

February, 2002

Genetics 453

Evolutionary Genetics

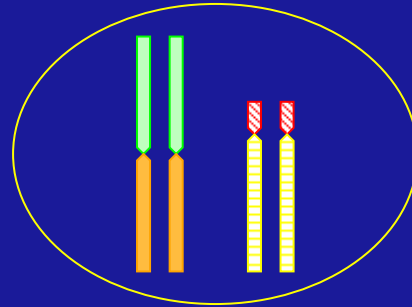
Chromosome Rearrangements

Joe Felsenstein

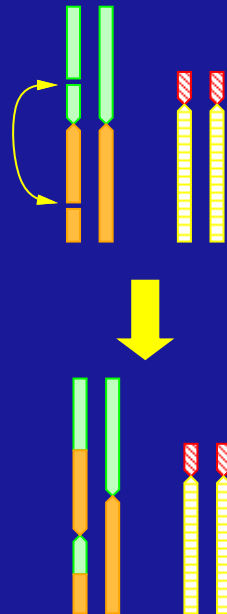
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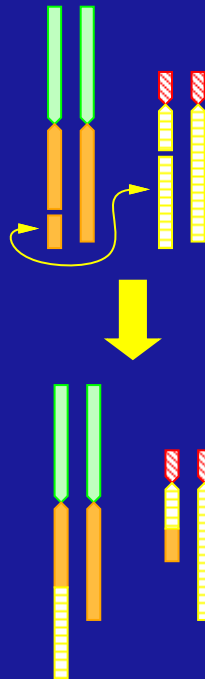
Chromosome Rearrangements



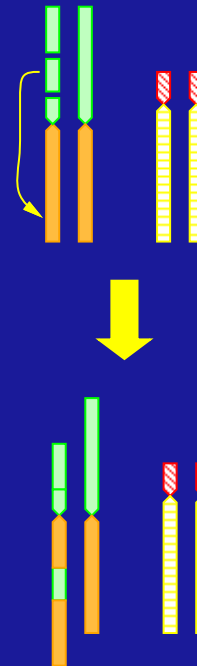
Inversion



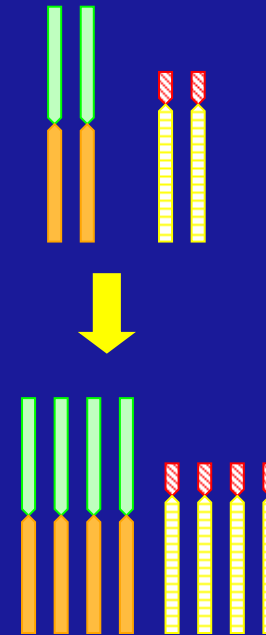
Translocation



Transposition



Tetraploidy



Additional question: when these occur they are rare in a population: how do they spread?

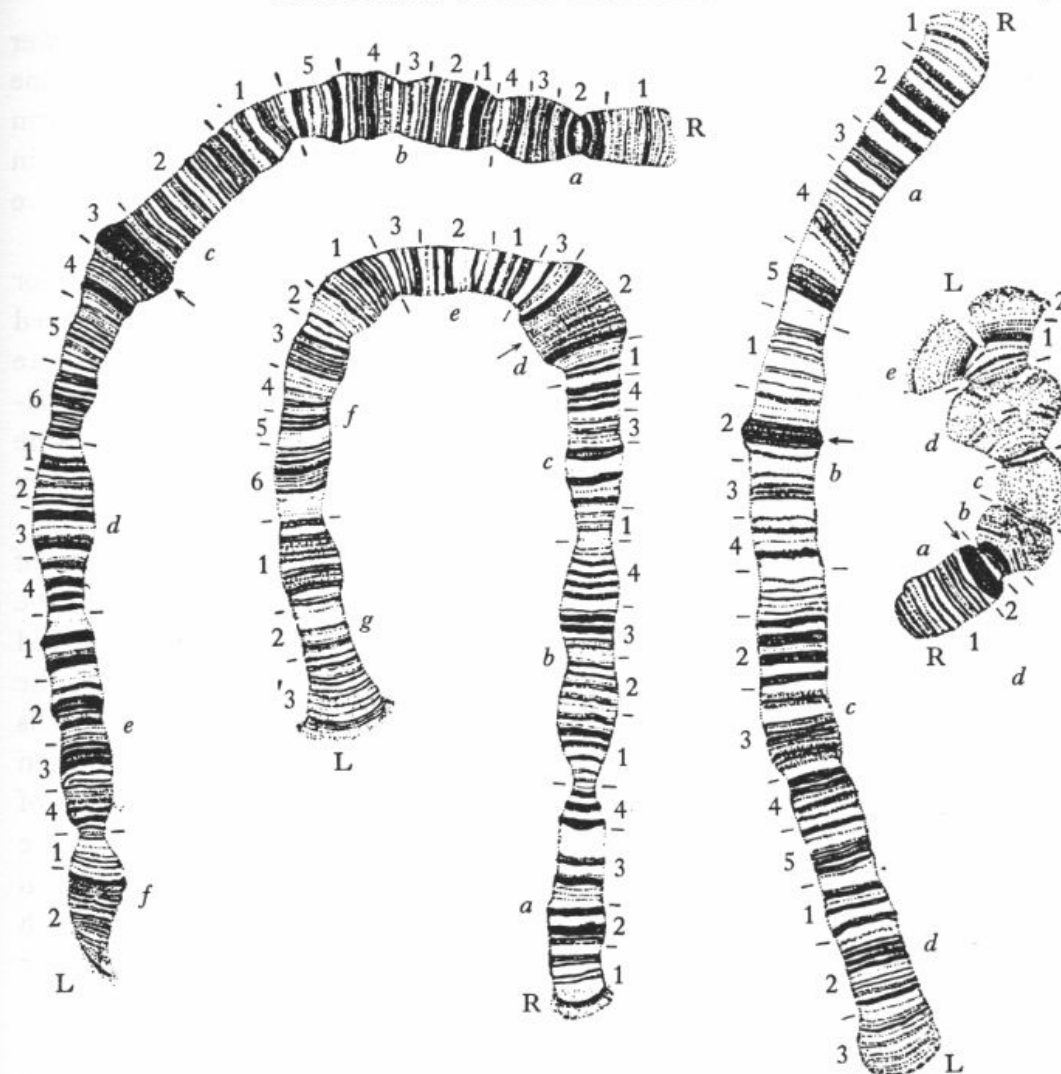
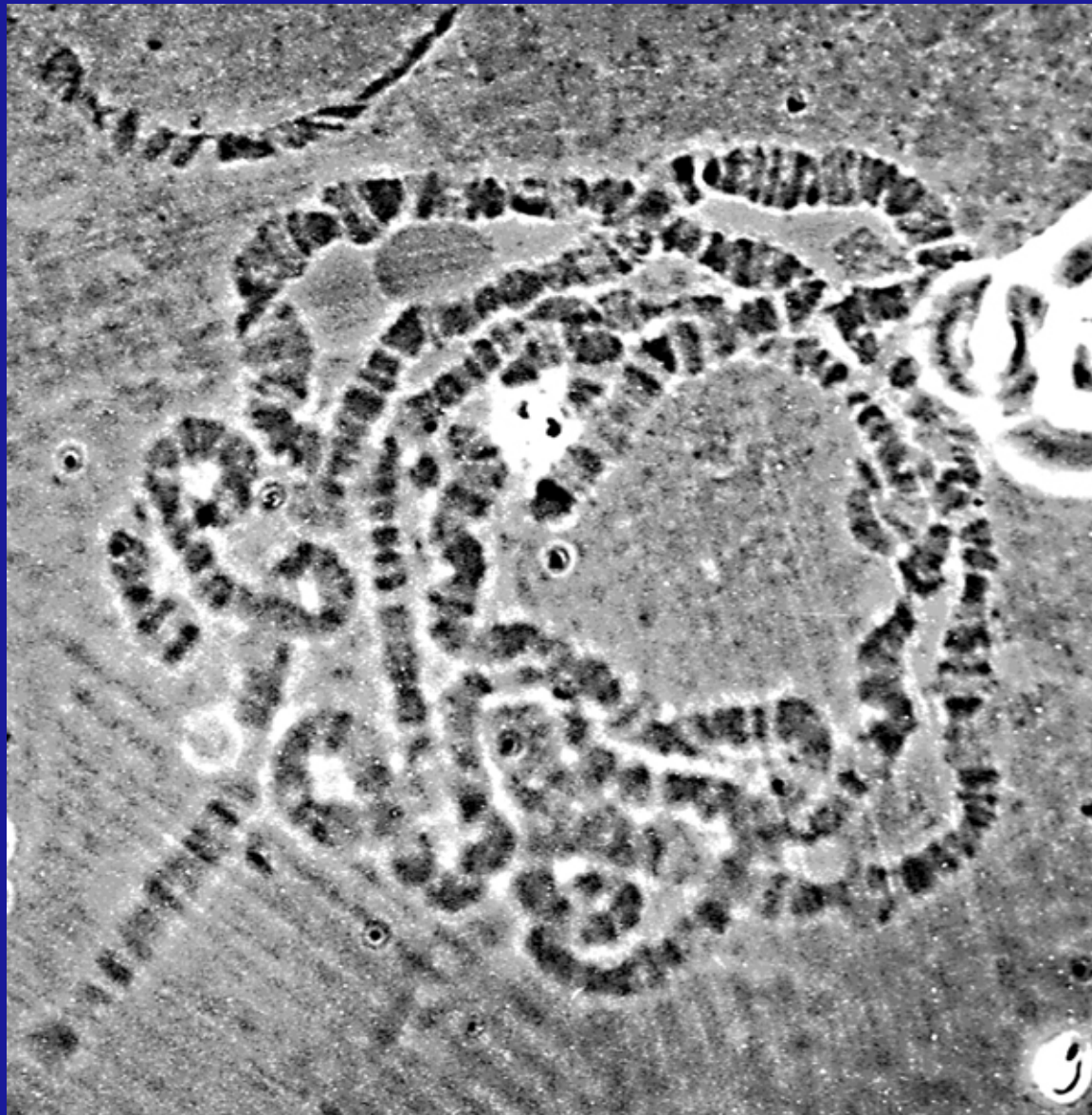


Fig. 4.1. The four polytene elements from a salivary gland nucleus of *Chironomus thummi*, showing the banding. Small arrows indicate the approximate positions of the centromeres. The shortest chromosome has its longer arm largely heterochromatic and the other three elements have short heterochromatic regions at the tips. From Bauer (1935).



