TAXONOMIC AND ECOLOGICAL NOTES ON THE DROSOPHILIDAE OF THE BONIN ISLANDS (DIPTERA)

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小笠原産ショウジョウバエの分類と生態

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A total of nine species belonging to three genera of the family Drosophilidae have hitherto been discovered from the Bonin Islands by the investigations of KIKKAWA & PENG, 1938 (KP) and WHEELER & TAKADA, 1964 (WT). Since 1968 several expeditions made by the persons mentioned below have brought a lot of material from Chichijima and Hahajima, which will be treated in this report: Dr. H. HASEGAWA (H), National Institute of Agricultural Sciences, April to May 1968, Dr. T. NAKANE (N), National Science Museum, July 1969, Mr. O. IWAHASHI (I), Ogasawara Branch of Tokyo Metropolitan Government, March to April 1970, and several members of our department——myself (O) assisted by Mr. K. SUZUKI (S), August 1970, Dr. O. KITAGAWA (K), February 1971, and Messrs. K. SUZUKI (S') and N. WATANABE (W), March to April 1971.

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I. Taxonomic accounts

The collection of the flies was made mostly by sweeping bushes (H, N, O S, S' W) and using fruit traps (OS, K, S'W), sometimes at light traps (OS), on mushrooms (OS, S'W), and at the "methyleugenol" traps for the Oriental fruit-fly, *Dacus* (*Strumeta*) *dorsalis* (I).

1. *Leucophenga boninensis* WHEELER et TAKADA, 1964.

CHICHIJIMA: Okumura (H); Omura, Komagari (OS, S'W); Kiyose (OS, K); Sakaiura, Chuôyama, Mt. Mikazuki (OS). HAHAJIMA: Loc. inc. (N); Okimura (OS, S'W); Kômoridani, Inokumawan (S'W). Previous records: Chichijima, Anijima, Ototojima, Nishijima, Hahajima, also Guam outside the Bonins (WT).

The occurrence in combination of the spiculated membrane surrounding egg-guide

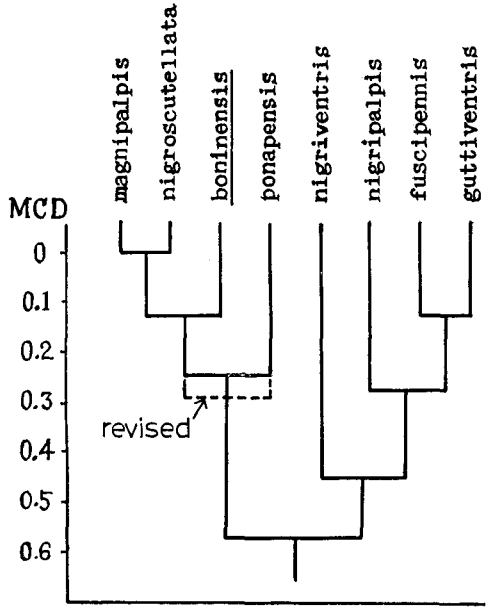

Fig. 1. A cluster dendrogram of the *guttiventris*-complex of the genus *Leucophenga* before and after (broken line) introducing two new characters for *L. boninensis*.

and the setigerous anterolateral corners of the female seventh abdominal tergite, observed in this species, is not the case of the related species. The former structure is present and the latter absent in *L. guttiventris* (DE MEIJERE) and *L. magnipalpis* DUDA, while they are vice versa in *L. nigripalpis* (LAMB) and *L. angusta* OKADA (OKADA, 1970, Fig. 4). *L. angusta* OKADA (1956. Syst. study Dros. Jap.: 28) is a substitute name for "L. *nigriventris* auct." The former was synonymized with "*nigriventris*" by me (1970: 21), while *nigriventris* MACQUART, 1843, was found synonymous with *Drosophila melanogaster* MEIGEN by TSACAS (1967: 158). Therefore *angusta* becomes a valid substitute name. I propose here also a name, *guttiventris*-complex in place of *nigriventris*-complex (OKADA, 1970).

The previously drawn cluster dendrogram of the eight related species of this complex analized with ten diagnostic characters (OKADA, 1970, Fig. 5) did not, however, show any fundamental change even by introducing two newly observed characters of the females of *L. boninensis* (Fig. 1).

2. *Mycodrosophila gratiosa* (DE MEIJERE, 1911).

