max. of top ⅓ tree)	0	1-5	10-50	55-100
(avg. of all needles)	0	1	10	25
Trees examined, number (total=173)	47	89	25	12
per cent	27	52	14	7

It is possible that grasshopper feeding on pine is more common than generally supposed. In a report from a Morgantown seedling nursery (Rogers 1980) grasshoppers damaged 514,000 seedlings (~5%), although grasshoppers were never observed feeding on pine. The damage was attributed to crickets until samples of both were caged separately with the seedlings. In the present study, the pine damage would have probably been attributed to other insects, such as the Japanese beetle, that sometimes fed on the pines during the day if I did not happen to be studying the social behavior of grasshoppers in the orchard.

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