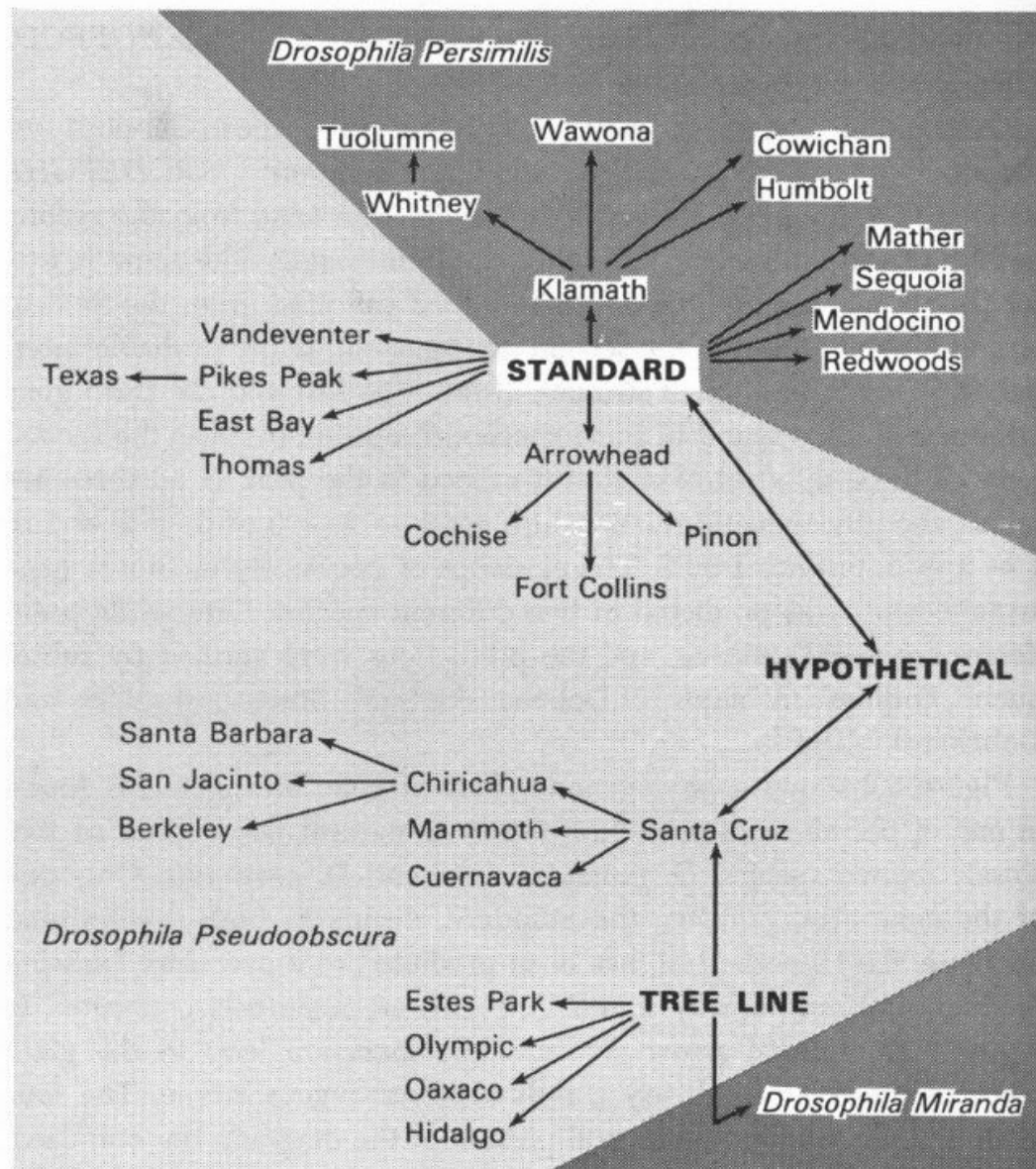
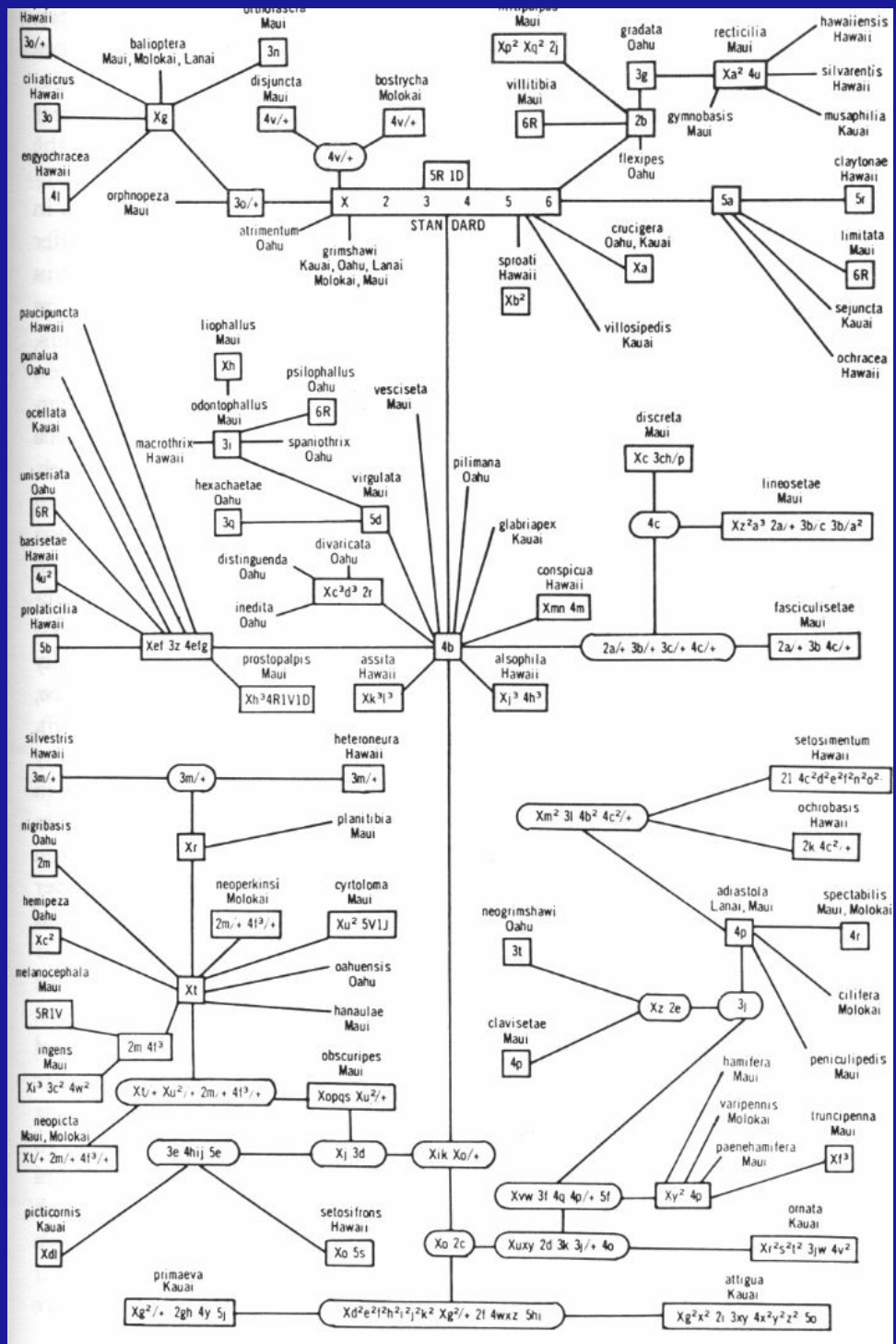
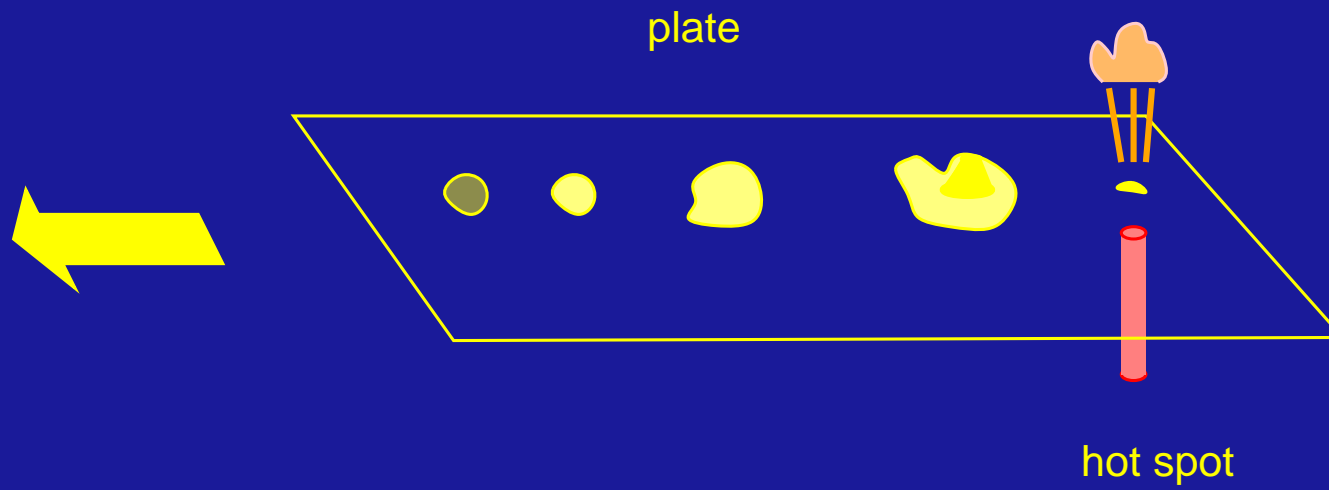