CHICHIJIMA: Omura (OS); Oogiura (S', W). HAHAJIMA: Okimura (OS, S'W). Also from Taiwan (Chitau, Yunshuei, Chai-I, VIII 1967) (Okada). Previous records: Java (DE MEIJERE, 1911, Type loc.); Sumatra (DUDA, 1926); Micronesia from Guam to Kusaie, Solomon (WT); Samoa (MALLOCH, 1934); Fiji and S. Africa (DUDA, 1939); Singapore (DUDA, 1923, as *biroi*); Ivory Coast (BURLA, 1954, as *fracticosta*); Seychelles (LAMB, 1914, as *fracticosta*); Japan, Okinawa (OKADA, 1956, 1963, as *splendida*); S. Korea (LEE, 1964, as *splendida*).

DUDA (1939) considered that *M. fracticosta* (LAMB, 1914) and *M. biroi* DUDA, 1923, are synonymous with *M. gratiosa*, and I found here that *M. splendida* OKADA, 1956, loc. cit.: 48, is also synonymous with it. I have ever seen specimens probably of this species from New Guinea preserved at the University of Texas, Austin. Consequently, this species is now found to cover a broad area of the Old World, ranging fron 0° E. to 170° W. longit. and from 20° S. to 40° N. latit.

As DUDA (1939) and BURLA (1954) indicated, this species shows a considerable variation in the abdominal color patterns, which can be roughly divided in the three

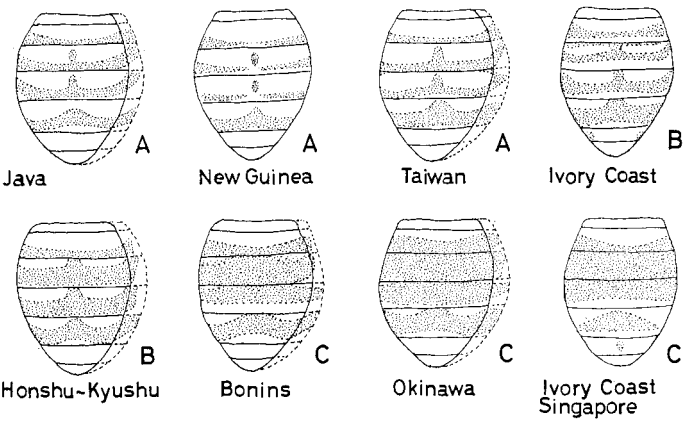

Fig. 2. Variation in the abdominal color patterns of *Mycodrosophila gratiosa*, divided in three types, A, B, and C.

types, A, B, and C. Type A: Caudal black bands on 3-4T (third and fourth tergites) narrow and medially still narrowing. Java, Micronesia, New Guinea, Taiwan. Type B: Caudal black bands on 3-4T rather broad, medially not narrowing. Seychelles, Ivory Coast, Japan. Type C: 3-4T nearly entirely black. Singapore, Ivory Coast, Okinawa, Bonins. In general, type A is distributed centering around southern Pacific islands, B in the more northern parts of Asia and Ethiopia, and C roughly intermediate areas.

GRESSITT (1954) suggested a possibility of transfer of flying insects in the winds circulating in vortices around the Pacific in the direction opposite to the trade winds. The occurrence of type C in Okinawa as well as the Bonins would be interpreted by his theory.

3. *Dettopsomyia nigrovittata* (MALLOCH, 1924).

HAHAJIMA: Okimura (S′). Newly recorded from the Bonins.

4. *Nesiodrosophila* sp.

HAHAJIMA: Inokumawan (S′).

5. *Scaptomyza pallida* (ZETTERSTEDT, 1847).

CHICHIJIMA: Omura (S′). HAHAJIMA: Kômoridani (S′). Previously recorded from Chichijima and Hahajima (WT).

6. *Scaptomyza* sp. I.

CHICHIJIMA: Omura (I). Resembles *Bunostoma* species in having fused egg-guide lobes.

7. *Scaptomyza* sp. II.

HAHAJIMA: Kômoridani (S′). Male genitalia resemble that of *Parascaptomyza* species, but acrostichal hairs are in six rows.

8. *Drosophila* (*Hirtodrosophila*) sp.

CHICHIJIMA : Sakaiura (O). HAHAJIMA : Okimura (O). Somewhat allied to *D. pseudonokogiri* Okada.

9. *Drosophila* (*Sophophora*) *suzukii* (Matsumura, 1931).

HAHAJIMA: Okimura (S′). Newly recorded from the Bonins.

10. *Drosophila* (*Sophophora*) *melanogaster* Meigen, 1830.

CHICHIJIMA: Kiyose (K, S′); Oomura (S′). Previous records from the Bonins. Chichijima (KP, WT), Hahajima (KP, WT), Naka-Iwoto (KP), Ototojima (WT).

11. *Drosophila* (*Sophophora*) *simulans* Sturtevant, 1919.

