lattice test system[2]. This is done by drawing them onto the graph paper[3], tracing the test system onto a transparent plastic film and then measuring the area, or cutting the drawing size to size and weighing them to find out the average area[4]. These methods are time-consuming, and there are possibilities of errors. To overcome such difficulties we have designed a new device for an easy and quick area calculation of the tissue.

Take two thin glass sheets of the size suitable to requirement. Clean them in mixture of sulphuric acid and chromic acid; rinse in distilled water and allow to drain, and dry. Any spot remaining on the glass surface should be cleaned with lint-free cloth. The sheets must be moisture-free. Flood one surface of one glass sheet with D.P.X. (Fig. 1 A–C) and press a thin graph paper against this surface firmly with utmost care to remove trapped air bubbles. Flood the upper surface of the graph paper, and mount over it another glass sheet very slowly with the help of a needle (Fig. 1 D). The air bubbles must be removed.

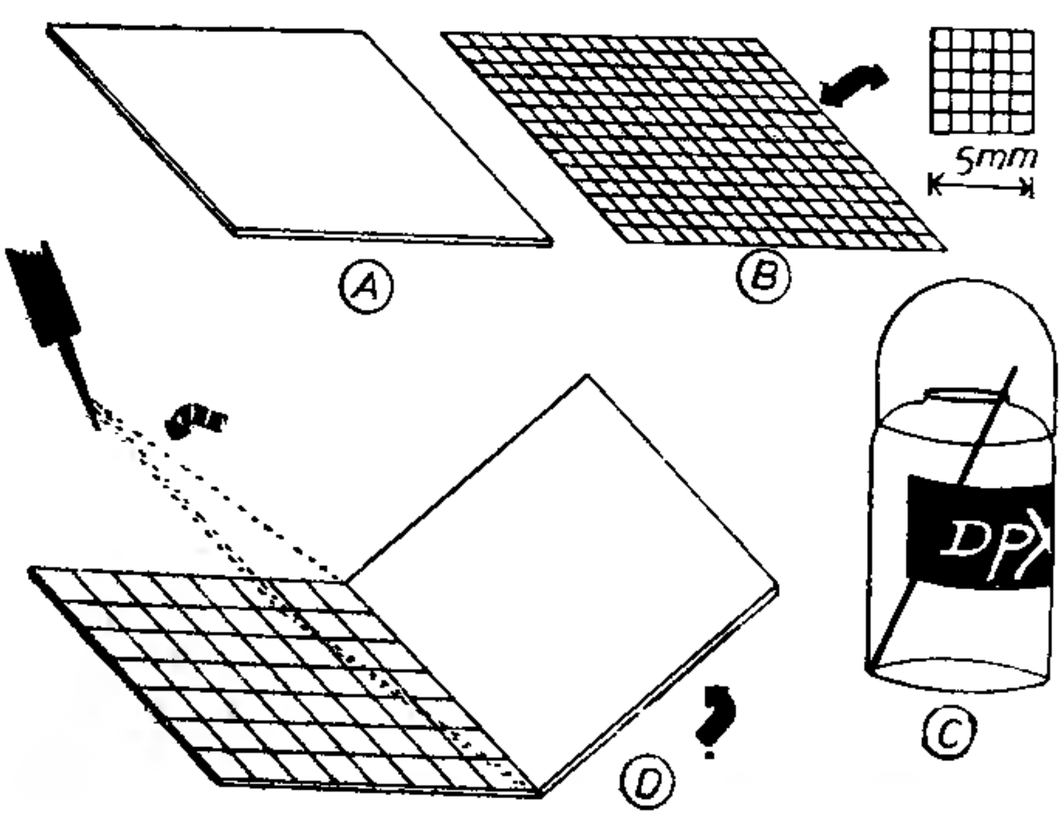

FIG. 1. Preparation of ACD.