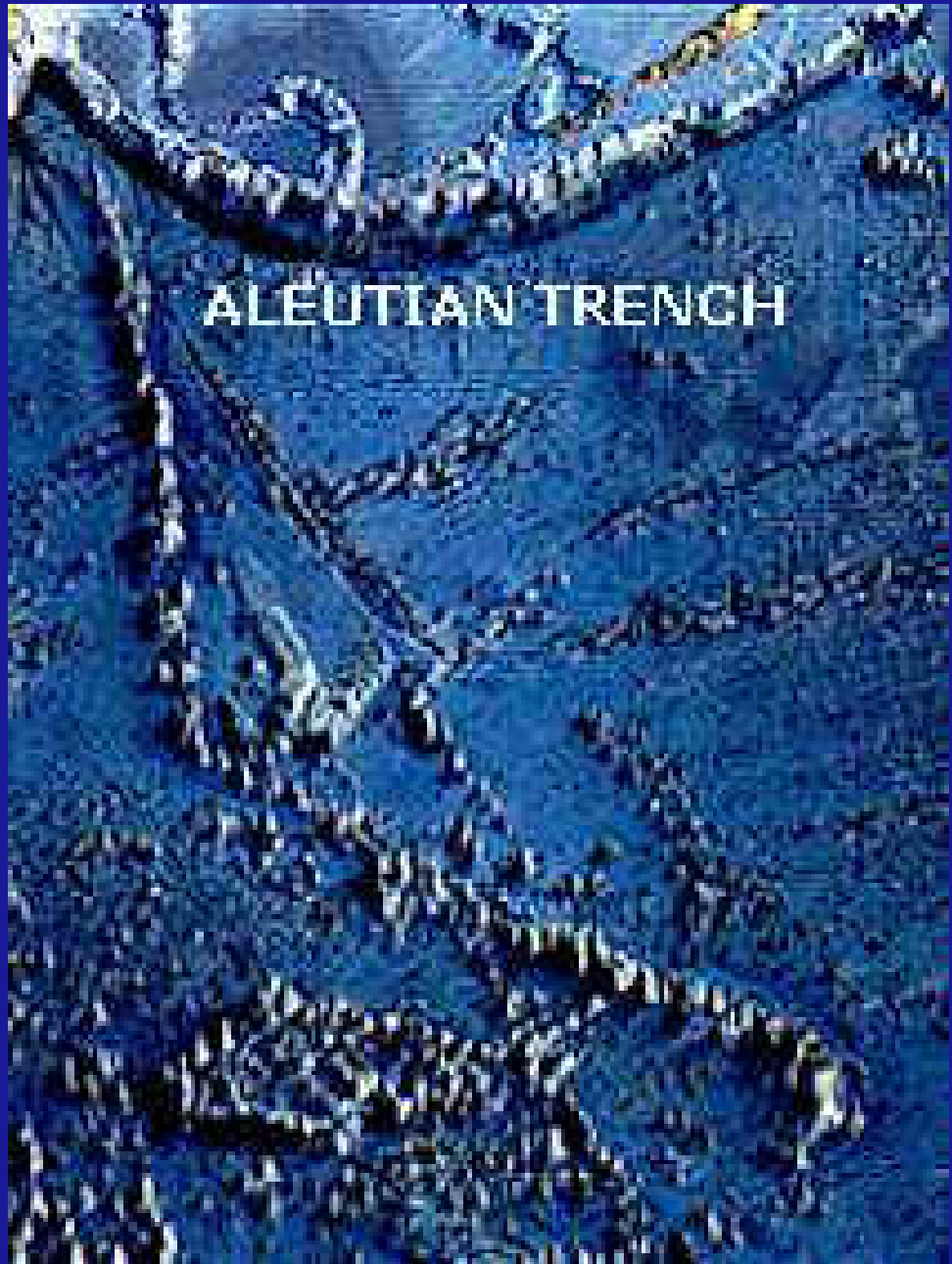
FIGURE 5.2

Phylogenetic relationships of the gene arrangements in the third chromosomes of *Drosophila pseudoobscura*, *D. persimilis*, and *D. miranda*.



