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One of the fundamental taxonomic procedures is to find and estimate the correlative characters among taxa. The facultative correlation is especially important, the obligatory one being discarded from taxonomic characters even by the numerical pheneticists.

The present research aims at finding the characters of facultative correlation in the species of the genus *Microdrosophila* Malloch. The characters examined are not restricted to the adult external features, but adult internal and early stage characters are also put into consideration. At present the knowledge of the early stage characters in this genus is very poor, owing to difficulty of obtaining offsprings in usual laboratory culture media. Only the feature of egg-filaments has been examined in several species, although insufficient for definite estimation.

In a key to the Japanese species of *Microdrosophila*, the author (1960) suggested already a series of characters of facultative correlation as summarized below (Figs. 1-4).

A. Proclinate orbital inside others; C3-fringe entire or nearly so; Malpighian tubules with stalks shorter (misprinted as *longer* in the key) than branches; aedeagus slender; egg-guide elongate: including *M. urashimae* (A3), and *M. fuscata*.

B. Proclinate orbital outside others; C3-fringe not entire; Malpighian tubules with stalks longer (misprinted as *shorter* in the key) than branches; aedeagus not slender; egg-guide not elongate: including *M. cristata* (B2), *M. maculata* (B1), and *M. purpurata* (B3).

This grouping by means of correlative characters has been proved highly prospective in admitting further species and further characters successfully, the species introduced being *M. matsudairai* (A1), *M. pleurolineata* (B4), and *M. nigripalpis* (B5), and the characters introduced being phallic organ and egg-guide components, clasper, and egg-filaments.

Although most of these introduced characters are not strictly correlative between

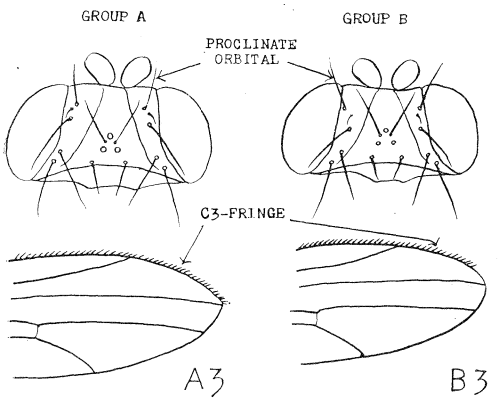

Fig. 1. Correlation between the positions of proclinate orbital bristle relative to reclinates and the ranges of C3-fringe. A3, B3. species, names in the text.

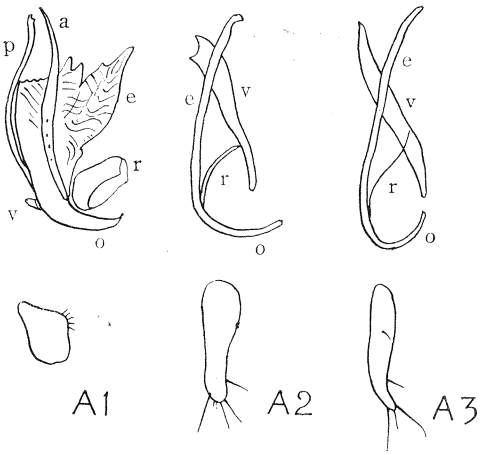

Fig. 3. Phallic organs (upper figs.) and egg-guides (lower figs.) of the group A species of *Microdrosophila*. A1-3. species, names in the text. a. anterior paramere; e. aedeagus; o. apodeme; p. posterior paramere; r. vertical rod; v. ventral fragma.

