

width is obtained by dividing the projected measurements by 20 because the 1-mm scale of the micrometer projected onto paper is 20-mm long. For example, the enlarged length of a wing of *Ceratitis capitata* (Wiedemann) was measured as 95.0 mm and the width, 46.5 mm; thus, the actual length, $(95 \div 20)$ was 4.75 mm, and actual width $(46.5 \div 20)$ was 2.33 mm. The area of the wing was determined by moving the tracer arm of the planimeter clockwise along the entire wing outline (Keuffel and Esser Co., 1963. Compensating Polar Planimeter Instruction Manual, 32 pp.). Again, the reading on the dial, (i.e., 0322 venier units or 32.2 cm^2) is divided by 20^2 to obtain the actual area of the wing (0.0805 cm^2 or 8.05 mm^2).—J. L. SHARP. Insect Attractants, Behavior and Basic Biology Research Laboratory, Agricultural Research, Science and Education Administration, USDA, P.O. Box 14565, Gainesville, FL 32604.

TOUMEYELLA SCALE, RED IMPORTED FIRE ANT, REDUCE SLASH PINE GROWTH—(Note). Heavy infestations of a native pine tortoise scale, *Toumeyella parvicornis* (Ckll.), (det. G. W. Dekle, Fla. Div. Plant Industry, Gainesville) consistently attended by workers of the red imported fire ant,

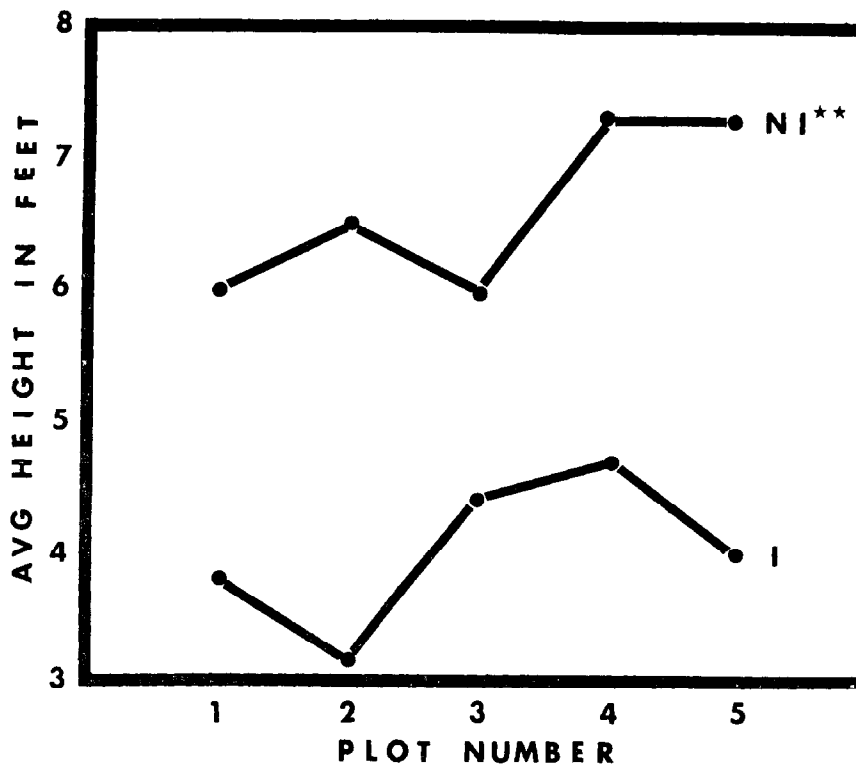


Fig. 1. Mean heights of 2 groups (5 plots/group) of 3-year-old slash pines in a Clay Co., FL plantation in July 1972. Pines heavily infested (=I; 5 trees/plot) with pine tortoise scale, *Toumeyella parvicornis* (Ckll.) tended by red imported fire ants, *Solenopsis invicta* Burcn, were only ca. 60% as tall as insect-free pines (=NI, 5 trees/plot).

Solenopsis invicta Buren, (det. W. F. Buren, Univ. of Fla., Gainesville) were found in a 3-year-old, bedded, typical slash pine (*Pinus elliottii* Engelm. var. *elliottii*) plantation located at the junction of state hwy. 16 and 21 in Clay County, FL during July 1972. At least 50% of the trees in a 40 ha area were infested, resulting in pockets of chlorotic, stunted trees, often covered with sooty mold. Measurements taken in 5 plots each with 5 infested and 5 non-infested trees showed that mean height growth was significantly ($p \leq .01$) reduced by 40% in scale-infested trees (Fig. 1). A survey of 37 forested counties in north Florida was conducted during the fall of 1972 by personnel of the Florida Division of Forestry, but failed to detect similar damaging scale infestations in young slash pine plantations. Live *T. parvicornis* scales were not found in the Clay County plantation 1 year after the outbreak was first detected and no similar outbreaks have been reported to date.

Toumeyella parvicornis commonly infests slash pine seedlings in 2-year-old plantations in Florida, but seldom persists into the 3rd growing season (unpubl.). Reasons for the above *T. parvicornis*-*S. invicta* outbreak are unknown. The potential for damage to young pine plantations would appear to be great if such scale-ant infestations should develop and persist in the future.—R. C. WILKINSON, Univ. of Fla., Dept. of Entomology and Nematology, Gainesville, and C. W. CHELLMAN, Fla. Div. Forestry, Tallahassee.



TUNNELING IN SLASH PINE BY *IPS CALLIGRAPHUS* (GERM.)—(Note). Six-spined pine engraver beetle adults sometimes make brood tunnels in the inner bark of living *Pinus* spp. (Felt 1906, N.Y. State Mus. Mem. 8: 349; Swaine 1918, Can. Dept. Agr. Bull. 14: 113; Blackman 1922, Miss. Agr. Exp. Sta. Tech. Bull. 11: 114; Beal and Massey 1945, Duke Univ. Sch. For. Bull. 10: 145). Facultative tunneling behavior observed during a host resistance study (unpubl.) might explain the partial success of this species in attacking living trees.

Adult *Ips calligraphus* attacks were induced on the scionwood portion of 32 (8 clones x 4 ramets) grafted slash pines by attaching attractive pine bolts artificially infested with *I. calligraphus* males to the trunks (cf. Wilkinson 1964, Fla. Ent. 47: 57). Some ramets of 1 clone were characterized by relatively low growth rate and large numbers of induced *Ips* attacks. Atypical tunnel patterns were most common in a tree which had a maximum oleoresin exudation pressure (OEP) of only 2.6 atmos. and which was killed by repeated attacks over a 4-week period. Atypical attacks were also found in some of the remaining 31 trees (OEP \geq 8 atmos.), but none of these trees died.

Brood gallery systems of the kind usually present in non-resistant host material were found in the inner bark of the attractive bolts (Fig. 1A). In this case a male was found in the central nuptial chamber and 1 female in each of the 3 adjoined egg galleries. In 1 apparently resistant tree (10 atmos. OEP), 6 live females were found side-by-side, tunneling vertically upward in a broad tunnel in the inner bark (B). Females were almost engulfed with oleoresin, which drained out of the bottom of the tunnel through the entry hole. This same pattern was repeated in some of the other apparently resistant trees. In the 1 tree which eventually died, adults had suc-