Formation of the Hawaiian Islands





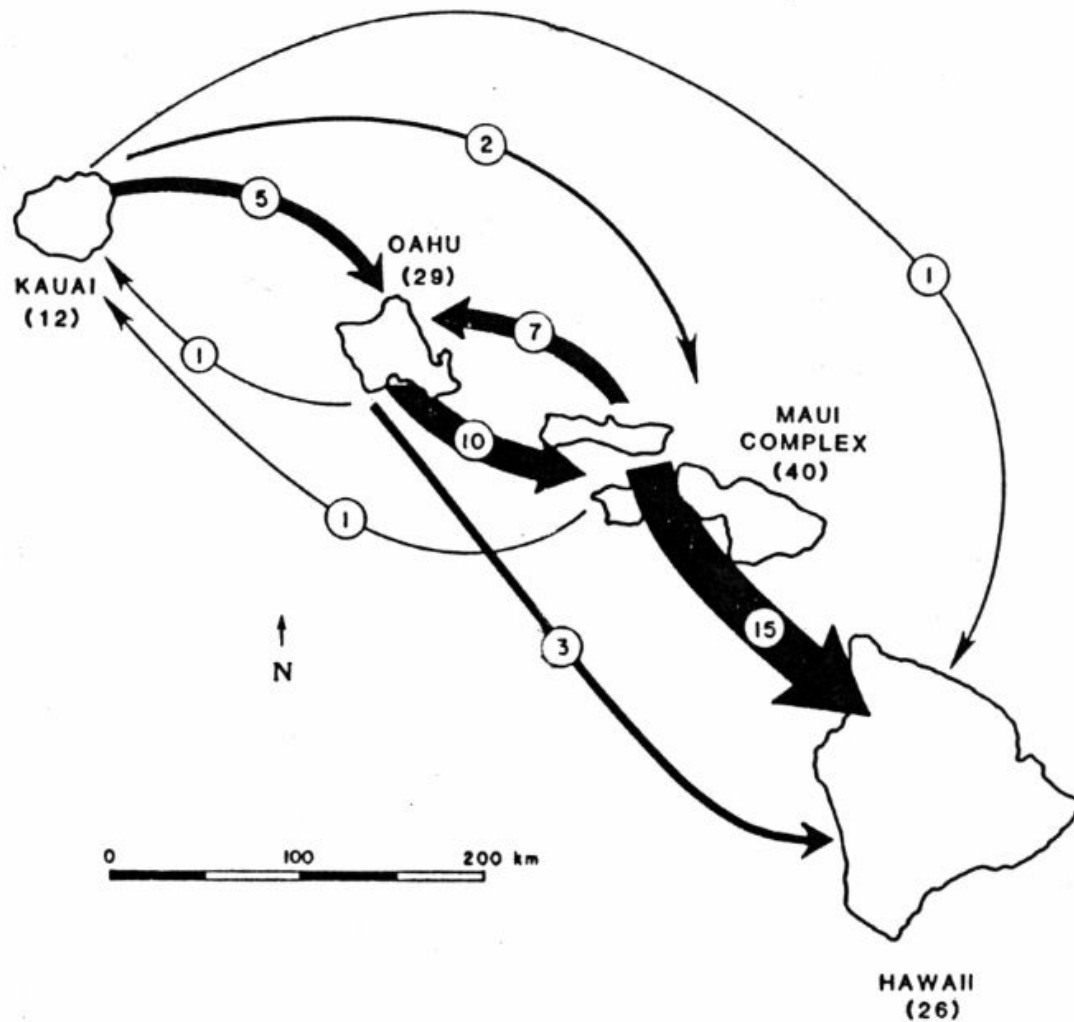
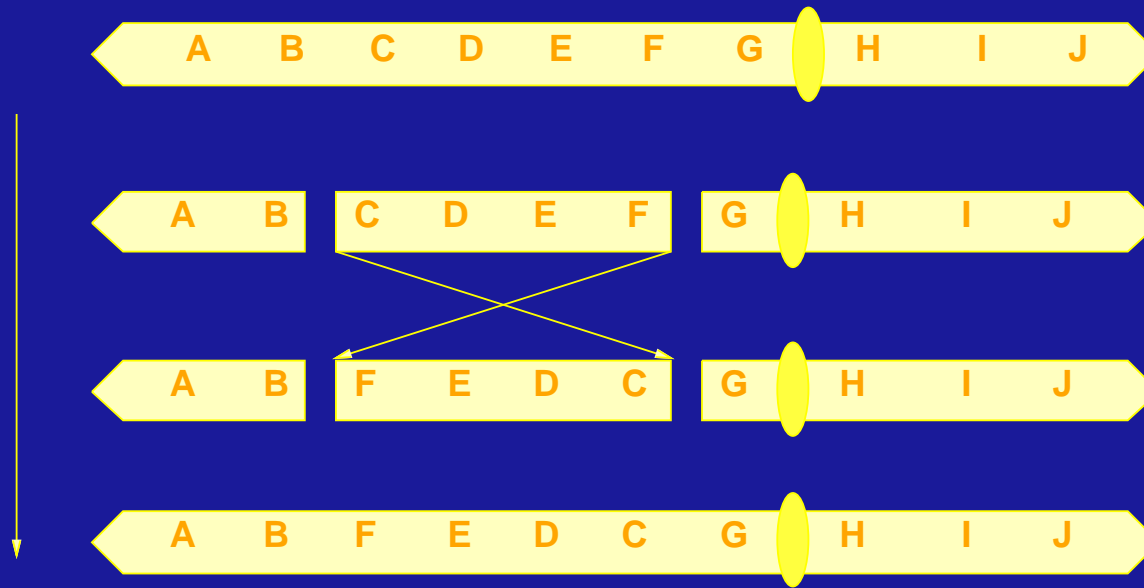
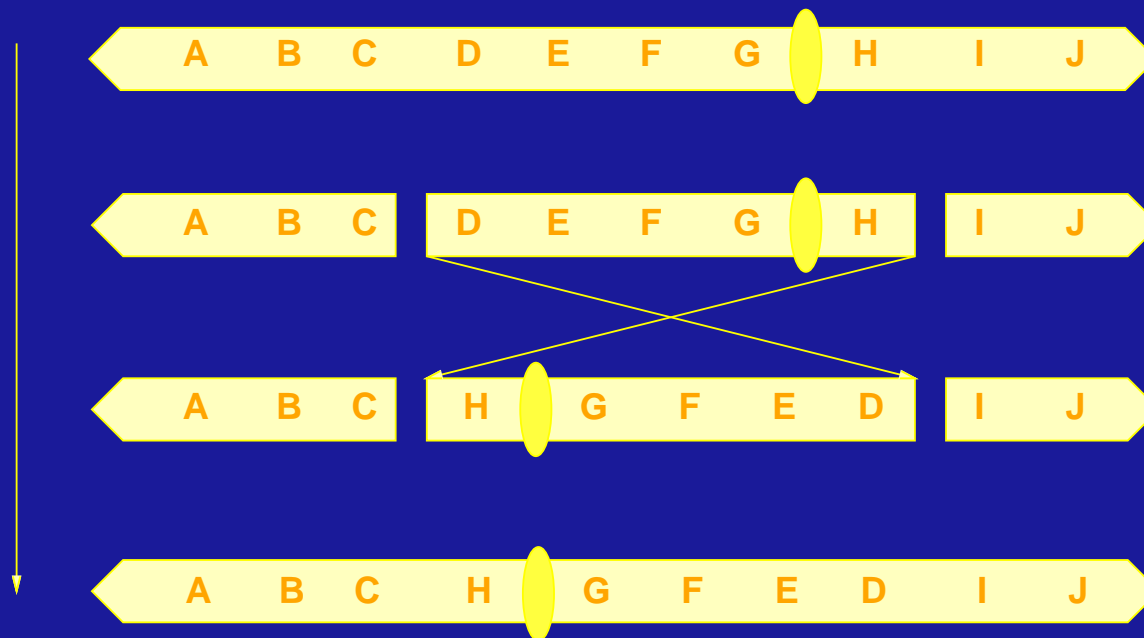


FIGURE 5.—Geographical summary of the proposed founder events invoked to explain the origin of the fauna of each island. The width of the arrows is proportional to the number of proposed founders. The number of species found on each island is given in parentheses.