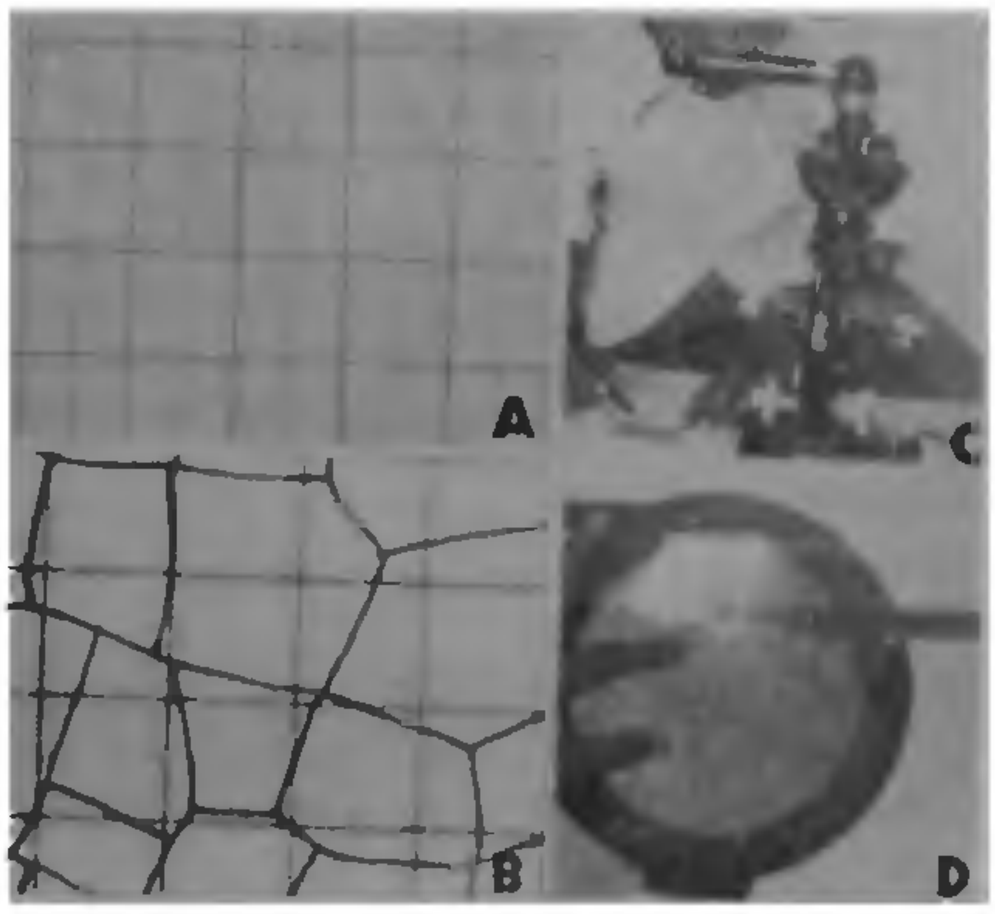

FIG. 2. Uses of ACD.

Allow to dry. Clean the three-ply ACD on all its surfaces to remove extra mountant.

The ACD thus prepared (Fig. 2 A) can be utilized in a variety of ways. Area of the tissue from the camera lucida drawing can be measured by placing the ACD over the drawing and counting the smallest squares of the ACD covering the area of interest (Fig. 2 B). Place the ACD on the table top over a white paper sheet below the camera lucida. View through the camera lucida and count the area of ACD covering the tissue to be measured (Fig. 2 C). The ACD can be placed over the viewing glass screen of the projection microscope to measure the image directly (Fig. 2 D). The actual area of the tissue can be calculated by using the following formula :

$$\text{Actual area in } \mu m^2 = \frac{\text{Area of tissue covered by ACD} \times 10^6}{(\text{Magnification of image})^2}$$

