1972

XI. The Drosophilidae of Taiwan[1,2]

臺灣的果蠅科

I. Genera *Leucophenga* and *Paraleucophenga*

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Introduction

According to Hennig (1941), the earliest knowledge concerning the Diptera fauna of the island of Taiwan was from the collections of the German teacher, Hans Sauter. Small portions of his collection reached various German museums, but the major part was divided between the Hungarian National Museum in Budapest and the German Entomological Institute in Berlin Dahlem. The Drosophilidae in these collections were studied by Dr. Oswald Duda of Habelschwerdt, Germany (now Bystrzyca, Poland; see Wheeler 1969), who published a very thorough account (Duda 1923).[4] Since many of the place-names used by Duda, having been copied from Sauter's labels, are no longer in use, we are including a table showing the modern (transliterated) names for these localities when they can be determined (Table 1). Hendel (1914) also described a few new species from Sauter's material, and Hennig (*op. cit.*) summarized the knowledge of the Drosophilidae from Taiwan up to 1940, and listed all the specimens present at that time in the Entomological Museum in Berlin. There are only a few small references to the fauna since his summary.

Taiwan, the island province of the Republic of China, was named Formosa by the Portuguese because of its great beauty. Located about 100 miles off the coast of the Chinese mainland, the island's area is slightly under 14,000 square miles (about the size of the Netherlands) and is extremely heavily populated, the present population exceeding 14 million.

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[4] This publication, however, resulted in considerable nomenclatural confusion. Around 1923–1924 Duda published five important articles dealing with the taxonomy of the Drosophilidae, with the following results: one sent to *Entomologische Mitteilungen* (Berlin-Dahlem) was never published; one which appeared July 31, 1924 dealt with European species; and of three dealing with Drosophilidae of Southeast Asia, the last one written (Duda 1923) was published first, while the two which had been written earlier (Duda 1924a, 1924b) did not appear until June, 1924. Thus, a number of his names are *nomina nuda* as of 1923.

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TABLE 1

Correlation between Taiwan locality names used by Sauter (Duda 1923) and their modern transliterated versions

Sauter's names	Modern names	Sauter's names	Modern names
Akau	A-hou	Polisha	Pu-li
Alikang	A-li-chien	Paroe*	.....
Anping	An-ping	Paiwan Dist.	Paiwan-she
Bansharyo	Fan-she-liau	Pilam	Pi-nang
Chip-Chip	Chi-chi	Palao	Pa-liau
Chipun	Chi-peng	Sokotsu	.....
Daitotei	Taipei	Sintiku	Hsin-chu
Fuhosho	.....	Suisharyo	Sui-che-liau
Gai-So-Kai	Wai-suang-hsi	Taihoku	Taipei
Hokuto	Pei-tou	Toa-Tsui-Kutsu	Chi-tou
Hoozan	Fon-fang-shan	Tapani	Tah-pan
Kosempo	Kuo-shing-pu	Toyenmongai	Tao-yuan
Koshun	Heng-chung	Takao	Kao-hsiung
Kankao	Kang-kou	Tainan	Tainan
Maruyama	Taipei	Taihorin	Ta-ping-ling
Macuyama	.....	Yentempo	Kao-hsiung

* Usually listed as "nördl. Paiwan Distr."

More than two-thirds of the island is mountainous, with spectacular scenery. Rainfall is plentiful and the lowlands are lush and green. The highest point is Mt. Morrison (= Yu-shan), at 13,000 feet; most of the flat lands lie in the west coast basin, and there is also a long, narrow valley close to the east coast. The climate is subtropical, the average temperature in the north being 70°F, and that in the south, 75°F. Although winter is brief, it is cold enough to produce snow on the mountain tops.

The specimens used in the present study came mostly from 16 major collection sites, indicated by solid circles in Fig. 1. Banana baits were used at times, but most of the specimens were taken by sweeping or from fungi. In addition to the senior author, other principal collectors were Dr. Lynn H. Throckmorton of the University of Chicago, and Jui-I Ting and Fei-Ing Shen of Taiwan. We also wish to thank Dr. Haruo Takada, Dr. Ken-Ichi Wakahama and Miss Yee-Chan Kan for their help and our special thanks go to Dr. Toyohi Okada for his great assistance in determining the systematic positions of many of the Taiwan species.

In view of its geographical position, it is not surprising that the flora and fauna of Taiwan have come from many different regions. It was pointed out by Hennig (*op. cit.*) that on this island there are faunal elements of both the Palaearctic and Oriental regions, as well as occasional forms whose nearest relatives are Nearctic or Neotropical. Nonetheless, the mass of evidence indicates that Taiwan belongs to the Oriental Region. The present study also indicates that there are numerous endemic species on the island also, but this number may not be as great as it seems since some of the species will likely be found in the Philippines, or on mainland China, etc.