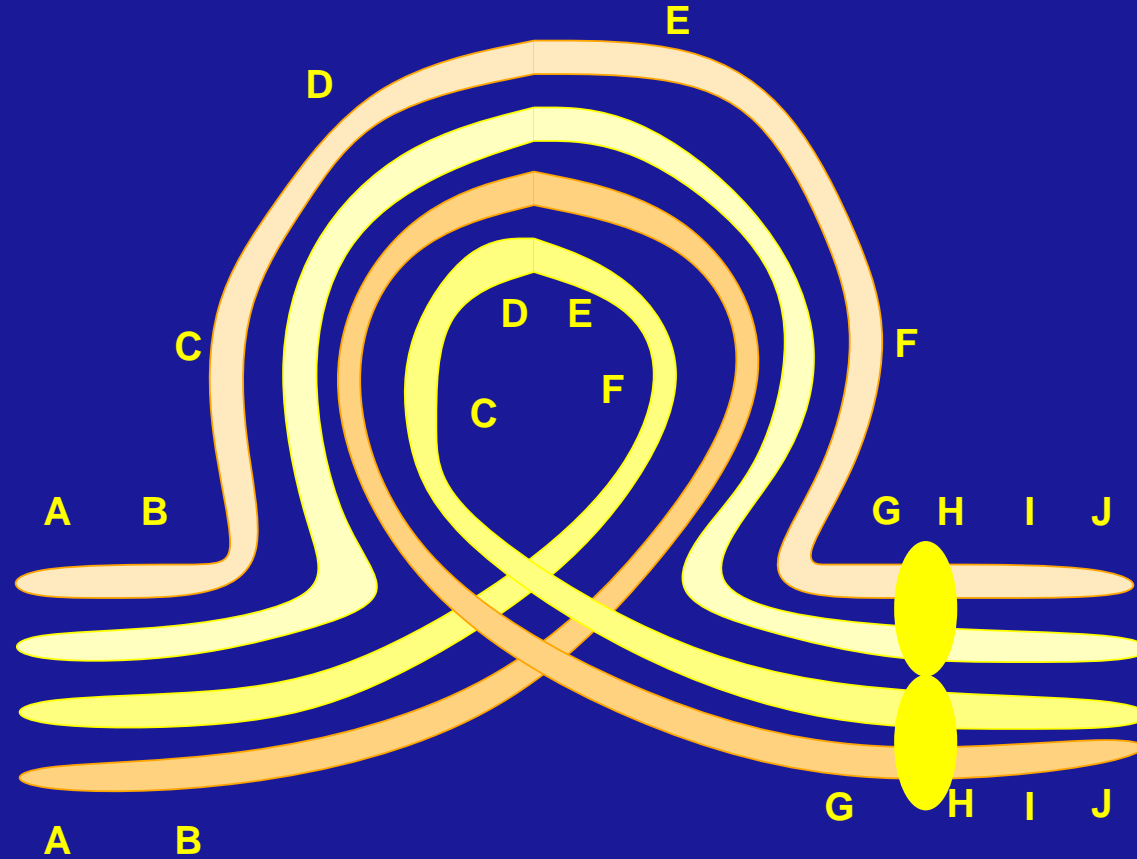
A Paracentric Inversion



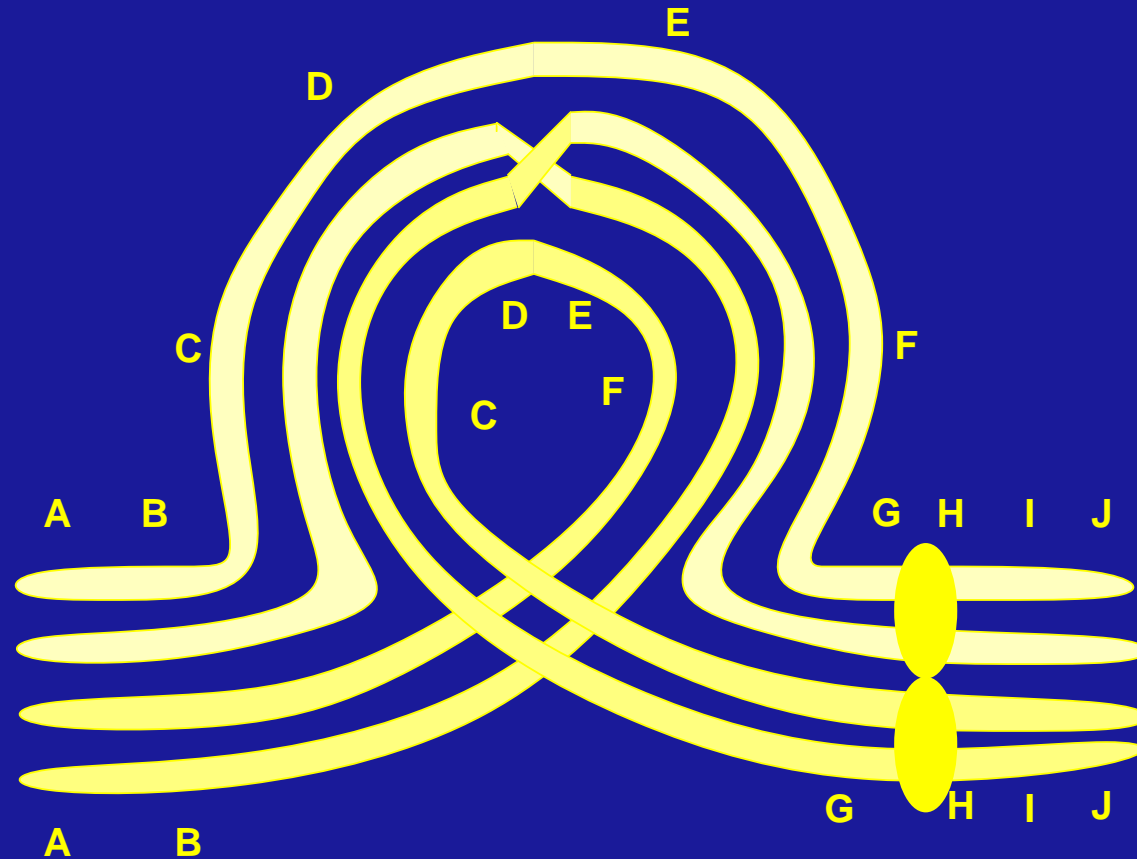
A Pericentric Inversion



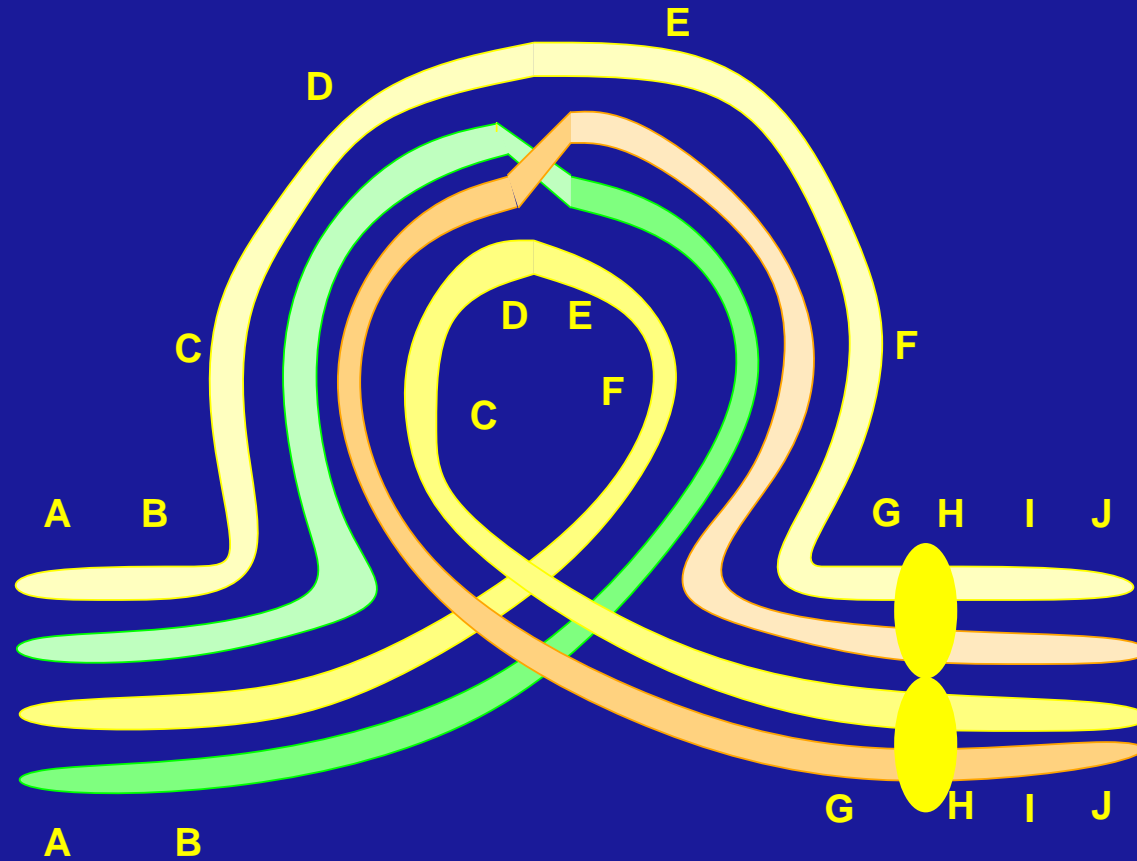
Pairing in a paracentric inversion heterozygote



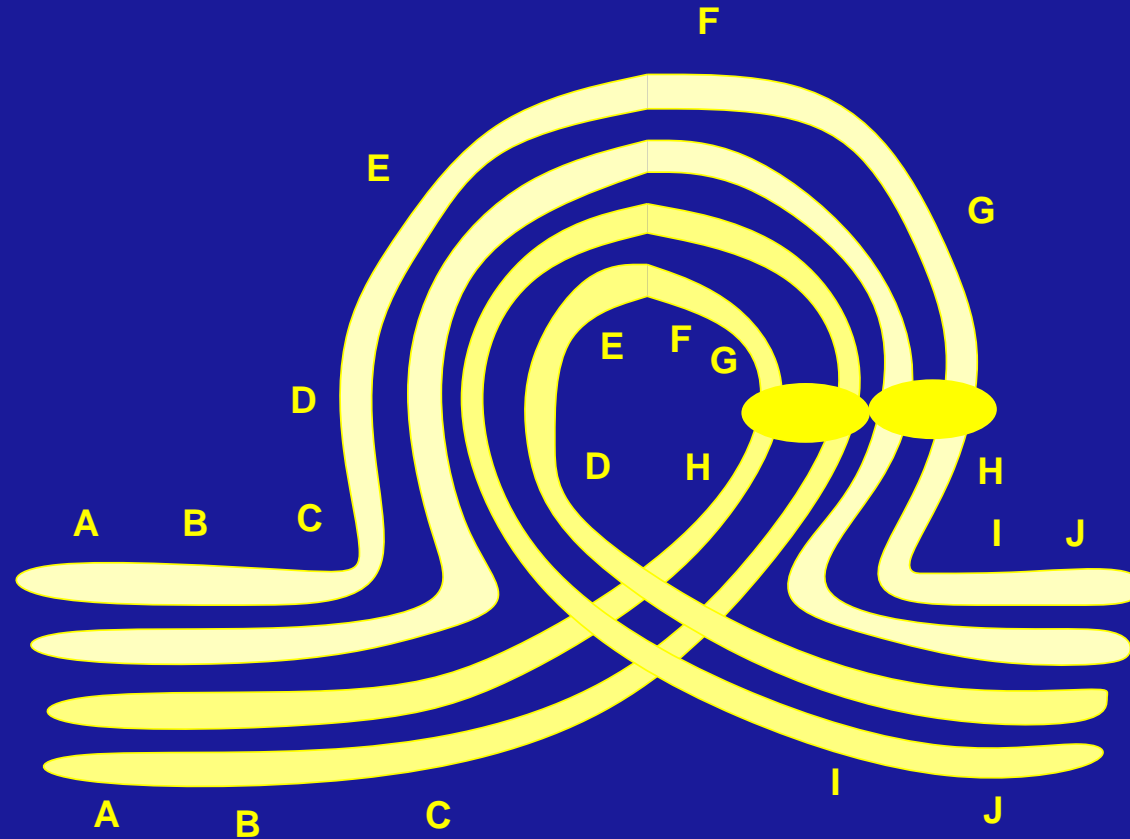
Crossing-over in a paracentric inversion heterozygote



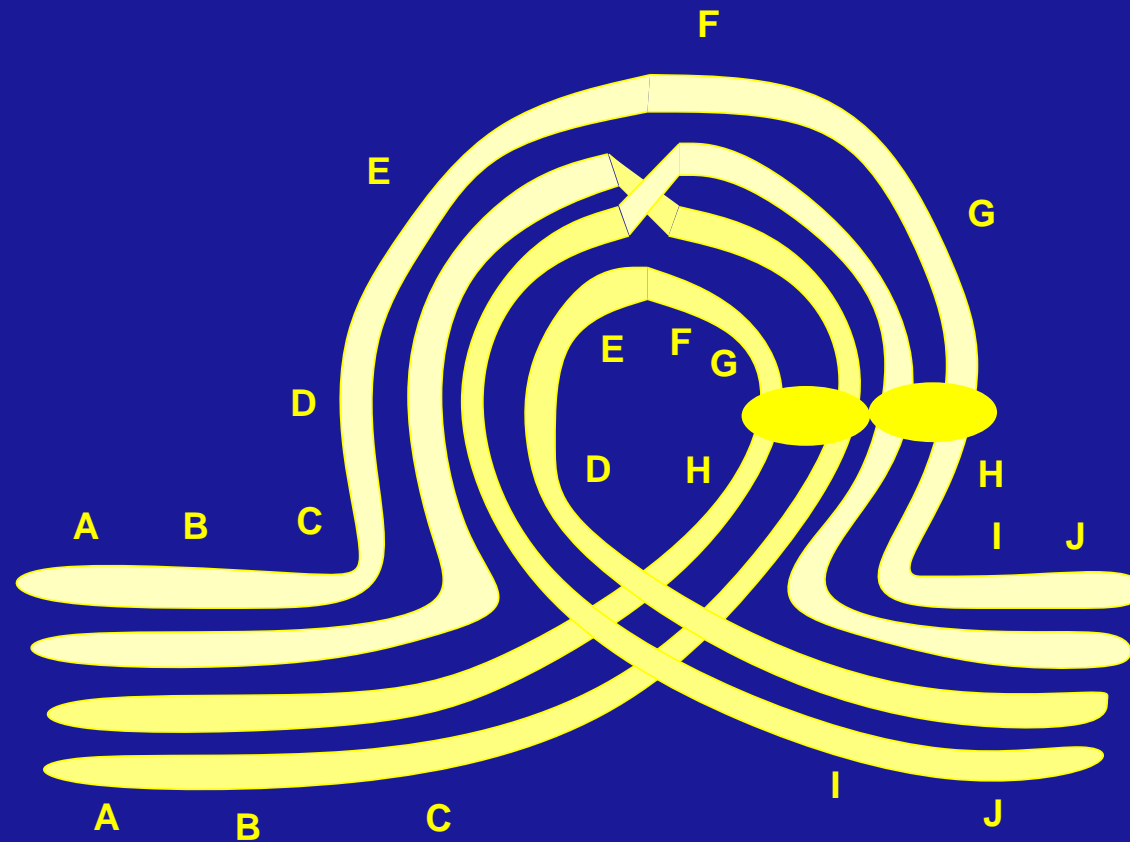
Crossing-over in a paracentric inversion heterozygote