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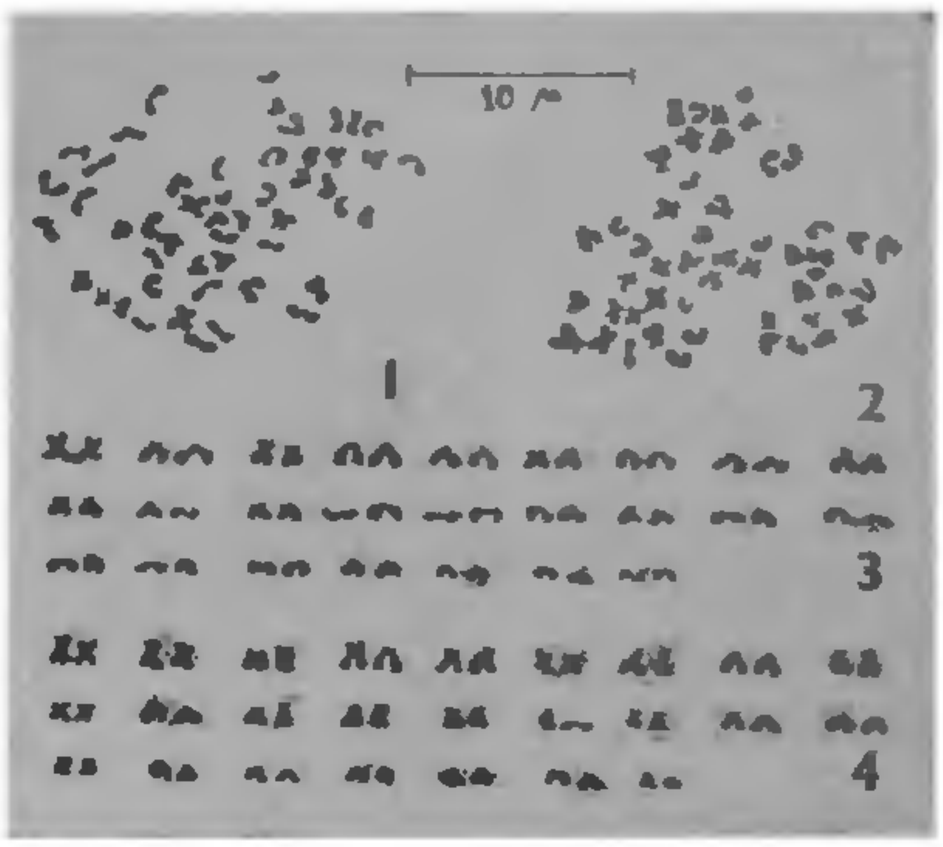
1. Sivaramakrishna, D., *Can. J. Bot.*, 1978, **56**, 1434.
2. Chalkley, H. W., *J. Nat. Cancer Inst.*, 1943, 4, 47.
3. Shah, J. J. and Patel, J. D., *Ann. Bot.*, 1970, 34, 415.
4. Ghouse, A. K. M. and Yunus, Md., *Bull. Torrey Bot. Club*, 1974, **101**, 363.

KARYOLOGY OF TWO SPECIES OF HILLSTREAM FISHES, *BARILIUS BENDELISIS* AND *RASBORA DANICONIUS* (FAM.: CYPRINIDAE)

ALTHOUGH chromosomal study has so far been carried out on some 800 species of fishes inhabiting both freshwaters and saltwaters[3] yet similar work is lacking on the hillstream fishes of India. Hence the present work was undertaken.

10 living specimens, 4 females and 6 males, of *Barilius bendelisis*, collected from the Ushri Falls off Giridih, Bihar and 4 female specimens of *Rasbora daniconius*, collected from the Yamuna River off Kulhal, U.P., form the materials for the present study. Kidneys and gills from both the sexes and testes from the males of the colchicinized specimens were processed according to the citrate-flame drying-Giemsa stain schedule described elsewhere[1]. The chromosomes of 3 well-spread metaphase complements in each sex were individually measured and their centrometic indices determined in order to ascribe the morphology as suggested by Levan *et al.*[2].

The overwhelming majority of metaphase complements in the kidney and gill tissue of both males (Fig. 1) and females (Fig. 2) of *B. bendelisis* consisted of 50 small chromosomes though a few complements contained 48, 49 or 51 chromosomes. The diploid number in this species was, therefore, placed at 50 chromosomes. The karyotypic analysis of both male (Fig. 3) and female (Fig. 4) complements revealed 25 homomorphic pair

