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# Observations of Intercastes in Solenopsis Invicta Buren

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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 minums 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

[1]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 (Maconnel 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 predeliction toward formation of $C_{11}$ isomers.

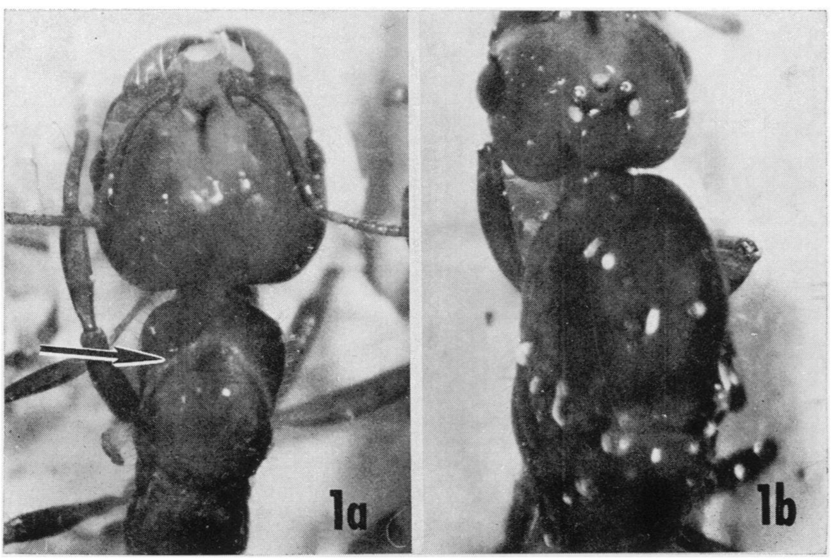


Fig. 1. Head and pronotum of intercaste. Arrow points to enlarged pronotal suture. Head and pronotum of dealated virgin queen.

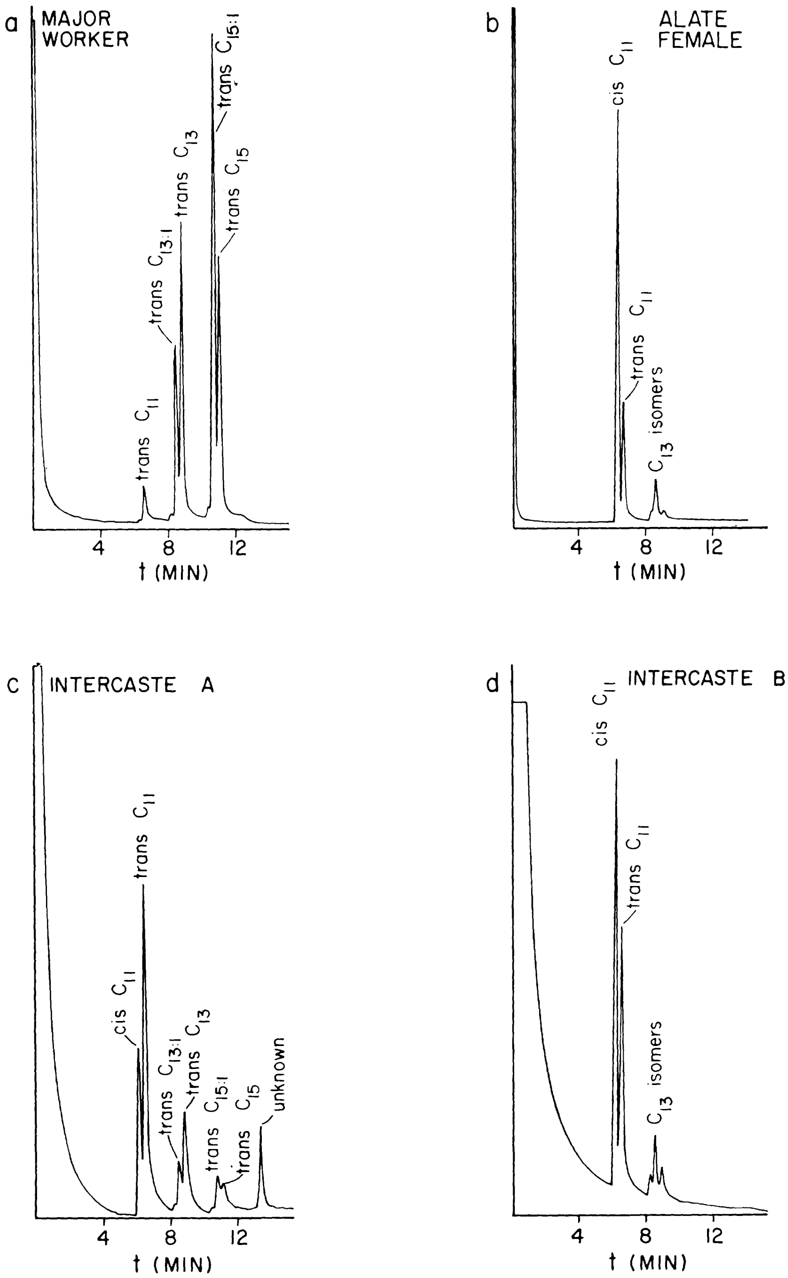


Fig. 2. Gas chromatograms of the venom alkaloids from major workers (a), alates (b), and 2 intercastes A and B (c & d) (Varian 3700, 1.83 m x 2 mm glass column packed with 3% OV-101 on 100/120 Gas Chrom Q, 20 ml $N_2$/min, 150-250°C at 10°/min, flame ionization detector).

The gas chromatogram of intercaste B was almost identical to that of an alate female. The higher ratio of the *trans* $C_{11}$ 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.