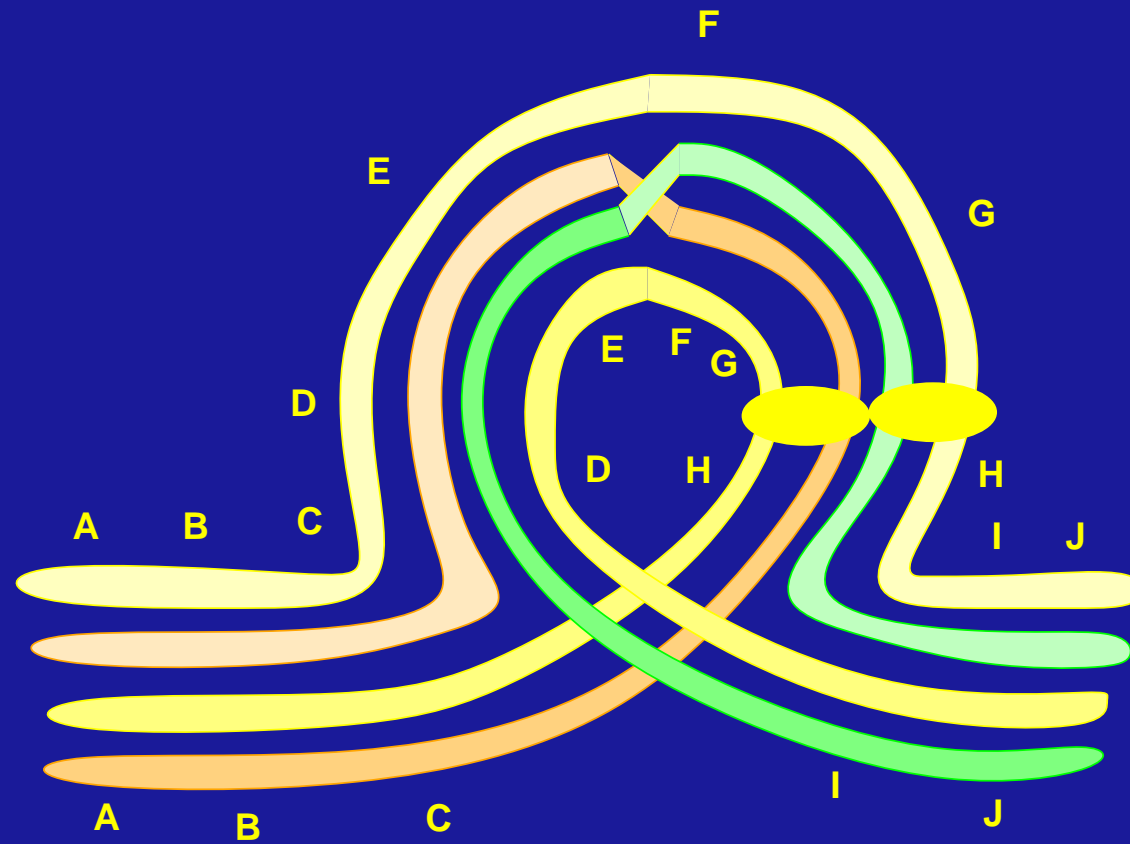
Pairing in a pericentric inversion heterozygote



Crossing-over in a pericentric inversion heterozygote



Crossing-over in a pericentric inversion heterozygote



A translocation

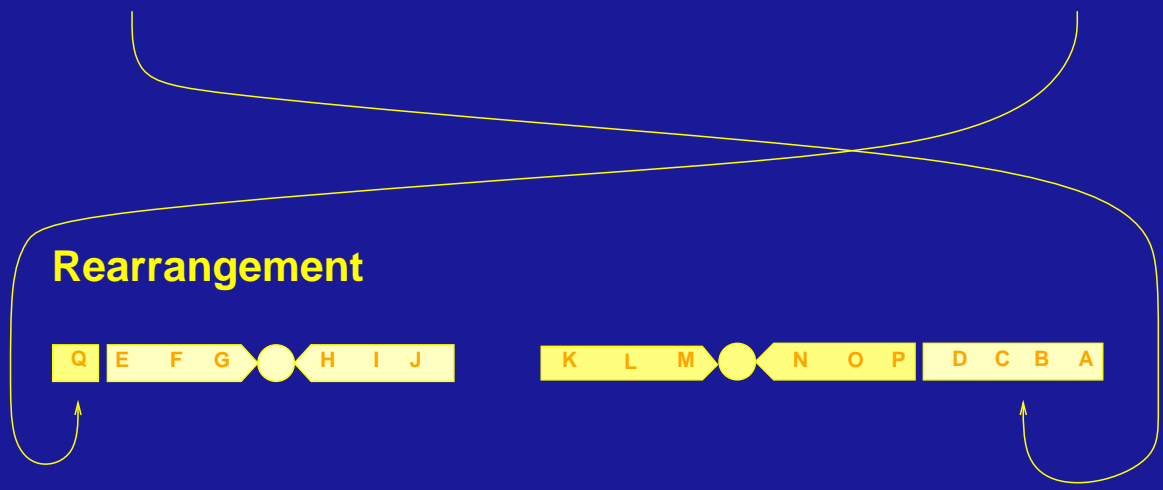
Before



Breaks



Rearrangement

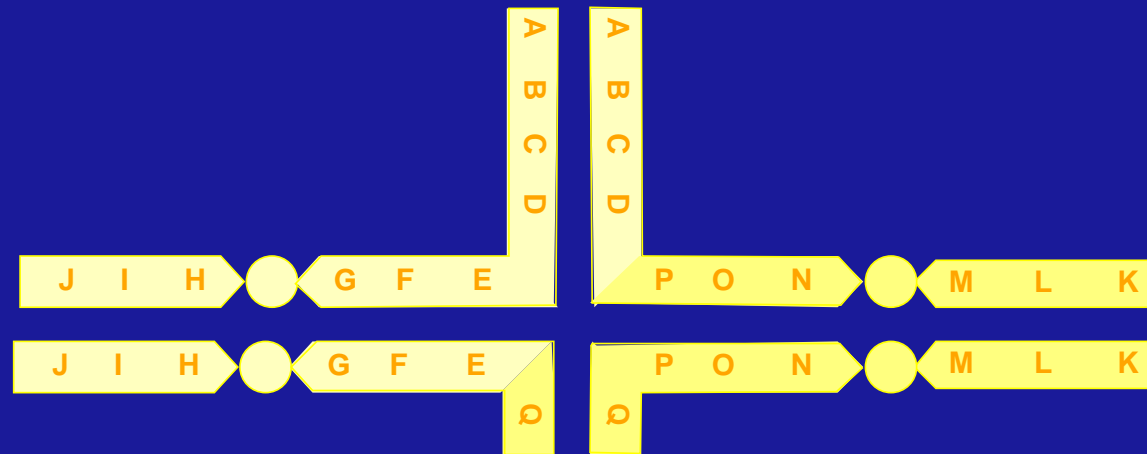


After



A translocation heterozygote

at first division of meiosis metaphase



A pair of translocated chromosomes

pairs with a pair of untranslocated chromosomes



Fig. 2.11 Meiotic prophase (diakinesis) in a sporocyte of *Ophioglossum reticulatum*, showing about 630 bivalents. (From Ninan.¹⁷⁴)

