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### Observations of Intercastes in *Solenopsis Invicta* Buren

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After our return to the United States, a nonoccluded virus was detected in a colony of an undescribed *Solenopsis* sp. that we had brought back for study (Avery et al., op cit.).

In 1979, 456 colonies from Cuiabá were screened for disease. Of these 444 were *S. invicta*; the remaining 12 were probably *S. saevissima* (determined by D. P. Wojcik). Of the total, 31 (6.30%) were infected with *T. solenopsae*, 13 (2.85%) with the undescribed dimorphic microsporidium, and 6 (1.32%) with the neogregarine. Dual infections of *T. solenopsae* and the undescribed microsporidium and of the neogregarine and the undescribed microsporidium were seen in 1 colony each.

Thus, 74 (11.56%) of the 640 colonies screened in 1976 and 1979 were infected by protozoa. *Thelohania solenopsae* occurred in a total of 52 (8.12%), the undescribed microsporidium in 23 (3.59%), and the neogregarine in 7 (1.09%).

A mold similar or identical to a dimorphic mold erroneously reported by Jouvenaz et al. (1977., op cit) as a yeast from *S. invicta* in the United States was seen for the first time in South America. This organism, which multiplies in the haemolymph but appears to be only very mildly pathogenic, was found in 1 colony.—D. P. JOUVENAZ, W. A. BANKS, AND J. D. ATWOOD. Insects Affecting Man and Animals Research Laboratory, Agricultural Research, Science and Education Administration, USDA, Gainesville, FL 32604.

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OBSERVATIONS OF INTERCASTES IN *SOLENOPSIS INVICTA* BUREN—(Note). The red imported fire ant, *Solenopsis invicta* Buren, exhibits classical polymorphism, which is defined as the coexistence of 2 or more functionally different castes of the same sex (Wilson 1971). The 2 basic castes are the worker and the female sexuals. In some species of ants, an intercaste (ergatogyne) occurs with characteristics intermediate between those of workers and female alates (Wilson, E. O. 1971. The Insect Societies.) We recently found 2 intercastes in our laboratory colonies of *S. invicta*. We report here our observations on these intercastes.

Female sexuals are easily distinguished from workers by their wings (wing scars if dealated) and by their large size. Less obvious characteristics are the presence of 3 ocelli, eyes much larger than those of the workers and a robust thorax. Workers vary in size, ranging from very small minims to large major workers. To obtain a comparison of the intercastes with normal workers and females, we made selected physical measurements of their head, eyes, and body and compared them with those of a major worker and an alate female (Table 1). Weights, lengths, and eye dimensions of the intercastes were intermediate between those of the worker and the alate queen, as would be expected for an ergatogyne. However, the head dimensions of the intercastes were greater than those of the alates or major workers. The major worker, though only about 1/2 the size of an alate queen, has head dimensions approximately equal to those of the alate. A larger major worker would have larger head dimensions in proportion to its length. The ratios of head length and head width to body length for the intercaste and major

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<sup>1</sup>Mention of a commercial or proprietary product in this paper does not constitute an endorsement of this product by the U.S. Department of Agriculture.

TABLE 1. DIMENSIONS OF WORKERS, INTERCASTES, AND ALATE FEMALES OF *Solenopsis invicta*.

Caste	Body length (mm)	Head width (mm)	Ratio of head width to body length	Head length (mm)	Ratio of head length to body length	Eye length (mm)	Eye diameter (mm)	Body weight (mg)
Major worker*	5.72	1.25	0.218	1.29	0.225	0.20	0.137	3.58
Intercaste	7.0	1.52	0.217	1.62	0.231	0.30	0.22	6.0
Alate queen*	8.86	1.20	0.135	1.21	0.136	0.41	0.29	12.69

\*Means based on average of 10 individuals.

worker were almost identical (ca. 1.7 times those of alate females). Therefore, we concluded that the dimensions of the intercaste were characteristic of oversized major workers and not of alate females. Conversely, both intercastes had rudimentary ocelli and either wing scars or wings present (Fig. 1a & b), which are characteristics found only in alate females.

Another distinct difference between alate females and workers is the reproductive system. Female alates have ovaries and a spermatheca; workers have neither. We found neither ovaries nor spermatheca in intercaste A; however, we found small ovaries and developing eggs, but no spermatheca in intercaste B. These data indicate that physiologically, intercaste B is more closely related to an alate queen than is A.