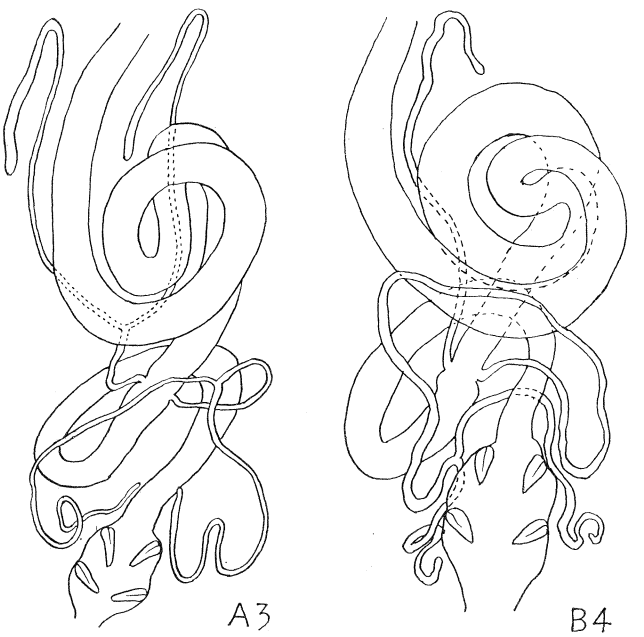

Fig. 2. Malpighian tubules in the two groups of *Microdrosophila*. Left, group A, common stalks shorter than branches; Right, group B, common stalks longer than branches, anterior tubules often unbranched. A3, B4. species, names in the text.

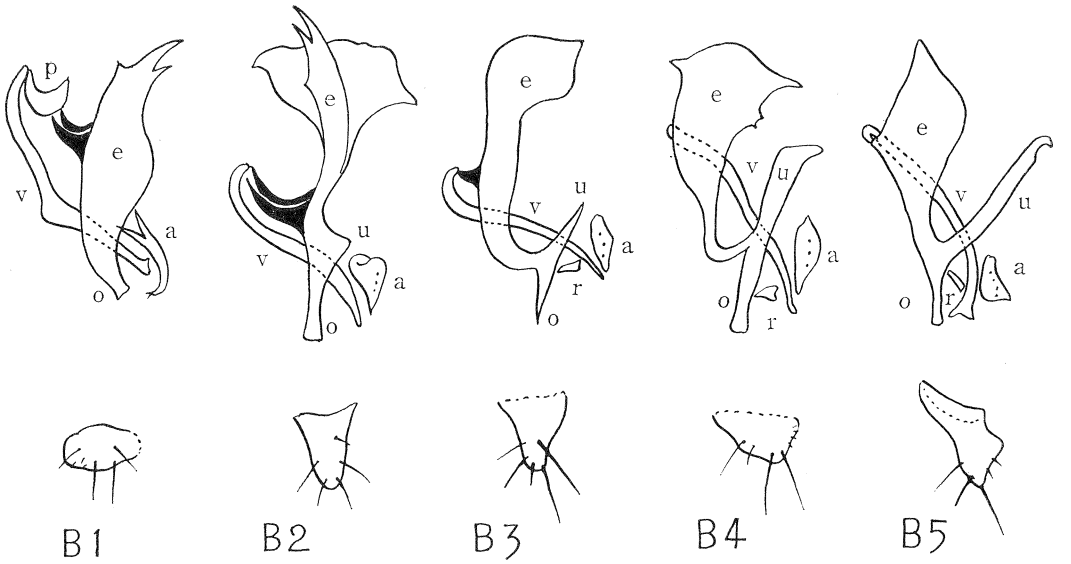

Fig. 4. Phallic organs (upper figs.) and egg-guides (lower figs.) of the group B species of *Microdrosophila*. B1-5. species, names in the text. u. ventral recurved process; other signs as in Fig. 3.

two groups, it is admitted that the taxonomic characters should not be archekastic (found in every member of the taxon: Stenzel, 1963). Furthermore, even the strictly correlated characters should not have their states differentiated in the same direction in the two groups.

In order to estimate the taxonomic relationships among the species (A1-3, B1-5) basing on these correlative characters, a simple method of numerical phyletics is adopted. At first, the two-state coding is made for each character according to presumed process of differentiation, the supposedly primitive or generalized state being coded O, and advanced or specialized one coded unity (Table 1). Basing on the table of the two-state coding for each species (Table 2), a similarity matrix is deviced applying MCD (mean character difference) method of Cain and Harrison (1958) (Table 3).

$$\mathrm{MCD}=\frac{1}{n}\sum_{i=1}^{n}\left|X_{ij}-X_{ik}\right| \quad (X_{ij}=\text{code value of } i\text{th character in } j\text{th species})$$

