The sperm length and the testis length in *Drosophila nasuta* snbgroup

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ABSTRACT

The species-specific sperm length and testis length were observed among the fourteen members of the *Drosophila nasuta* subgroup. The sperm length was highly correlated with the testis length and they reflected the taxonomic relationship. The present study suggests that the sperm length does not play an important role in the reproductive isolation in this subgroup.

1. INTRODUCTION

It has been reported that the sperm, the testis and the ventral receptacle are similar in length in *Drosophila* species and they are species specific (Yanders and Perras 1960, Hess and Meyer 1963, 1968, Kurokawa *et al.* 1964). However their role in reproductive isolation mechanisms has not been clear (Tokuyasu 1974). The *Drosophila nasuta* subgroup belonging to the *immigrans* species group consists of more than ten species and subspecies. Varying degree of the reproductive isolations are present among the members of this subgroup (Wilson *et al.* 1969, Kitagawa *et al.* 1982). We measured the sperm and testis lengths of flies from 35 lines of 14 members of the *nasuta* subgroup and examined the data from the viewpoint of the evolutionary genetics.

2. MATERIALS AND METHODS

Strains used in the present study are listed in Table 1. These strains were provided by Prof. O. Kitagawa, Tokyo Metropolitan University (Kitagawa *et al.* 1982). Taxon-I and Taxon-J are considered to be subspecies of *D. pallidifrons* (Kitagawa, personal communication). Flies were reared by the iso-female line method at 25°C in uncrowded conditions. Older than 7 day males were dissected in ringer solution. The testis with the seminal vesicle was mounted on the slideglass and stretched for the measurement of the testis length. To measure the sperm length, the testis was removed and the seminal vesicle was ruptured in ringer solution by thin steel needles, left for a few minutes and a coverslip was mounted gently. Both preparations were traced with the aid of camera lucida. The tracing length of the testis was measured by a curvemeter and the tracing length of the sperm by a personal computer with a digitizer. Ten testes were prepared from each strain for the

Table 1. *The sperm length and the testis length in isofemale lines of fourteen species and subspecies of the D. nasuta subgroup*

Species Locality	Line	Sperm length (mm)			Testis length (mm)	
		N	Mean	S. E.	Mean	S. E.
<i>D. albomicans</i>						
Nago, Japan	NGO-15	12	4.17	0.15	5.20	0.08
San-hu-tan, Formosa	SHT-7	13	4.19	0.12	4.81	0.08
Chiang Mai, Thailand	CNX-134	10	4.99	0.07	5.54	0.09
Penang, Malaysia	PEN-42	18	3.83	0.18	4.83	0.07
Kuala Lumpure, Malaysia	KUL-13	9	4.50	0.16	5.24	0.10
<i>D. nasuta</i>						
Coimbatore, India	D-1	52	3.06	0.19	4.24	0.08
Coimbatore, India	CJB-1	11	3.75	0.06	4.23	0.04
Reuniom Island	RUN-7	25	3.31	0.05		
Mahe, Seychelles	SEZ-3	39	3.58	0.07	4.43	0.12
<i>D. kepulauana</i>						
Puerto Princesa, Philippines	PPS-48	28	2.28	0.11	3.26	0.06
Puerto Princesa, Philippines	PPS-121	45	2.71	0.06	3.16	0.02
<i>D. kohkoa</i>						
Rangoon, Burma	RGN-140	23	2.55	0.09	3.16	0.08
Singapore, singapore	SIN-43	15	2.09	0.19	3.55	0.07
Los Baños, Philippines	LOB-26	40	2.10	0.07	2.84	0.04
Kuching, Sarawak, Malaysia	KCH-5	23	2.91	0.05	3.11	0.11
<i>D. niveifrons</i>						
Lae, Papua New Guinea	LAE-221	12	5.00	0.14	6.20	0.08
Lae, Papua New Guinea	LAE-276	10	5.13	0.16	5.20	0.20
<i>D. pulaua</i>						
Kuching, Sarawak, Malaysia	KCH-78	33	1.80	0.06	2.89	0.03
Miri, Sarawak, Malaysia	MMY-9	27	1.91	0.06	2.96	0.05
<i>D. sulfurigaster</i>						
<i>D. s. albostrigata</i>						
Los Baños, Philippines	LOB-5	24	3.20	0.09	3.88	0.08
Kandy, Sri Lanka	KDY-9	4	3.27	0.12	4.72	0.11
Singapore, Singapore	SIN-3	25	4.23	0.43		
<i>D. s. neonasuta</i>						
Mysore, India	MYS	6	2.67	0.12	3.71	0.07
Nagara Hole, India	NHO-13	21	3.08	0.10	3.90	0.04
<i>D. s. bilimbata</i>						
Guam, Marianas Islands	GUM-3	42	3.27	0.05	3.45	0.06
Tongatapu, Tonga	TBU-54				3.73	0.03
Hawaii, U.S.A.	HW	24	2.59	0.06		