Biochemical evidence for the intercastes comes from a comparative study of venom alkaloids. The venom components of *S. invicta* have been identified (Macconnel et al. 1970, 1971. Tetrahedron 26: 1129; Brand et al. 1972, 1973. Toxicol. 10: 259) as various 2-methyl-6-alkyl or alkenyl substituted piperidines. Components of worker venom had the 6-substituents *trans* to the methyl group and were composed mainly of alkaloids with  $C_{13}$  and  $C_{15}$  saturated and mono-unsaturated side chains (double bonds are *cis*) (Fig. 2a). In contrast, alate female venom (Fig. 2b) consisted primarily of the *cis*  $C_{11}$  isomer with minor amounts of *trans*  $C_{11}$  and *cis,trans*  $C_{13}$  isomers. We analyzed the venom of the 2 ergatogynes and compared the resulting chromatograms (Fig. 2c & 2d) with those of alate females and major workers. Intercaste A had venom components characteristic of both workers and alate females with worker  $C_{13}$  and  $C_{15}$  isomers clearly expressed, as were alate female isomers. The high percentage of *trans*  $C_{11}$  isomer might have been an expression of worker *trans*-alkaloid production, superimposed on the alate females predilection toward formation of  $C_{11}$  isomers.

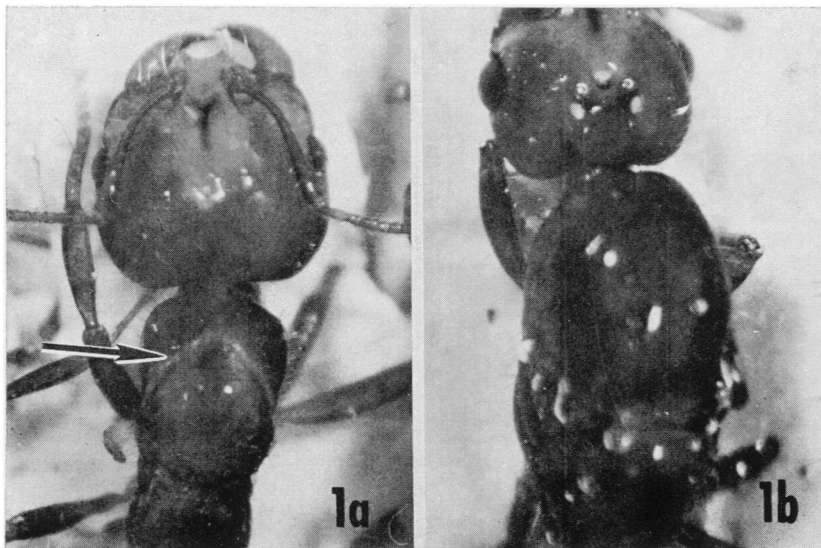


Fig. 1. Head and pronotum of intercaste. Arrow points to enlarged pronotal suture. Head and pronotum of dealated virgin queen.