CHICHIJIMA: Omura (OS, S′W) ; Kiyose (OS, K, S′W) ; Miyanohama, Komagari, Minamifukurozawa (S′W) ; Loc. inc. (I). HAHAJIMA: Okimura (OS, S′W) ; Kômoridani, Inokumawan (S′). Previous records from the Bonins. Chichijima, Hahajima (KP).

12. *Drosophila* (*Sophophora*) *kikkawai* Burla, 1954.

CHICHIJIMA: Kiyose (O, K); Mt. Mikazuki (O); Komagari (S′); Loc. ? (I). Newly recorded from the Bonins.

13. *Drosophila* (*Sophophora*) *pectinifera* Wheeler et Takada, 1964.

CHICHIJIMA: Omura (OS, S′); Kiyose (K, S′); Mt. Mikazuki, Komagari, Kominato, Chuôyama (OS); Miyanohama, Oogiura (S′); Okumura (I); Loc. inc. (N). HAHAJIMA: Okimura (O, S′W); Kômoridani, Inokumawan (S′). Previously recorded only from the Bonins: Chichijima, Hahajima (WT).

14. *Drosophila* (*Drosophila*) *daruma* Okada, 1956.

CHICHIJIMA: Minamifukurozawa (S′W). Newly recorded from the Bonins. The flies were found in a large swarm on a nest of birds.

15. *Drosophila* (*Drosophila*) *immigrans* Sturtevant, 1921.

CHICHIJIMA: Omura, Miyanohama, Komagari (S′W); Kiyose (K, S′); Loc. inc. (I). HAHAJIMA: Okimura (O, S′W); Komôridani, Inokumawan (S′). Previous records from the Bonins. Hahajima (WT).

16. *Drosophila* (*Drosophila*) *annulipes* Duda, 1924.

CHICHIJIMA: Omura, Kiyose (O) ; Oogiura, Komagari (S′); Loc. inc. (I). HAHAJIMA: Loc. inc. (N). Previous records from the Bonins: Chichijima, Hahajima (WT).

The following two hitherto recorded species were absent from the present collections. 17. *Drosophila* (*Hirtodrosophila*) *novicia* Wheeler et Takada, 1964, Hahajima, also Palau outside Bonins (WT). 18. *D.* (*Sophophora*) *ananassae* Doleschall, 1858, Chichijima, Hahajima, Naka-Iwoto (KP).

II. Faunal structures

The drosophilid fauna of the Bonin Islands is not very rich, consisted, thus far known, of up to eighteen species belonging to five non-endemic genera. Seven species (39%) are cosmopolitan: *Dettopsomyia nigrovittata, Scaptomyza pallida, Drosophila mela-*

nogaster, *D. simulans*, *D. kikkawai*, *D. ananassae* and *D. immigrans*, five (28%) are endemic: *Nesiodrosophila* sp., *Scaptomyza* sp. I, *Sc.* sp. II, *Drosophila pectinifera* and *D.* sp., four (22%) are radically south-Asiatic: *Mycodrosophila gratiosa*, *D. suzukii*, *D. daruma* and *D. annulipes*, and the remaining two (11%) are confined to Micronesia: *Leucophenga boninensis* and *D. novicia*.

The records of relatively high endemism (about 30%) of the insect faunae of the Bonins have been frequently given by various investigators and were summarized by NAKANE (1970). The figure holds good for the drosophilids (28%), though less than in Japan as a whole (35%).

A summarized collection data (Table 1) shows that *D. immigrans* and *D. simulans* are prevalent in both Chichijima and Hahajima, and *L. boninensis* and *D. pectinifera*, which are endemic or subendemic, are next abundant in both islands.

III. Sex-ratio in natural populations

The collection data (Table 1 and Fig. 3) shows in general high sex-ratio, (♀/♂) × 100, which is about 50 (30~70) in each of relatively abundantly inhabited species. An exceptional case is *D. daruma*, which showed an opposite extreme. The high ratios of males in the natural populations of drosophilids are rather general phenomena (CARSON