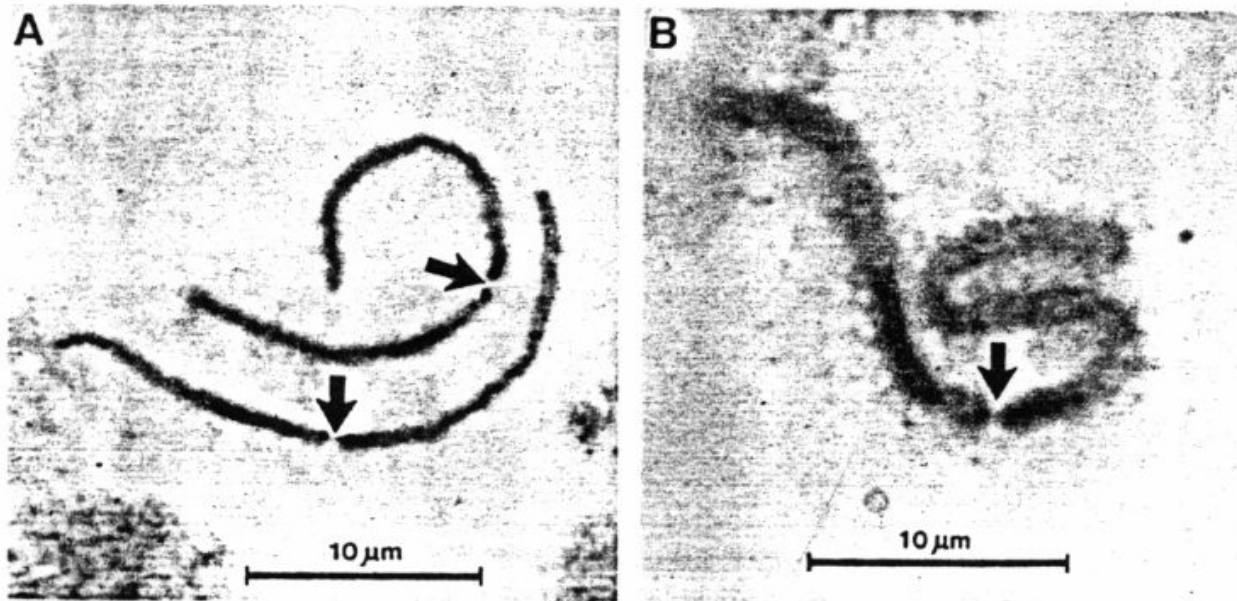
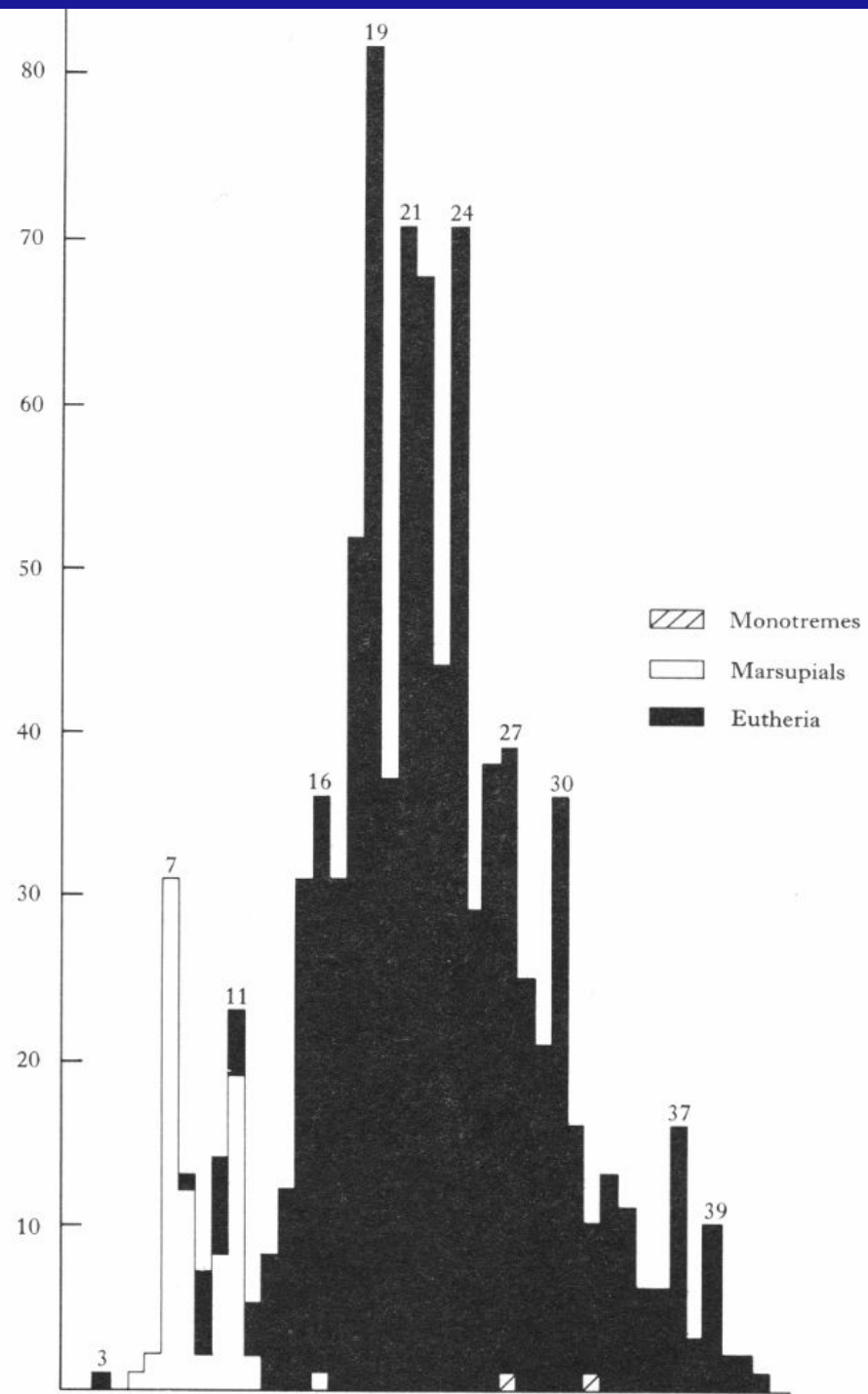


Fig. 1. Chromosomes from prepupal cerebral ganglia. (A) Worker prometaphase chromosomes. Identical C-banding provides evidence for homology of the two chromosomes. (B) Male prometaphase chromosome. Chromosomes consistently display a large centromeric C-band on the short arm and a smaller centromeric C-band on the long arm. Most of the short-arm C-band is not immediately adjacent to the centromere, though a very small portion of the short-arm C-band is centromeric. Arrows indicate position of centromere.



