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INTRASPECIFIC POLYMORPHISM OF KARYOTYPE IN *DROSOPHILA ALBOMICANS*[1]

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Tsing-Cheng Wang, Chien-Chung Chen and Fei-Jann Lin (1988) Intraspecific polymorphism of karyotype in *Drosophila albomicans*. *Bull. Inst. Zool., Academia Sinica* 27(2): 127-131. Seven strains of *Drosophila albomicans* collected from Taiwan, Okinawa and Thailand were analysed for their intraspecific variations of karyotype. Chromosome 4's of Thailand strains were significantly shorter than those of other chromosome complement, and the chromosome Y's, on the other hands, were significantly longer in the complement. The length of chromosomes 4 and Y among the strains measured were negatively correlated. Possibility of translocation between these two linkage groups is suggested. Significant intraspecific variations of C-banding pattern were also found in chromosome 4. Except for the absence of B-chromosome in Thailand strains and the longest linkage group being the chromosome X, our results are also consistent with previous reports.

Key words: Karyotype, Polymorphism, *Drosophila*.

Drosophila albomicans is a member of *nasuta* species subgroup of the *immigrans* species group of subgenus *Drosophila* (Lin and Tseng, 1973). The distribution of *D. albomicans* ranges from Thailand (Wilson *et al.*, 1969), Taiwan (Duda, 1923, 1924; Kikkawa and Peng, 1937; Wilson *et al.*, 1969; Mather and Thongmeearkom, 1972; Lin and Tseng, 1973), Cebu, Philippines (Mather and Thongmeearkom, 1972), and Okinawa Islands, Japan (Kikkawa and Peng, 1938; Okada, 1965). The species can be collected from almost every part in Taiwan, including Peng-Hu (澎湖) and Lan-Hsu (蘭嶼) Islands except the elevation above 1,500 meters and human association on the lower altitude (Duda, 1923, 1924; Lin and Tseng, 1973; Lin *et al.*, 1977). Remarkable genetic divergence has occurred in this species. According to Inoue and Kitagawa (1975) and Kitagawa *et al.* (1982), *D. albomicans* populations collected from Thailand, Taiwan and Okinawa has genetically differentiated at the level of the subspecies or of the semispecies. In this paper, we report the karyotype polymorphisms among the *D. albomicans* collected from those three areas.

MATERIALS AND METHODS

Seven strains of *Drosophila albomicans* established each by an isofemale are used in this study. Strain nos. 57.1, 93.19 and 105.3 are collected from Taiwan, strain nos. 160.01 and 191.01 are from Thailand, and strain nos. 162.01 and 163.15 are from Okinawa, Japan, respectively. Somatic metaphase chromosomes were prepared from neuroblast cells of

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male 3rd-instar larvae using an air-dried technique modified from those of Guest and Hsu (1973). At least 30 well-spreaded karyotypes were randomly sampled from each strain to calculate the % of total chromosome length (% TCL) as described by Boyes *et al.*, (1971) using an Olympus Vanox-S photomicroscope and Image Analyzer. C-banding technique developed by Sumner *et al.*, (1971) and applied by Pimpinelli *et al.* (1976) on *Drosophila* was used to visualize heterochromatic polymorphism.

RESULTS AND DISCUSSION

Chromosome 2 (2R+2L) is the longest linkage group in this observation. This is inconsistent with a previous report which indicated that the chromosome X is the longest (Lin *et al.*, 1974). As reported previously (Rangnath and Hagele, 1982), the C-bandings restrict to the pericentric heterochromatin regions.

In *D. albomi*cans, sex chromosome are fused centrically with chromosome 3 (Wakahama *et al.*, 1983 and our observation). Chromosome 3 attached by chromosome Y (chromosome 3-Y) is morphologically different from that by chromosome X (chromosome 3-X). We therefore treat them as two different linkage groups in % TCL calculations. Chromosome 3-Y is consistenly longer than chromosome 3-X in every strain analysed (Table 1). Chromosome 3-X's, on the other hands, have greater centromeric heterochromatic regions (Fig. 2). These two linkage groups, however, show no significant inter-strain variations for both % TCL (Table 1, $p<0.05$, according to Duncan's multiple range test) and heterochromatin distribution (Figs. 1 and 2, developed by C-banding technique).