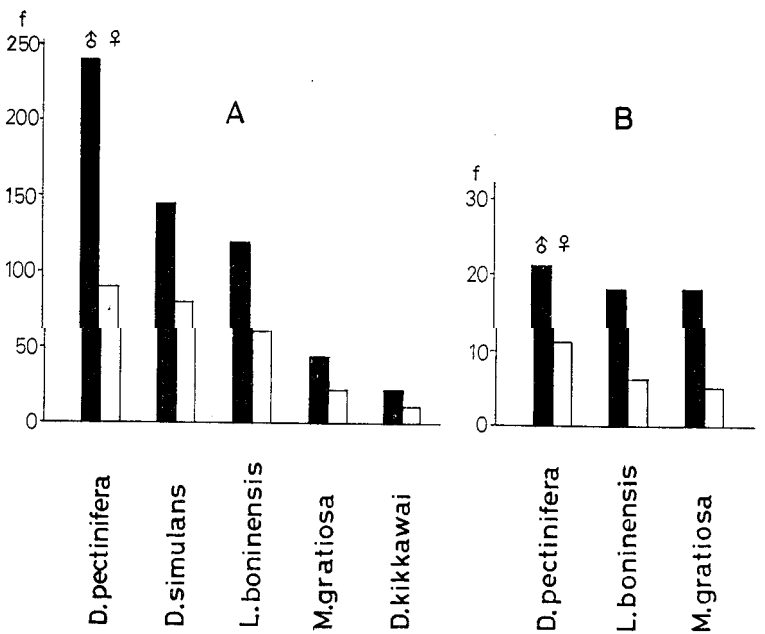

Fig. 3. Frequencies of the males and females. A. Major species collected in Chichijima and Hahajima in August 1970. B. Three species collected indoors during a heavy rainfall, at Omura, August 27, 1970.

Table 1. Frequencies of the drosophilid species collected in the Bonin Islands, 1968-1971. Some flies used for culture stocks are not counted.

	Species	Chichijima		Hahajima		Total		
		♂	♀	♂	♀	♂	♀	♂+♀
1.	*Leucophenga boninensis*	104	50	146	119	250	169	419
2.	*Mycodrosophila gratiosa*	37	16	13	9	50	25	75
3.	*Dettopsomyia nigrovittata*			38	41	38	41	79
4.	*Nesiodrosophila* sp.			1	1	1	1	2
5.	*Scaptomyza pallida*	1			1	1	1	2
6.	*Sc.* sp. I		1				1	1
7.	*Sc.* sp. II			2		2		2
8.	*Drosophila* (*Hirt.*) sp.		1	1		1	1	2
9.	*D. suzukii*			8	1	8	1	9
10.	*D. melanogaster*	10	3			10	3	13
11.	*D. simulaus*	1,325	814	524	289	1,849	1,103	2,952
12.	*D. kikkawai*	29	15			29	15	44
13.	*D. pectinifera*	201	78	439	120	640	198	838
14.	*D. daruma*	33	1,203			33	1,203	1,236
15.	*D. immigrans*	1,495	582	1,416	272	2,911	854	3,765
16.	*D. annulipes*	8	2		1	8	3	11
	Total							9,450

& STALKER, 1951 ; OHBA, 1954 ; ISHIHARA, 1955 ; TAKADA, 1958 : OKADA, 1962 ; KANEKO & TAKUMITSU, 1969), not special for the forms of oceanic islands.

IV. Flight activity under rainfall

It happened that a large number of flies were coming indoors to rest upon walls during a heavy rainfall in the night, 27 VIII 1970, at Omura. About eighty flies belonging to three species, *Drosophila pectinifera*, *Leucophenga boninensis*, and *Mycodrosophila gratiosa*, were captured (SUZUKI leg.) The sex ratio of each species was as high as usual (Fig. 3 B). As the so-called wild species as these three are seldom coming indoors in usual case, it can be said that the flight activity of the flies was accelerated by the rainfall.

SCHMID (1968) observed in a forest of Türich that the collection of drosophilid flies by mean of an aspirating pump, "Johnson-Taylor VI-O", was greater in the rainfall than on the fine weather. I have also further experiences of "rainfall capture" in the main land of Honshu, e. g., under roof of an old shrine and on window of a cottage in forests. The acceleration of flight activities by rainfalls would result the flies enable to seek for the shelters. It was unexpected, however, that *D. simulans*, one of the most predominant "domestic" species in the Bonins, did not come indoors under rainfall.

Summary

The several recent surveys in the Bonin Islands resulted in the finding of sixteen species of Drosophilidae, including five hitherto unrecorded : *Mycodrosophila gratiosa* (=*M. splendida* OKADA, syn. n.), *Dettopsomyia nigrovittata*, *Drosophila suzukii*, *D. kikkawai* and *D. daruma*, as well as four unidentified, probably new : *Nesiodrosophila* sp., *Scaptomyza* sp. I, *Sc.* sp. II, and *Drosophila* (*Hirtodrosophila*) sp.

The effect of introduction of new characters to the previously obtained dendrogram of the *guttiventris*-complex (new name for *nigriventris*-complex) was analysed taxometrically. The variations in the abdominal color patterns of *Mycodrosophila gratiosa* were studied biogeographically. Furthermore, the acceleration by rainfall of the flight activity of the flies, the faunal structures of the drosophilids, and also the sex-ratios of natural populations were analysed.

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