For the convenience, the character 15 (egg-filament) which includes NC (no comparison) and is found less correlative is omitted from calculation. The sum of code values for each species signifies the degree of phylogenetic differentiation of the species, and is named here d. i. (divergency index) (Table 2).

$$\text{d. i.}=\frac{1}{n}\sum_{i=1}^{n}X_{ij} \quad (\text{d. i. of } j\text{th species})$$

Then, the clustering is made using weighted pair-group and average linkage methods (Sokal and Sneath, 1963), which resulted as illustrated in Fig. 5. Different from ordinary

Table 1. Two-state coding of the characters.

Characters	State 0	State 1
1. C3-fringe	not entire	entire
2. Ant. reclinate orb.	inside post. recl.	outside post. recl.
3. Malpighian tub. length	stalk shorter than branches	stalk longer than branches
4. Mp. tub. post. branches	free or apposed apically	fused to each other apically
5. Clasper	separated from genital arch & anal plate	fused to genital arch or anal plate
6. Aedeagus, size	slender	thick
7. Aedeagus, dorsal process	absent	present
8. Aedeagus, ventral process	absent	present
9. Anterior parameres	present	absent
10. Posterior parameres	present	absent
11. Vertical rod	absent	present
12. Ventral fragma	vestigeal	well developed
13. Egg-guide, size	as long as or shorter than broad	much longer than broad
14. Egg-guide lobe	only pubescent	with strong setae
15. Egg-filaments	two	one

Table 2. Character state coding and divergence index of each species.

Ch. / Sp.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	d. i. × n (excl. Ch. 15)
A2	1	0	0	0	0	0	0	0	0	0	1	0	1	1	NC	4
A3	1	0	0	0	1	0	0	0	0	0	1	0	1	1	1	5
A1	1	0	0	1	0	1	0	0	1	1	1	1	0	0	1	7
B1	0	1	1	0	1	1	1	0	1	1	0	0	0	1	NC	8
B2	0	1	1	0	0	1	1	1	1	0	0	0	0	1	0	7
B3	0	1	1	0	1	1	1	1	1	0	1	0	0	1	0	9
B4	0	1	1	0	1	1	1	1	1	0	1	0	0	1	NC	9
B5	0	1	1	1	1	1	1	1	1	0	1	0	0	1	1	10

Table 3. MCD matrix (exclusive of Ch. 15).

	A2	A3	A1	B1	B2	B3, 4	B5
A2	0	1	7	10	9	9	10
A3	1	0	8	9	10	8	9
A1	7	8	0	9	10	10	9
B1	10	9	9	0	3	3	4
B2	9	10	10	3	0	2	3
B3, 4	9	8	10	3	2	0	1
B5	10	9	9	4	3	1	0

