*Zoological Studies* **47**(3): 293-301 (2008)

Zoological Studies

# Cooption of Neo-X and Neo-Y Chromosomes in *Drosophila albomicans*

Sung-Han Lin[1], Yu-Yang Huang[1], and Hwei-yu Chang[1,2,*]

[1]*Department of Entomology, National Taiwan University, Taipei 106, Taiwan*

[2]*Research Center for Biodiversity, Academia Sinica, Nankang, Taipei 115, Taiwan*

*(Accepted October 9, 2007)*

**Sung-Han Lin, Yu-Yang Huang, and Hwei-yu Chang (2008)** Cooption of neo-X and neo-Y chromosomes in *Drosophila albomicans*. *Zoological Studies* **47**(3): 293-301. *Drosophila nasuta* has 8 chromosomes, whereas its sibling species *D. albomicans* has 6 because a pair of neo-sex chromosomes has evolved through fusion events in < 0.5 Ma. It remains unclear how the newly joined sex chromosomes differentiated from their homologous 3rd autosome of *D. nasuta*. The body size of $F_1$ hybrid males from a cross between *D. albomicans* males and *D. nasuta* females was significantly smaller than those of the parental species, but an intermediate size was obtained from the reciprocal cross. There are 2 possible explanations: (1) the ancestral mitochondria of *D. nasuta* are not compatible in the derived *D. albomicans* nuclear environment; and (2) the neo-Y chromosome cannot work well with the homologous ancestral 3rd autosome of *D. nasuta*. In the present study, experiments were conducted to exclude the possible involvement of mitochondrial incompatibility. We established 5 sets of coupled highly inbred *D. albomicans* strains and another 5 sets of *D. nasuta* strains, and subsequently examined their reproductive ability and the body size of their progeny. Each set of coupled strains had nearly the same homogeneous nuclear genome but had different (self vs. non-self) mitochondria. These coupled strains showed indistinguishable reproductive ability and body size between them, indicating that mitochondrial compatibility was not the major cause. Alternatively, our cross experiments demonstrated that the body size of the offspring reverted to normal when the neo-X and neo-Y relationships were restored by backcrossing the small $F_1$ males to *D. albomicans* females. However, the body size remained small when $F_1$ males were backcrossed to *D. nasuta*. The backcross results support the 2nd explanation, thus implying that after coevolution of the neo-sex chromosomes, the neo-Y may depend on the presence of the neo-X chromosome in males, but not vice versa. http://zoolstud.sinica.edu.tw/Journals/47.3/293.pdf

**Key words**: Coevolution, *Drosophila nasuta*, Hybrids, Sex chromosome.

*Drosophila albomicans* (2*n* = 6) and *D. nasuta* (2*n* = 8) belong to the *D. nasuta* subgroup of the *D. immigrans* species group (Duda 1940, Wilson et al. 1969). According to molecular evidence, this sibling species pair is young and diverged < 0.5 million yrs ago (Ma) (Chang et al. 1989, Bachtrog 2006). During the divergence of these sibling species, hereditary materials in nuclear (n)DNA and mitochondrial (mt)DNA co-evolved for millions of generations within species, as did the X and Y chromosomes. Some aspects of chromosome evolution in this species pair have been studied (Yu et al. 1997 1999, Yang et al. 2004 2008), but many questions remain unanswered.

Except for the larger average body size of adult *D. albomicans* flies comparing to *D. nasuta* under our cultural conditions, these 2 species are morphologically indistinguishable (Chang and Tai 2007). Since body size is a quantitative trait, the hybrid $F_1$ of reciprocal crosses are supposed to be intermediate. Although female offspring meet this expectation, we noticed that $F_1$ males from a cross of *D. albomicans* males to *D. nasuta* females were significantly smaller than males of both parental species, whereas the body size of males from the reciprocal cross was intermediate. These observations raised 2 questions: What is the reason for this discrepancy of reciprocal

*To whom correspondence and reprint requests should be addressed. E-mail:hwei@ntu.edu.tw