(to be continued)

Table 1. (Continued)

Species Locality	Line	Sperm length (mm)			Testis length (mm)	
		N	Mean	S. E.	Mean	S. E.
<i>D. s. sulfurigaster</i>						
Port Moresby, Papua New Guinea	POM-402	25	3.71	0.09	4.64	0.06
Wau, Papua New Guinea	WAU-1	11	3.91	0.12	4.16	0.10
<i>D. pallidifrons</i>						
Ponape, Caroline Islands	PNI-9	103	0.91	0.01	1.45	0.04
Ponape, Caroline Islands	PNI-75	59	0.98	0.01	1.43	0.03
Taxon-I						
Wau, Papua New Guinea	WAU-181	62	1.13	0.01	1.55	0.02
Taxon-J						
Noumea, New Caledonia	NOU-98	70	0.95	0.02	1.57	0.04
Taxon-F						
Kuching, Sarawak, Malaysia	KCH-208	28	2.36	0.05	2.71	0.04
Miri, Sarawak, Malayasi	MMY-88	101	1.29	0.06		

N: The number of sperm measured.

measurement of the testis length and more than four testes for the sperm length.

3. RESULTS AND DISCUSSION

Table 1 shows the results. Difference in sperm length was detected among the members of the *nasuta* subgroup. The longest mean sperm length, 5.13 mm of *D. niveifrons*, was more than fivetimes larger than that of Taxon-J (0.95 mm). The mean sperm length and the mean testis length by isofemale line were highly correlated in the, *nasuta* subgroup. The correlation coefficient between them was 0.914 and statistically significant at the 0.1% level.

The sperm length appears to reflect the taxonomic relationship as suggested by Yanders and Perras (1960). Three *D. pallidifrons* subspecies having the shortest sperm considered to be most primitive (Lambert 1982). Species more the distant from them (Lambert 1978, 1982), the sperm length was longer.

The differences in the sperm length and the testis length between isofemale lines were observed. The analysis of variance was applied to detect the difference in the testis length between the isofemale lines within the species or subspecies except Taxon-F, Taxon-I and Taxon-J. In *D. albomicans*, *D. kohkoa*, *D. niveifrons*, *D. s. albostrigata*, *D. s. neonasuta*, *D. s. bilimbata* and *D. s. sulfurigaster* significant difference between isofemale lines was observed at 0.1%, 0.01%, 1%, 0.1%, 5%, 0.1% and 0.1% and 0.1% levels, respectively.

Against significant difference between isofemale lines the difference between subspecies was not statistically significant in both *D. sulfurigaster* and *D. pallidifrons*. Intersubspecific crosses of each species result in hybrid males with low fertility (Wilson *et al.* 1969, Takanashi, 1983, Kitagawa, personal communication). *D. albomicans*, *D. nasuta* and *D. kepulauanana* are closely related to each other and fertile F₁ hybrid females and males were obtained from reciprocal crosses between any pair of species of them (Kitagawa *et al.* 1982). Significant difference in the sperm length was observed among these three species at the 0.1% level. *D. pulaua* had a different sperm length from four *D. sulfurigaster* subspecies members, though the cross between *D. pulaua* and *D. sulfurigaster* resulted in fertile females and males (Takanashi 1983). These facts suggest the sperm length has no decisive role in the reproductive isolation mechanisms in *D. nasuta* subgroup.

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