ORIENTATION OF THE HETEROMORPHIC SEX-BIVALENT IN *MUELLERIANELLA* (*N*=14, HOLOKINETIC)

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The orientation of associations (bivalents, multivalents) of holokinetic chromosomes at first meiotic metaphase is often assumed to be amphitelic for the bulk of the chromosome (equational, autoorientational, postreductional). This may be generally true for the coccid and *Luzula* systems (LA COUR 1952; NORDENSKIÖLD 1962; JOHN and LEWIS 1965), but in leaf-hoppers and in Lepidoptera it is often different. In neo-X-Y complexes in leaf-hoppers, involving a trivalent and a large (coorientating but unconnected) univalent, the trivalent orientation is alternate (syntelic, alloorientational, reductional) (WHITTEN 1968). In *Bombyx* (MURAKAMI and IMAI 1974), multivalents resulting from radiation induced rearrangements tend to orientate syntelic when small (trivalents) and either syntelic or amphitelic when large (quadrivalents, quinquevalents). For the proper segregation of the sex chromosomes pre- or postreduction may both be effective, but the mechanical conditions of the complex may favour one of the two. From the figures published by JOHN and CLARIDGE (1974) it appears that the orientation of heteromorphic XY bivalents in the leaf-hopper *Oncopsis* tends to be syntelic, but no estimate is given of the frequency of this orientation, nor do JOHN and LEWIS (1965) give quantitative information on the consistence of syntelic orientation in species where it can be observed. We found it useful, therefore, to conduct a small study on sex bivalent orientation in the leaf-hopper sibling species *Muellerianella fairmairei* (Perris) and *M. brevipennis* (Boheman). (Homoptera-Delphacidae, DROSOPOULOS 1976, 1977). The sex complex is probably a neo-XY system. In the former the difference between the two heteromorphic chromosomes is somewhat more pronounced than in the second. Already at diplotene-diakinesis (Fig. 1)
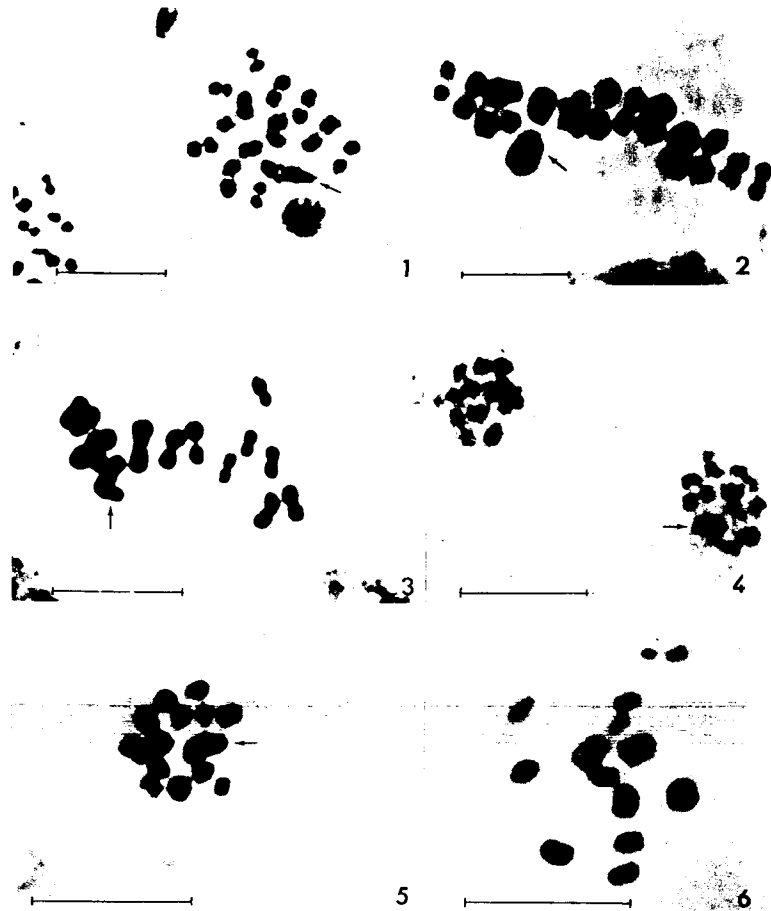
Fig. 1. — Diplotene-diakinesis in *M. fairmairei*. Note large heteromorphic sex-bivalent with incompletely terminalised chiasma.
Fig. 2. — Metaphase I in *M. brevipennis* with syntelic heteromorphic sex bivalent. Closely apposed, parallel chromatids perpendicular to equator are vaguely visible. Fourteen bivalents.
Fig. 3. — Metaphase I in *M. fairmairei*. Large element of heteromorphic sex-bivalent with « tail ». Fourteen bivalents.
Fig. 4. — Interkinesis in *M. fairmairei*. One cell with large sex chromosome.
Fig. 5. — Metaphase II in *M. fairmairei*. Note large sex element.
Fig. 6. — Metaphase II in *M. fairmairei*. Note absence of large sex element. In each case the bar represents 10 microns.
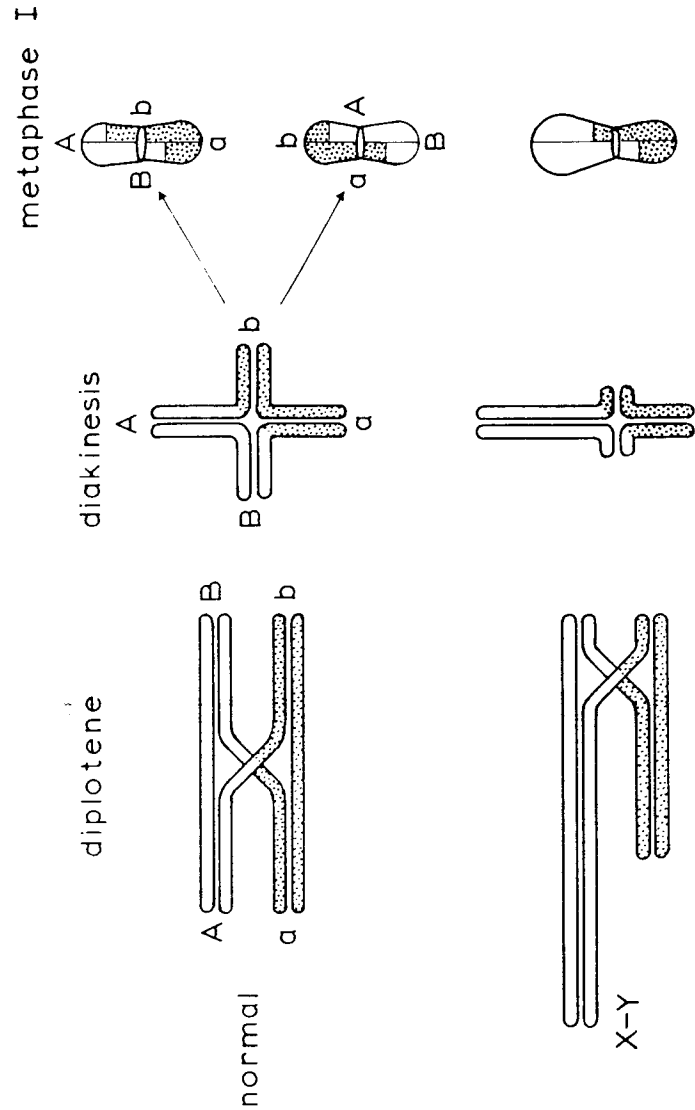