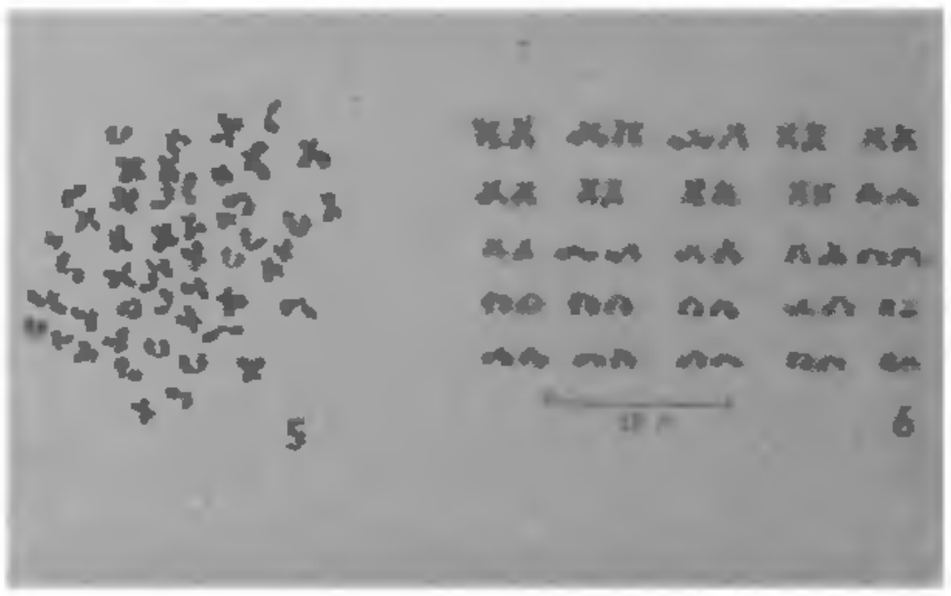


FIGS. 1–3. Camera lucida drawings of the meta phase complement in male (Fig. 1) and female (Fig. 2) *B. bendelisis*. Karyotype of male (Fig. 3) and female (Fig. 4) *B. bendelisis*.

of gradually seriated chromosomes. Morphological detection of any sex chromosome was not possible due to the absence of heteromorphic nature or differential staining behaviour in any pair in either sex of this species. The longest metacentric pair, arranged first in the karyotypes of both the sexes, could be designated as "Marker" since they could easily be identified in all the well-spread complements. The chromosomes from the longest to the shortest measured between 1·5 µm and 0·5 µm.

The karyotypes varied to some extent from plate to plate even in the same individual possibly due to unfavourable disposition. Hence the chromosome formula for *B. bendelisis* was determined from the average of 3 metaphase complements in each sex and tentatively suggested as $n = 3$ m (Nos. 1, 3 and 6) + 3sm (Nos. 2, 10 and 12) + 5st (Nos. 7, 9, 13, 16 and 19) + 3t (Nos. 4, 5 and 14) + 11T (Nos. 8, 11, 15, 17, 18, and 20–25) (NF 72). A few chromosomes (Nos. 4, 5 and 14), however, had their centromeric indices at the borderline of two morphological entities, for which the formula would be slightly flexible while accounting for any individual complement. No suitable divisional stages could be obtained from the testis of *B. bendelisis* for which the germinal chromosomes could not be studied.

The metaphase complements in the female *R. daniconius* (Fig. 5) also contained 50 chromosomes of gradual seriations measuring between 2·0 µm and 0·8 µm in length. The karyotype (Fig. 6) comprised of 9 pairs of metacentric (Nos. 1, 2, 4–9 and 20), 3 pairs of submetacentric (Nos. 3, 10 and 11), 3 pairs of subtelocentric (Nos. 13, 14 and 19) and 10 pairs of telocentric (Nos. 12, 15, 17–19 and 21–25) chromosomes (NF 80). No heteromorphic pair could be found in this sex.



FIGS. 5–6. Metaphase complement in female *R. daniconius* (Fig. 5) and karyotype (Fig. 6) of the same.

While no congeneric species of *Barilius* had been studied earlier, 3 species of the genus *Rasbora, viz., buchanani*, $2n = 50$[3], *heteromorpha* and *trilineata*, $n = 24$[5] received cytological attention prior to the present one. In the family Cyprinidae, the 130 odd species that have so far been cytologically investigated have their diploid numbers varying between 44 and 104 chromosomes (mainly between 44 and 54 chromosomes) with a distinct peak at 50[3,4]. The diploid number of 50 in the two species studied, further contributes to the likely modal number of 50 chromosomes in this family.

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1. Khuda-Bukhsh, A. R. and Manna, G. K., *Indian Biologist*, 1976, 8, 23.
2. Levan, A., Fredga, K. and Sandberg, A. A., *Hereditas*, 1964, **52**, 201.
3. Manna, G. K. and Khuda-Bukhsh, A. R., *Nucleus*, 1977, **19**, 119.
4. — and —, *J. Zool. Res.*, 1977, **1**, 34.
5. Post, A., *Z. Zool. Syst. Evol.*, 1965, **3**, 47.