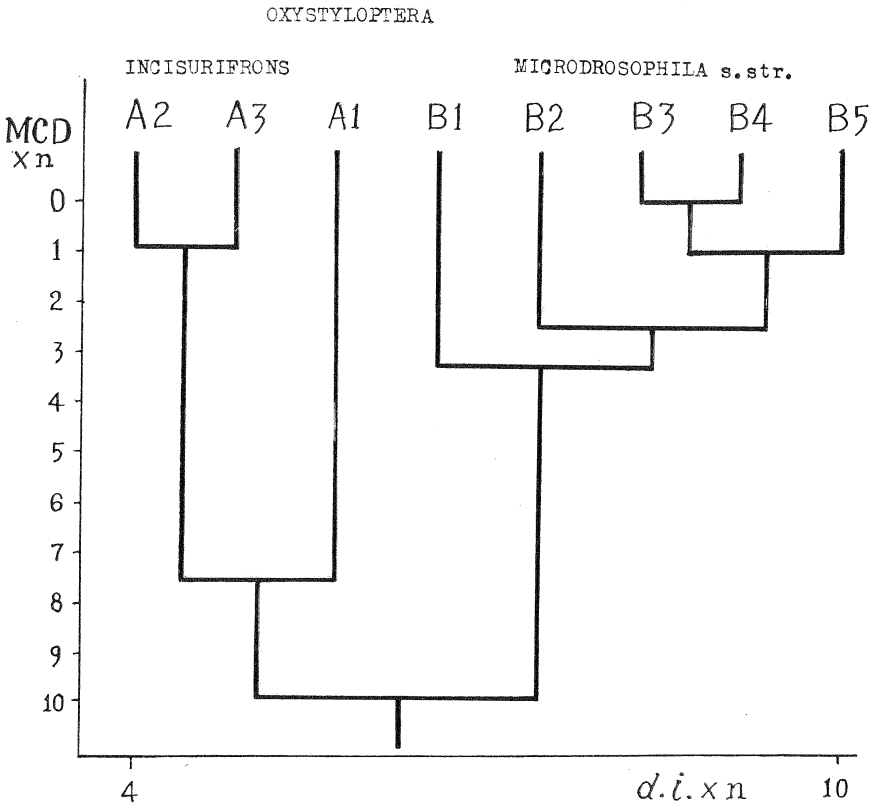

Fig. 5. A dendrogram of clustering species of *Microdrosophila* into three subgenera. A1-3, B1-5, species, names in the text. Further explanation see in the text.

numerical phenetic methods, the abscissa of the diagram takes a meaning of phyletic order of species, roughly corresponding with divergency indices.

As a result it is suggested that sp. A1 (belongs subgenus *Oxystyloptera* Duda, 1924) is related closer to the other members of group A (A2 and A3) than to that of group B (B1-5). If subgenus *Oxystyloptera* is regarded as a valid taxon as thought by the author (1960), the group A except A1 and group B should be ranked as separate subgenera parallel with *Oxystyloptera*. According to the original description of the genus *Microdrosophila* by Malloch (1921), *M. quadrata*, the type species of *Microdrosophila* seems to belong to group B, this group should become the nominate subgenus. For group A except A1, another name, *Incisurifrons* Duda, 1924, which was synonymized with *Microdrosophila* by Sturtevant (1927), becomes available.

Consequently, the genus *Microdrosophila*, including about twenty-seven named species from the world, so far as the author is aware, is classified into three subgenera as shown in the list below.

Genus *Microdrosophila* Malloch, 1921 (type: *quadrata*)

Subgenus *Oxystyloptera* Duda, 1924 (type: *tectifrons*)

bimaculata (de Meijere, 1908)	Java
latifrons Okada, 1965	Okinawa
mamaru Burla, 1954	Africa
matsudairai Okada, 1960	Japan, S. Korea, Okinawa
sexsetosa Duda, 1939	Africa
tectifrons (de Meijere, 1914)	Java

Subgenus *Incisurifrons* Duda, 1924 (type: *congesta*)

congesta (Zetterstedt, 1847)	Europe
distincta Wheeler and Takada, 1964	Palau
fuscata Okada, 1960	Japan, S. Korea
pectinata Okada, 1966	Nepal
urashimae Okada, 1960	Japan, S. Korea
zetterstedti Wheeler, 1959	Europe

Subgenus *Microdrosophila* Malloch, 1921 (type: *quadrata*)

cristata Okada, 1960	Japan
elongata Okada, 1965	Okinawa
errator Wheeler and Takada, 1964	Micronesia
korogo Burla, 1954	Africa
maculata Okada, 1960	Japan
mabi Burla, 1954	Africa
marginata Okada, 1966	Nepal
nigrohalterata Okada, 1966	Nepal
nigripalpis Okada, 1966	Nepal, Japan
ochracella Wheeler and Takada	Micronesia
pauciramosa Okada, 1966	Nepal
pleurolineata Wheeler and Takada, 1964	Micronesia, Okinawa
purpurata Okada, 1956	Japan, S. Korea
quadrata (Sturtevant)	N. America
submarginata Okada	Okinawa

Summary

Basing on a series of correlative characters, classification of the genus *Microdrosophila* was attempted. In clustering the species into subgenera, a simple procedure of numerical phyletics, combining two-state coding of character, MCD matrices, pair-group simple-linkage methods, and divergency index (d. i.), was applied.

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