Fig. 7. — Diagram of orientation of a holokinetic autosomic bivalent with one (median) chiasma (segregation is half pre-reductional, half postreductional, whatever the orientation) and holokinetic heteromorphic sex bivalent with preferential alloorientation.

the shape of the bivalent is such that syntelic orientation may be expected to be the more probable orientation at MI. At metaphase I (Figs. 2, 3) all of over 500 cells studied in many individuals of several populations of Europe showed syntelic orientation. Interkinesis (Fig. 4) is not usually clearly recognizable, but the cells that could be studied showed a clear 1:1 segregation for the two elements of the sex bivalent: prereduction. This was confirmed at metaphase II (Figs. 5, 6). Whereas in the coccids and in *Luzula* the chromatids are well separated from diakinesis onwards and reassociate at second prophase, they tend to remain closely apposed in leaf-hoppers and *Bombyx*, only separated by a narrow light line at metaphase I, perpendicular to the equator (Fig. 2). This undoubtedly favours syntelic orientation. In their behaviour these chromosomes are much closer to monokinetic chromosomes than are those of the coccids and *Luzula*. Although this may be a general characteristic of the Heteroptera both for autosomes and sex bivalents (HALKKA 1959; LEWIS and SCUDDER 1958), there are exceptions: unlike the autosomes, the unpaired sex chromosomes of *Dicranocephalus agilis* (LEWIS and SCUDDER 1958) are committed to autoorientation at MI (postreduction).

It may be noted (cf. JOHN and LEWIS 1965) that for holokinetic chromosomes with a median chiasma the distinction prereduction-postreduction does not make sense. Half of the chromosome segregates prereductionally, half postreductionally whatever the orientation (Fig. 7). For monokinetic chromosomes the centromere can be taken as a reference point and then prereduction is the strict rule under normal conditions.

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