CHROMOSOME VARIATION WITHIN *DROSOPHILA SIMULANS* DETECTED BY QUINACRINE STAINING

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WHEN stained with quinacrine or nitrogen mustard derivatives of quinacrine, certain regions of Drosophila salivary gland chromosomes fluoresce with extraordinary brilliance (VOSA 1970; ELLISON and BARR 1971). Although the biochemical specificity of this reaction is not well understood, the method of quinacrine staining can be used for cytological comparisons of chromosomes among species and within populations (ELLISON and BARR 1971; BARR and ELLISON 1971).

D. simulans (STURTEVANT 1920) is one of the three widespread species of Drosophila which have been reported to be chromosomally monomorphic throughout their distributions (CARSON 1965). We have found, however, that there are consistent differences among certain laboratory stocks of *D. simulans* with regard to regions of the fourth chromosome which fluoresce intensely after staining with quinacrine.

MATERIALS AND METHODS

Salivary gland preparations of four laboratory stocks of *D. simulans* (wild-type stocks from Honduras and from Madison; a vermilion stock and a yellow, white stock from the California Institute of Technology) were examined using the method of quinacrine staining as described elsewhere (ELLISON and BARR 1971). After photographing the fluorescence patterns of any given preparation, the tissue was restained with orcein and mounted in Euparal. All photography was carried out with a Zeiss Universal microscope equipped with Planapochromat objectives. A xenon 150W light source, a Zeiss BG12 excitation filter, and a Zeiss 53 barrier filter were used for all fluorescence microscopy.

Mass matings between the yellow, white stock and each of the other three stocks were made in both directions. Polytene chromosomes from the progeny of these crosses were examined, and the F_1 individuals were tested for fertility in mass matings.

RESULTS

The fourth chromosome of three of the laboratory stocks (Honduras, Madison, and vermilion) shows two regions of brightly fluorescent material, one at the base adjacent to the chromocenter and one at the tip. These two regions are usually paired ectopically, forcing the fourth chromosome to assume a U shape with both ends near the chromocenter (Figure 1A,B). The fourth stock (*yw*) shows only one region of bright fluorescence, located at its base adjacent to the chromocenter. The distal tip of the fourth chromosome of this stock is rarely seen associated with the chromocenter or paired with the base (Figure 1C,D). Rather,