Chromosome 4's of Thailand strains (stock nos. 160.01 and 161.01) are the shortest complement among all. Similar phenomenon also has been reported previously (Wilson *et al.*, 1969; Clyde, 1980; Kitagawa *et al.*, 1982). Ramachandra and Rangnath (1985, 1987) believed that the shortest chromosome 4 in Thailand strain might result from the disintergration of this chromosome into smaller dot-like B chromosome. In our observation, no B chromosome has been found. On the other hands, we found that chromosome Y's of Thailand strains are significantly longer than those of other strains (Table 1). In facts, in the strains we have tested, % TCL's of chromosome 4 and chromosome Y is negatively correlated (Fig. 3, slope=1.38, $r=0.81$, $p<$

TABLE 1
Percent total chromosome length (% TCL) of each linkage group in *Drosophila albomicans* collected from Taiwan, Okinawa and Thailand

Stock number	Linkage group*					
	X	Y	II	III-X	III-Y	IV
57.1	20.7 ± 2.09^{a}	$13.9\pm2.02^{a\,b}$	27.0 ± 2.98^{b}	22.3 ± 3.58^{a}	23.9 ± 3.07^{a}	$15.2\pm2.46^{b\,c\,d}$
93.19	$23.3\pm1.87^{b\,c}$	$13.9\pm2.15^{a\,b}$	$24.8\pm2.56^{a\,b}$	23.1 ± 2.28^{a}	23.3 ± 2.09^{a}	$14.8\pm2.23^{b\,c}$
105.3	$22.0\pm2.06^{a\,b}$	15.5 ± 1.82^{b}	23.1 ± 2.32^{a}	22.5 ± 3.04^{a}	23.0 ± 1.87^{a}	$17.0\pm1.95^{c\,d}$
160.01	24.4 ± 2.73^{c}	17.8 ± 2.65^{c}	26.6 ± 3.37^{b}	22.3 ± 3.50^{a}	23.9 ± 2.74^{a}	8.1 ± 1.44^{a}
161.01	23.9 ± 1.55^{c}	18.7 ± 2.53^{c}	26.1 ± 3.56^{b}	23.2 ± 2.19^{a}	25.2 ± 3.37^{a}	6.9 ± 1.53^{a}
162.01	21.3 ± 1.21^{a}	13.2 ± 1.57^{a}	$25.1\pm2.16^{a\,b}$	22.4 ± 1.69^{a}	24.5 ± 2.26^{a}	16.7 ± 1.86^{d}
163.15	$23.5\pm1.50^{b\,c}$	12.3 ± 2.49^{b}	27.1 ± 2.49^{b}	22.0 ± 3.74^{a}	25.0 ± 3.48^{a}	13.5 ± 2.65^{b}

* 1) III-X and III-Y indicate chromosome III centrically fused with chromosome X or Y, respectively.
2) Different letters in the same column indicate the significant difference between strains at the level of $p<0.05$ according to Duncan's multiple range test.

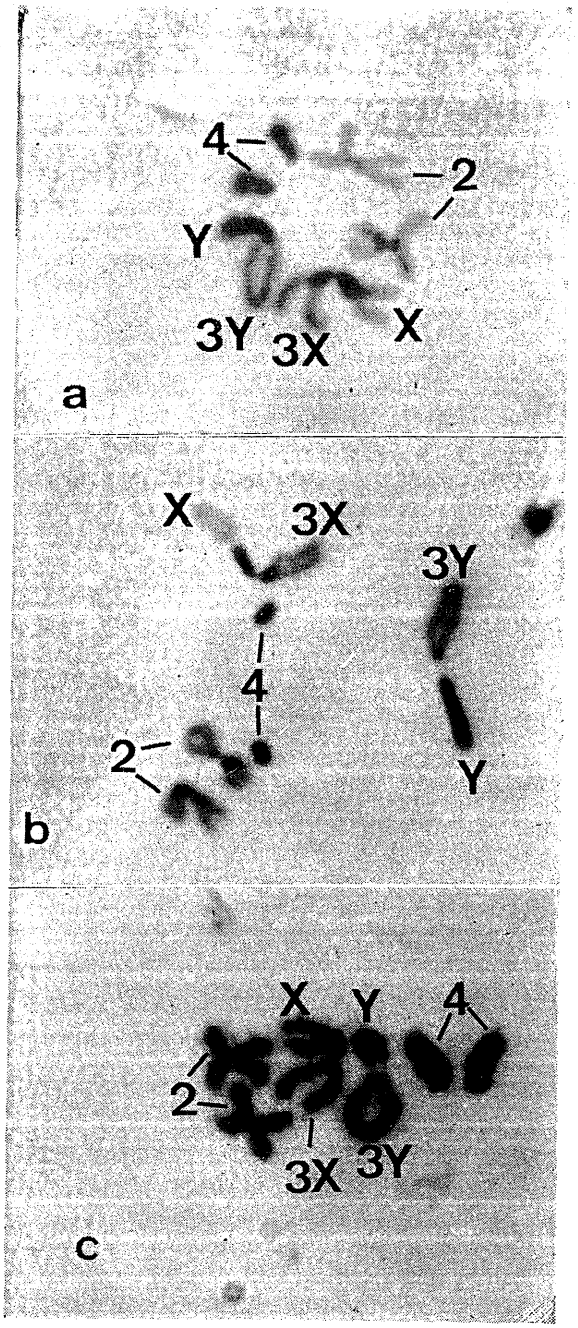

Fig. 1. Metaphase configuration of *Drosophila albomicans* (magnification, 1600×). a. Taiwan stock (♯ 93.19); b. Thailand stock (♯ 160.01); c. Okinawa stock (♯ 162.01). Linkage groups as indicated in the figure.