Holotype specimens of the new species described here are located in the *Drosophila Type and Reference Collection* of the Genetics Foundation, Department

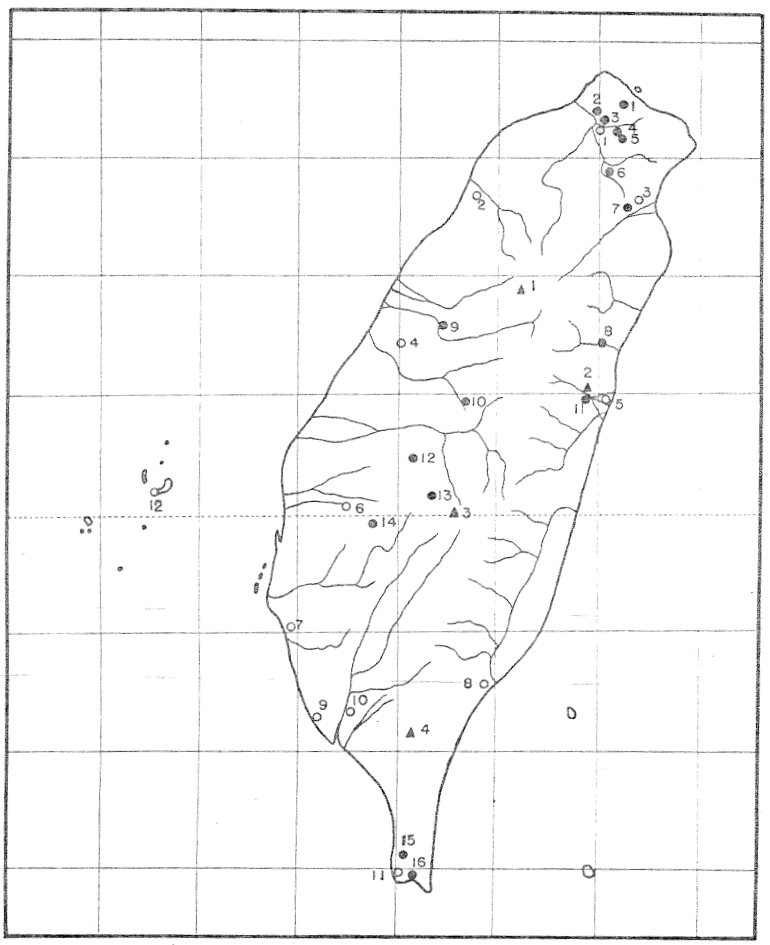

FIG. 1. Map of Taiwan showing principal cities, mountains and major collecting sites. *Solid circles:* collecting sites—1, Chi-tu; 2, Yang-ming-shan; 3, Nankang; 4, Sheng-keng; 5, Shih-ting; 6, Wulai; 7, Chung-tou; 8, Toroko; 9, Ku-kwang; 10, Puli; 11, Mu-kua-hsi; 12, Chi-tou; 13, Ali-shan; 14, Yun-shui; 15, Shu-chong-hsi; 16, Kenting.

Open circles: principal cities—1, Taipei; 2, Hsin-Chu; 3, I-Lan; 4, Taichung; 5, Hwa-Lien; 6, Chia-I; 7, Tainan; 8, Taitung; 9, Kao-Hsiung; 10, Ping-Tung; 11, Heng-Chung; 12, Ma-Kong.

Triangles: mountains—1, Chu-kao-shan; 2, Mu-kua-shan; 3, Yu-shan; 4, Ta-wu-shan.

of Zoology, The University of Texas at Austin. Paratypes are located in this collection and in the collection of the Academia Sinica, Nankang, Taipei, Taiwan.

In the hope of avoiding misunderstandings, Table 2 lists most of the locality names used in this work beside their equivalents in Chinese characters.

Genus **Leucophenga** Mik

Leucophenga Mik 1886. Wiener Entomol. Zeit. 5:317. Type species: *Drosophila maculata* Dufour.

References: Duda 1924a, b: Wheeler & Takada 1964; Okada 1968; Okada 1970; Bächli 1971.

TABLE 2

List of localities referred to, in Chinese and in English

13 阿里山 Ali-shan	16 墾丁 Kenting	獅頭山 Shih-tou-shan
旗山 Chi-shan	9 谷關 Ku-kuan	壽山 Shou-shan
12 溪頭 Chi-tou Nantou	觀音瀧 Kuang-ing-long	15 四重溪 Szu-chung-hsi
1 七堵 Chi-tu	關子嶺 Kuang-tzu-lin Tainan	十字路 Szu-tze-lu
⑥ 嘉義 Chia-I	關西 Kuang-si	大貝湖 Ta-pei-hu
礁溪 Chiaw-hsi	國姓鄉 Ko-sing-hsiang	大水堀 Ta-shui-ku
觸口 Chu-kou	六份 Liu-fen	大坪林 Ta-ping-lin
竹山 Chu-shan Nantou	暖暖 Luan-luan	⑦ 臺南 Tainan
7 圳頭 Chung-tou	木柵 Mu-cha	④ 臺北 Taipei
福山 Fu-shan	11 木瓜溪 Mu-kua-hsi	8 太魯閣 Taroko
恒春 Hen-chung	木瓜山 Mu-kua-shan	凍頂 Tong-ting
② 新竹 Hsin-Chu	3 南港 Nankang	土城 Tu-cheng
新莊 Hsin-chuang	澎湖 Peng-Hu	外雙溪 Wai-suang-hsi
⑨ 花蓮 Hwalien	⑩ 屏東 Pingtung	6 烏來 Wulai
③ 宜蘭 I-Lan	10 埔里 Puli Nantou	霧社 Wu-she
高雄 Kaohsiung	三地門 San-ti-meng	2 陽明山 Yang-ming-shan
基隆 Keelung	深坑 Sen-keng	14 沄水 Yun-shui Chia-I
	5 石碇 Shih-ting	