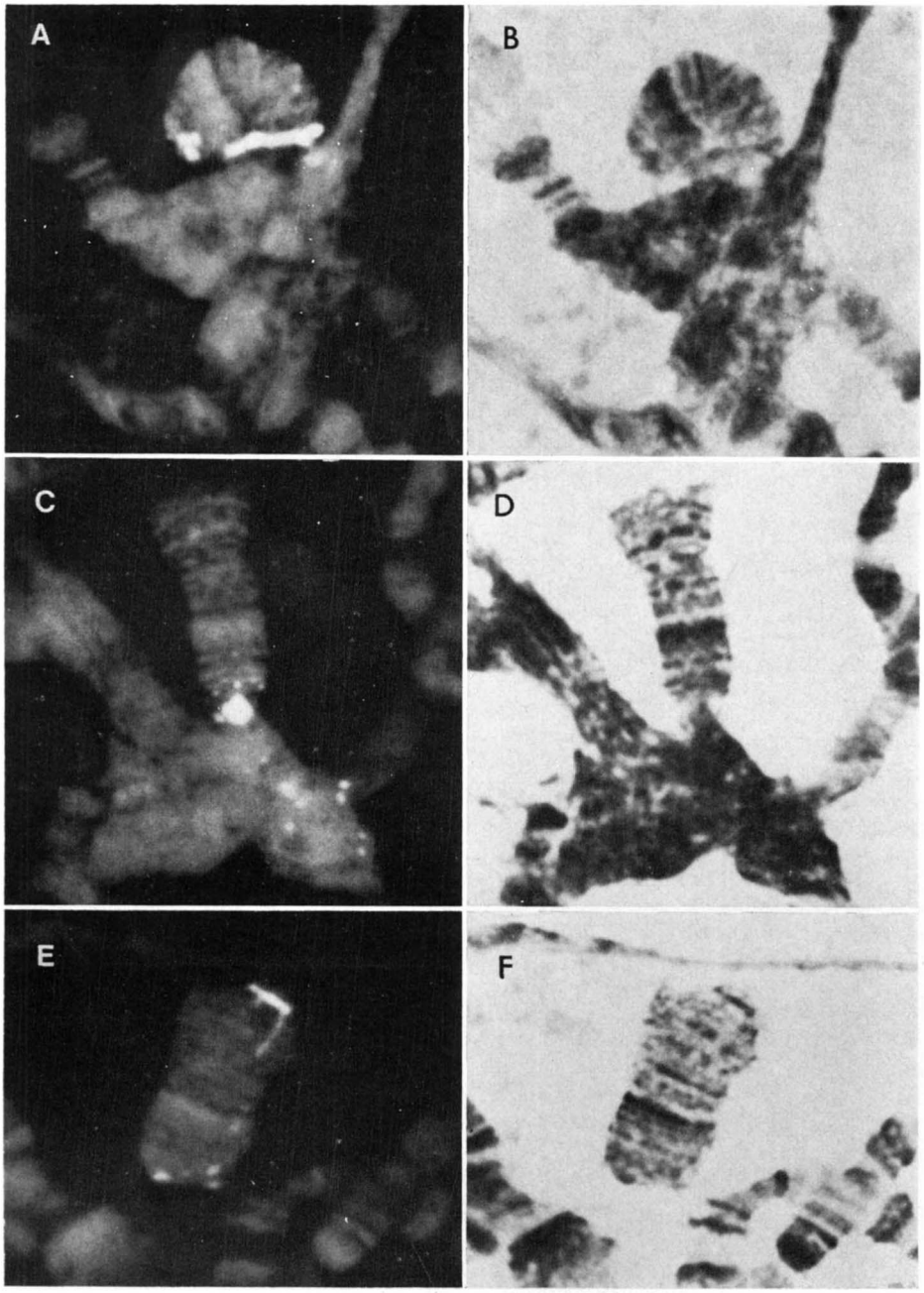

FIGURE 1.—Fourth chromosomes from *Drosophila simulans* (2460 ×). A: Quinacrine preparation of a fourth chromosome from the Honduras stock showing the typical U shape. B: Orcein preparation of the cell shown in A. C: Quinacrine preparation of a fourth chromosome from *yw* showing the rod morphology typical of this stock. D: Orcein preparation of the cell shown in C. E: Quinacrine preparation of a fourth chromosome from the F_1 of *yw* × Honduras. Notice

the chromosome extends as a straight element from the chromocenter. The banding pattern and morphology of the fourth chromosome of our *yw* stock thus fit closely the description given by HORTON (1939). In all of our stocks, dots of brightly fluorescent material are sometimes seen in the chromocenter, as shown in Figure 1C.

An examination of the polytene chromosomes of heterozygotes from crosses of the yellow, white stock with each of the other stocks shows that the banding patterns of the stocks are identical with respect to the fourth chromosome except for the distal tip. The wild-type stocks from Honduras and Madison and the vermilion stock have two extra bands at the distal tip of chromosome *4* as compared to the yellow, white stock (Figure 1E,F). One of these extra bands fluoresces intensely after quinacrine staining and even in the heterozygous condition tends to pair ectopically with the base and deform the entire fourth chromosome into a U shape. In two cases (one in *yw* × Madison; one in Honduras × *yw*), polytene cells were found in which the heteromorphic fourth chromosomes were totally asynapsed. In these cases, one of the asynapsed chromosomes had intensely fluorescing regions on each end and was U shaped, while the other fourth chromosome had at its base one intensely fluorescing region and was rod shaped.

The mass matings between the *yw* stock and each of the other three stocks were all successful in both directions and yielded fertile progeny.

DISCUSSION

Drosophila simulans had previously been considered to be chromosomally monomorphic throughout its widespread distribution (CARSON 1965; DOBZHANSKY 1970). CARSON, however, warned of the difficulties involved in demonstrating that any species is truly monomorphic. The evolutionary significance of the apparent monomorphism of certain cosmopolitan species of Drosophila is not well understood (DOBZHANSKY 1970). It is clear, however, that natural populations of *D. simulans* show far less variability than those of the sibling species *D. melanogaster* with regard not only to chromosome rearrangements but to allelic substitution as well (O'BRIEN and MACINTYRE 1969; BERGER 1970).

Our breeding studies show that there is among our four stocks of *D. simulans* no isolating mechanism stringent enough to be detected in mass matings.

We have found no evidence of polymorphism for chromosome *4* within any of our *D. simulans* stocks. Whether this absence of intra-stock polymorphism reflects the chromosome constitution of the natural populations from which our laboratory stocks were derived, the genetics of the founder flies (PARSONS 1970), or selection within our stocks, is unknown. The finding that our *yw* stock of *D. simulans* carries a terminal deficiency for two bands of chromosome *4* is

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that the distal, subterminal bright fluorescence extends only half-way across the chromosome. The plane of focus for this photograph was chosen to demonstrate the distal region; some of the fluorescent material at the proximal end of the chromosome is not apparent in the photograph. F: Orcein preparation of the cell shown in E.

reminiscent of the small terminal deficiencies of the second chromosome characteristic of three of the ten standard, wild-type stocks of *D. melanogaster* (LINDSLEY and GRELL 1968).

The fact that we could so readily identify the chromosome differences reported above attests to the usefulness of quinacrine staining in studies of the cytogenetic structure of Drosophila populations.

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