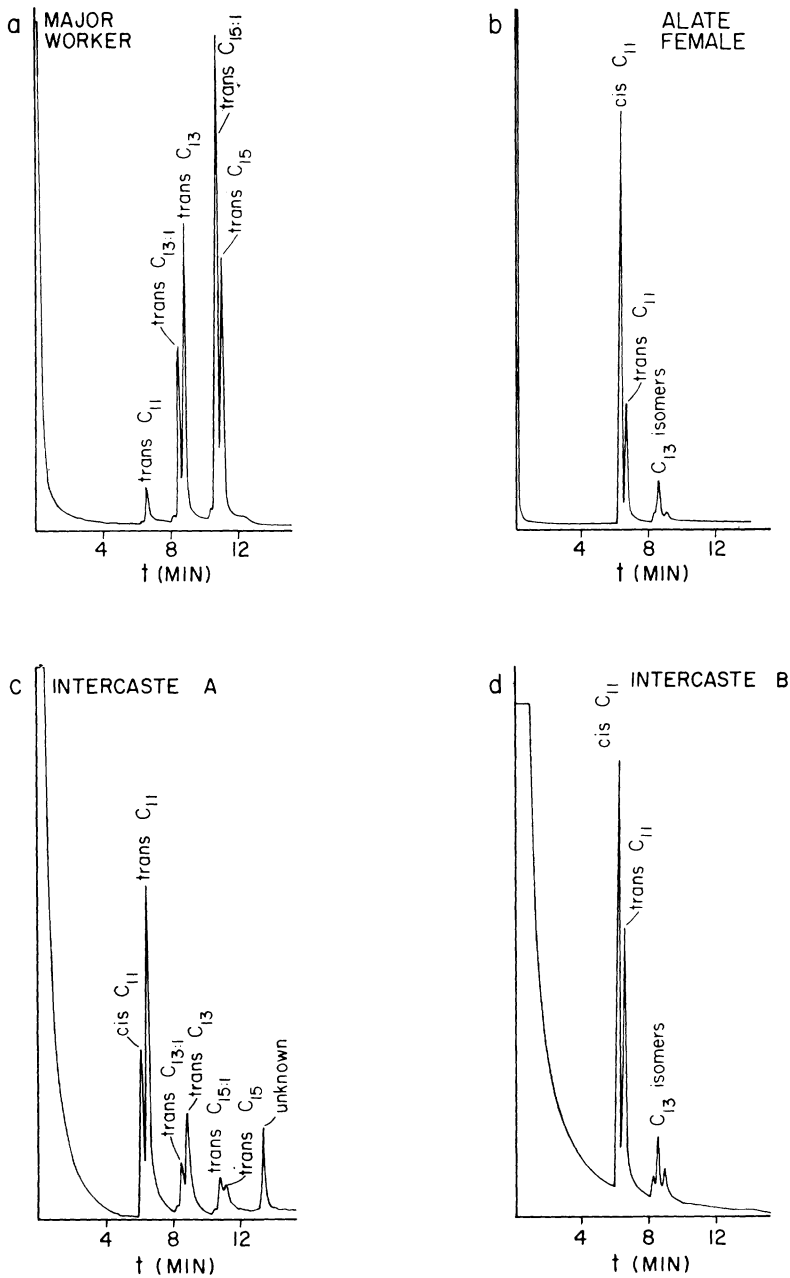


Fig. 2. Gas chromatograms of the venom alkaloids from major workers (a), alates (b), and 2 intercastes A and B (c & d) (Varian 3700, 1.83 m x 2 mm glass column packed with 3% OV-101 on 100/120 Gas Chrom Q, 20 ml N<sub>2</sub>/min, 150-250°C at 10°/min, flame ionization detector).

The gas chromatogram of intercaste B was almost identical to that of an alate female. The higher ratio of the *trans* C<sub>11</sub> isomer probably reflects the biochemical contribution of the worker genome to an intercaste that otherwise most closely resembled an alate female.

Recent studies (Robeau and Vinson. 1976. J. Ga. Ent. Soc. 11: 198-203) have shown that juvenile hormone analogues stimulate the production of major workers, intercastes, and female alates in fire ant colonies. Our data suggest that the 2 aberrant individuals we found might have resulted from anomalous JH activity.—B. MICHAEL GLANCEY, R. K. VANDER MEER, A. GLOVER, AND C. S. LOFGREN, Insects Affecting Man and Animals Research Laboratory, Agricultural Research, Science and Education Administration, USDA, P.O. Box 14565, Gainesville, FL 32604.

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## ANNOUNCEMENT

### MANAGEMENT OF INSECT PESTS WITH SEMIOCHEMICALS

Forty-one of the world's leading scientists in the use of insect semiochemicals—pheromones, kairomones, oviposition deterrents, and other behavior modifiers—convened in Gainesville, FL, on 23-28 March 1980. The purpose of the colloquium was to discuss current research in this field and to make recommendations for getting semiochemicals recognized as safe and environmentally acceptable supplements in existing insect pest control programs or as alternatives to conventional insecticides. The colloquium was sponsored jointly by the Insect Attractants, Behavior, and Basic Biology Research Laboratory, USDA and the Department of Entomology and Nematology, University of Florida.

The week-long program held sessions discussing the use of insect attractants for monitoring pests in field and orchard crops, forests, and stored products and also discussed using traps to suppress insect pest populations in common ground and recreational areas of cities, in forests, in unseasoned lumber at sawmills, and in field crops like cotton. A third session discussed using semiochemicals to control crop pests via disruption of the mating process. Of particular interest in this session was that damage to cotton caused by the pink bollworm was reduced to subeconomic levels in fields treated with pheromone, although mating in the pheromone-treated areas was not totally eliminated. Similarly, economic control of the pink bollworm was achieved in a mass trapping experiment, although traps were less than 100% efficient in capturing males attracted to them. These results are encouraging and demonstrate the potential of semiochemicals in agricultural pest control, particularly when integrated with more conventional control methods involving insecticides, parasites and predators, pathogens, resistant varieties, and good cultural practices.

A fourth session dealt with formulation, toxicology, and registration of semiochemicals for insect control. Three of the principal hindrances to effective application and utilization of semiochemicals in the past have been the cost of semiochemicals themselves, the development of dependable, long-lasting formulations that can be easily and cheaply delivered to the crop, and governmental regulations concerning registration. Recent changes in the U. S. Environmental Protection Agency's registration procedures and