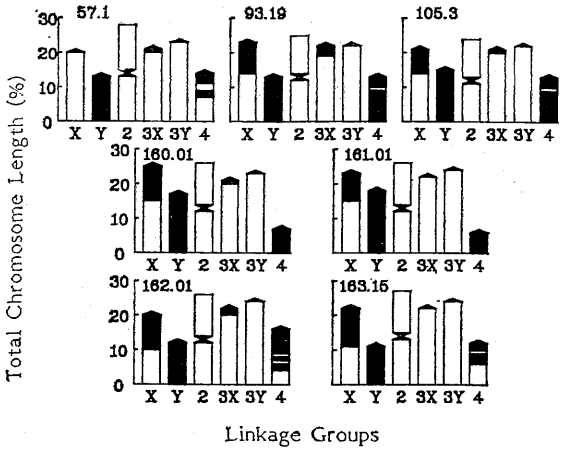

Fig. 2. Diagrammatic illustrations of % total chromosome length and C-band distributions (dark areas) of metaphase chromosomes of *Drosophila albomicans*. Flies include those collected from Taiwan (♯ 57.1, Kenting; ♯ 93.19, Chitou; ♯ 105.3, Wulai), Thailand (♯ 160.01, Nakhon Nayok; ♯ 161.01, Chiang Mai) and Okinawa (♯ 162.01, Ishigaki Id.; ♯ 163.15, Nago). Linkage group 3-X and 3-Y indicate chromosome 3 associated with chromosome X or Y, respectively.

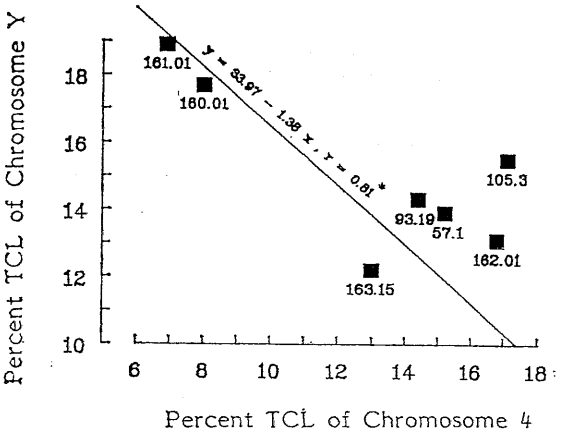

Fig. 3. Negative correlation in % total chromosome length of chromosome 4 and chromosome Y of *Drosophila albomicans*.

0.05). Therefore, an alternative explanation for shorter chromosome 4 in Thailand strains might be because of the translocation between chromosome 4 and chromosome Y.

Chromosome Y's are entirely positive C-banded. This is consistence with Rangnath and Hagele's observation (1982). In their report, flies collected from Okinawa reveal 3 C-banded areas on chromosome 4. This is also true in one of our Okinawa strain collected from Ishigaki Island, Okinawa (stock no. 162.01, Table 1 and Fig. 2). However, in other stocks, chromosome 4's show less numbers of C-bands and are significantly varied in heterochromatin distribution. There are two C-band areas in flies collected from Taiwan (Kenting, stock no. 57.1; Chi-tou, stock no. 93.19 and Wulai, stock no. 105.3) and Okinawa (Nago, stock no. 163.15). Those flies collected from Thailand are entirely C-banded.

C-bands in chromosome Y are also restricted to pericentric areas. Excepts for flies from Kenting (stock no. 57.1), C-bands in chromosome X extend to 1/3 to 1/2 length that of the chromosome X. Chromosome X of flies from Kenting also are the shortest chromosome complement among all. This is consistent with what has been reported previously that chromosomes with larger C-bands are always larger than their homologous partner which shows shorter C-band regions in other races (Rangnath and Hagele, 1982).

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紅果蠅染色體核型之種內多態型

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本文報告採自臺灣、沖繩羣島及泰國等七個紅果蠅品系在染色體核型上之變異，其中較重要者爲泰國品系之第四對染色體顯著地短於其他各品系，而Y染色體正好相反。作者認爲其變異可能源於此二染色體間之位移所致。染色體上之異染色質區分佈之多態型，亦以第四對染色體最爲顯著。本研究中，在泰國品系中並未發現如前人研究報告中所指之超額染色體，且在所有分析的品系裏，第二對染色體之長度爲所有染色體長度之冠，而非如前人研究中所揭示之X染色體最長，其餘結果則大致與前人研究報告之觀察相吻合。