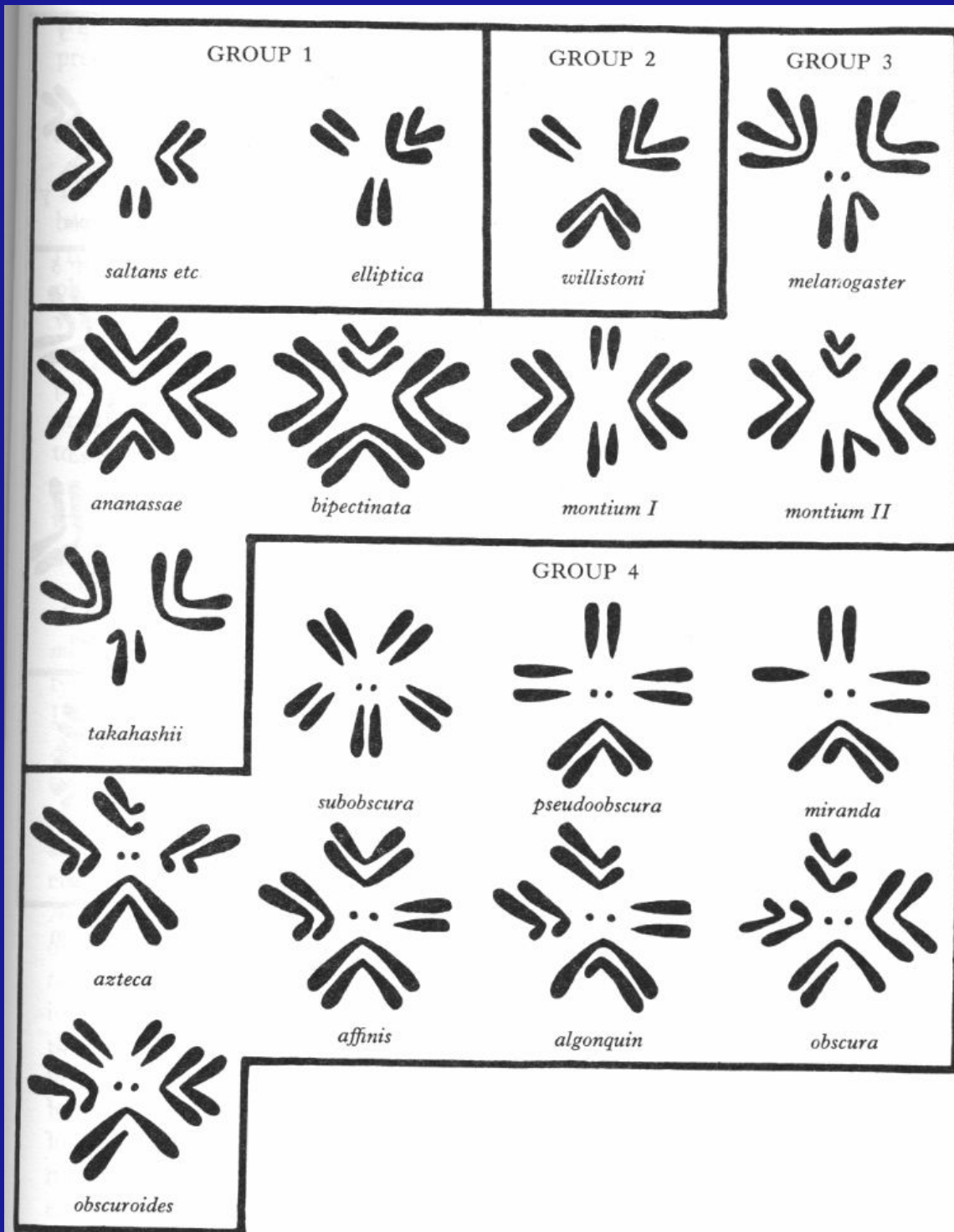


Fig. 11.3. Male karyotypes of some members of the subgenus *Sophthora* of

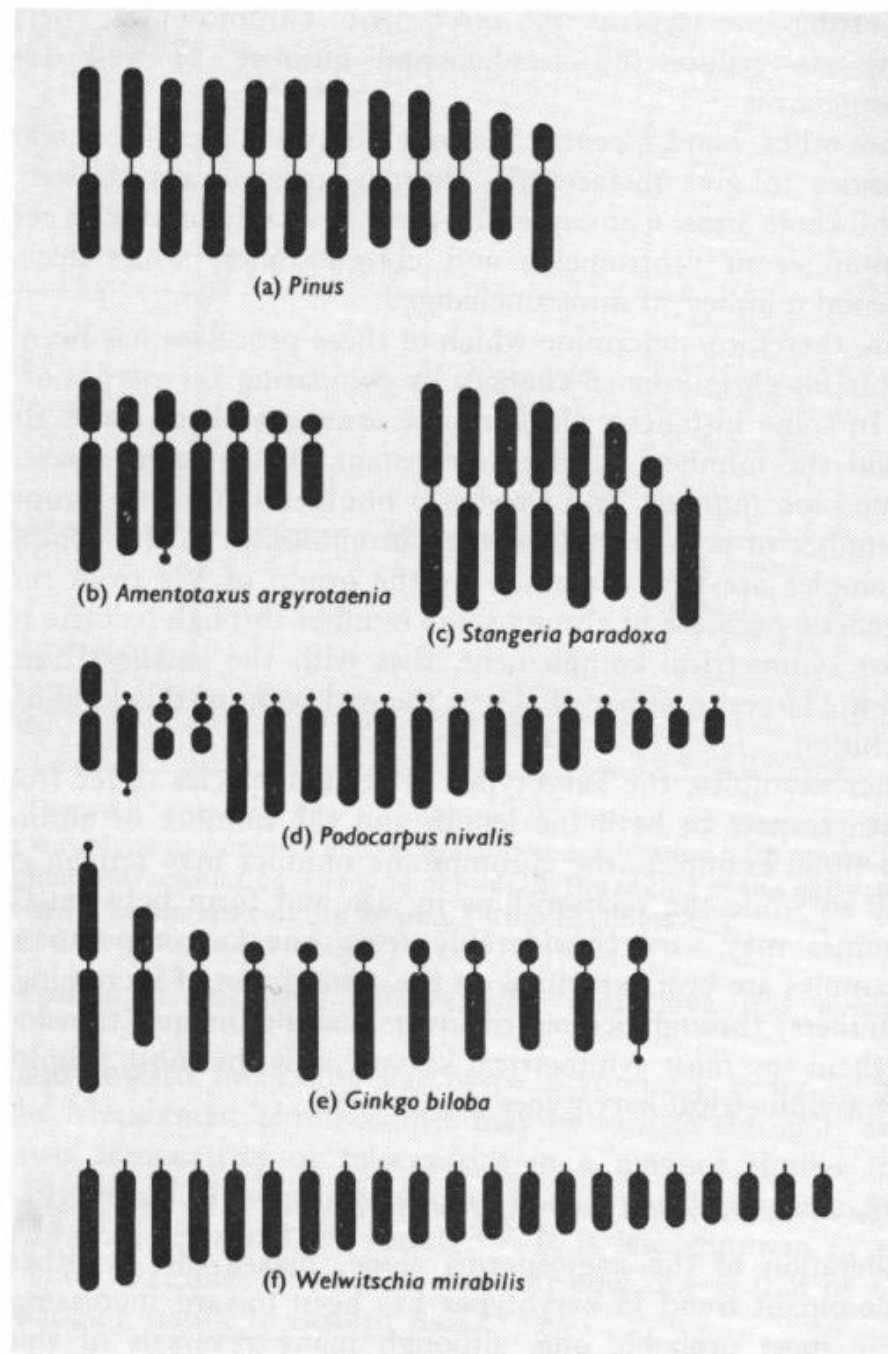


Fig. 4.12 Karyotypes of various genera of gymnosperms. (a) *Pinus*, showing the symmetrical karyotype characteristic of the families Pinaceae, Cupressaceae, and most genera of Taxodiaceae. (b), (c), Moderately asymmetrical karyotypes of *Amentotaxus argyrotænia* (Taxaceae) and *Stangeria paradoxa* (Cupressaceae).

Barriers between mating of polyploids and euploids

a tetraploid

an ordinary diploid



gametes



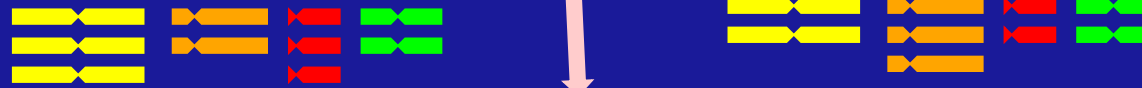
triploid offspring

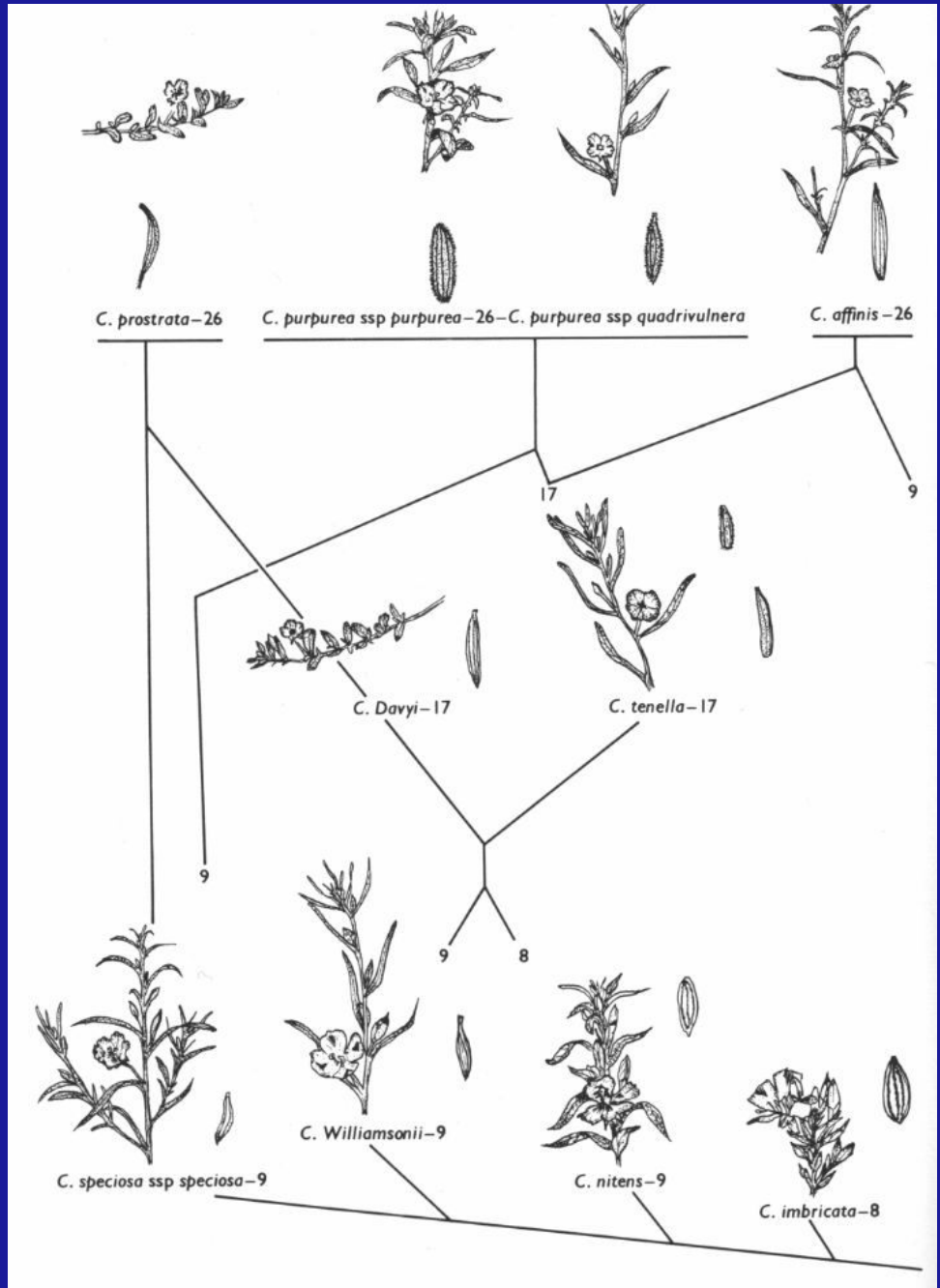


gametes



the resulting aneuploid offspring





This freeware-friendly presentation prepared with

- Linux (operating system)
- PDFLaTeX (mathematical typesetting and PDF preparation)
- Idraw (drawing program to modify plots and draw figures)
- Adobe Acrobat Reader (to display the PDF in full-screen mode)

(except that we had to use Microsoft Windows to project this as the X server I have in Linux is not too great)