A Terminal Association of Two Pericentric Inversions in First Metaphase Cells of the Australian Grasshopper *Austroicetes interioris (Acrididae)*

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Abstract. *Austroicetes interioris* is polymorphic for pericentric inversions. The three autosomal polymorphisms are considered to be heterotic. In each case the chromosome with the inversion differs from its standard counterpart in the amount of heterochromatin present. Consequently the various karyotypes have appreciable diversity in heterochromatin content. Two of the inversion chromosomes form a terminal association considered to be chiasmate in nature. The resulting quadrivalents favour one particular first metaphase orientation and this causes segregation distortion. The terminal associations and the heterochromatin disparity between the members of each polymorphism are considered to be due to translocations with break points situated in regions of little genetic activity near chromosome tips and causing interchange of telomeres but not of euchromatic segments. Evolutionary implications of such rearrangements are discussed (Summary see p. 66).

Introduction

Terminal associations between nonhomologous chromosomes occasionally occur in first metaphase cells of multiple inversion heterozygotes, e.g. the grasshopper *Trimerotropis gracilis* (White, 1961), and of hybrids, e.g. population hybrids of the 15 chromosome race of the grasshopper *Keyacris* (formerly *Moraba*) *scurra* (White, 1957) and racial hybrids of the salamander genus *Triturus* (Spurway and Callan, 1960). White (1961) postulated these associations to be due to true chiasmata formed in minute homologous terminal segments in otherwise nonhomologous chromosomes, the relatively weak synaptic forces in these segments being effective if there is structural heterozygosity to prevent complete synopsis or hybridity to reduce synaptic affinity of homologous chromosomes. John and Lewis (1965) have investigated chromosomal associations, many of them terminal ones, in subspecies hybrids of the grasshopper *Eyprepocnemis plorans*. They are critical of White's hypothesis and believe some of these associations to be non-chiasmate nonhomologous ones and the rest to be due to multiple interchange hybridity. According to them, several successful interchanges between acrocentric chromosomes (i.e. a type which would be opposed by strong selection pressure against the heterozygotes) have played an important part in *Eyprepocnemis* speciation.

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Austroicetes interioris (White and Key, 1957) has a chromosome complement of 21 in the male (2n = 20 + X0). Three of the autosomes and the X chromosome are polymorphic for pericentric inversions, the “Trangie” chromosome having arisen by inversion of most of the material in the 2nd autosome, the “Quorn” and “Flinders” chromosomes by inversion of nearly half of the material of the 4th and 6th autosomes.

![Fig. 1. First metaphase chromosomes of a male heterozygous for the Trangie chromosome (2Tr), the Quorn chromosome (4Qu) and the Flinders chromosome (6Fl). Aceto-carmine, × 1600](image1)

![Fig. 2. Associations of nonhomologous chromosomes in first metaphase. One association involves the short arm of the large metacentric autosome (1) and the distal end of the Standard 4 chromosome (4St). The other involves the Trangie and Flinders chromosomes. The Quorn chromosome is present as a univalent. Aceto-carmine, × 1600](image2)

respectively (Fig. 1). Other structural changes have also occurred in these chromosomes so that each of the inverted sequences is markedly different, in the amount of heterochromatin present, from its acrocentric, “Standard” counterpart. Likewise, more than one structural change is involved in the X chromosome polymorphism, the two alternative forms of the X chromosome differing in length. The one with an arm ratio of about 9:1 is approximately 10% longer than the one with an arm ratio of 4:1, as can be readily seen in ovarian or gastric caeca cells of females treated with colcemid (desacetyl-methyl-colchicine, CIBA).

In many individuals of this species, nonhomologous autosomes form durable associations (Fig. 2) in the meiosis of the male which last to