This is the third largest genus in the family, with about 170 described species (*Drosophila* has 1500+, *Scaptomyza* has about 400). The distribution is worldwide, with the majority of the species being tropical and only a few inhabiting the colder regions. Taxonomically, it is a most difficult group to work with; laboratory culture has never been achieved, and major sexual dimorphisms are common, making the positive association of ♂♂ with ♀♀ in wild-caught collections quite difficult and uncertain. As far as is known, the larvae live in various kinds of fungi. Adults are collected mainly by sweeping, around fungi, on fallen logs, and at times in flowers.

The genus is characterized as follows: arista plumose, with long dorsal and ventral branches; face very flat; acrostichal hairs in numerous rows; prescutellar bristles well developed. Wings rarely without color pattern, usually darkened generally or with distinct pattern of markings; costa reaching only to end of 3rd vein; 3rd costal section with a series of tiny thornlike spines. Body size ranges from 2.5 to 4.5 mm.

Based mainly on his extensive study of *Leucophenga* from Ethiopia (Africa), Bächli divided the genus into 8 species groups; the *ornata* gp., *cuthbertsoni* gp, *proxima* gp., *flavopuncta* gp., *subpollinosa* gp., *flaviseta* gp., *mutabilis* gp., and *argentata* gp. All but 3 of these groups are known to have representatives in Asia.

The present report lists 29 species of *Leucophenga* from Taiwan, including the

following newly described species: *atriventris*, *digmasoma*, *orientalis*, *spilossoma*, and *taiwanensis*. An additional 10 species are known to occur in Taiwan, but these are known at present only from single individuals, or from a few individuals in rather poor condition, so that we prefer to wait for additional material before describing them.

In the account which follows, the species are listed alphabetically.

♂ **Leucophenga abbreviata** (de Meijere)

Drosophila abbreviata de Meijere 1911:400 (Java).
Drosomyiella abbreviata, Hendel 1914:113.
Leucophenga abbreviata, Duda 1923:26.

References: Duda 1923, 1924a; Okada 1966.

The short (abbreviated) 4th longitudinal vein is unusual, and led Hendel (1914) to place the species in a new genus, *Drosomyiella*. In all other respects, however, it seems to be a typical *Leucophenga*.

♂, ♀. Body length 2-3 mm. Palpi tan, slender. Mesonotum dull yellowish-brown; tip of scutellum usually paler than disc; pleurae pale but often a bit darker above. Halteres pale or somewhat discolored. Wings without a pattern; 4th vein short, not reaching wing margin. Abdomen with a distinct pattern of medial and lateral spots.

Duda (1924b: Fig. 16) has a wing photograph; Okada (1966) gave a complete description, and figured (his Fig. 29–34) the head, wing, scutellum, abdomen and male genitalia.

Specimens examined: TAIWAN: 31 ♂, 15 ♀, Yun-shui; Ta-shuei-ku; Puli; Chu-kou; Khan Ing Lang. NEPAL: 1 ♀, Birganj, Lothar.

Duda (1923) listed specimens from "Chip-Chip, Taihorin, and Tappani." Okada (1966) also reported specimens from Nepal.

The Angusta Complex

This complex of species was summarized by Okada (1970, under the name "*nigriventris*" complex), who pointed out that all of the known species show a remarkable sexual dimorphism in palpi, and are also characterized by an unusual degree of polymorphism in abdominal color pattern. Female palpi are large, flat, almost without bristles, and are usually seen protruding from the oral cavity. Male palpi are smaller, narrower, and have a few distinct bristles along the lower margin and apex.

The described Taiwanese species belonging to this complex are: *fuscipennis* Duda, *guttiventris* (de Meijere), *magnipalpis* Duda, *angusta* Okada, *nigripalpis* Duda, and *nigroscutellata* Duda.* These species are difficult to separate one from another, and we have tried to point out the features which seem most useful in this regard, as well as the variability observed in the Taiwan specimens.

Bächli (1971:77) placed these species, along with 16 African species, in his *mutabilis* species group.

* The following new species also belong to the *angusta* complex: *atriventris*, *orientalis*, *spilossoma*, and *taiwanensis*.

Leucophenga angusta Okada

Leucophenga angusta Okada 1956: 28 (Honshu, Japan).
= *Leucophenga nigriventris* of authors, not *Drosophila nigriventris* Macquart 1843 (a synonym of *Drosophila melanogaster* Meigen acc. to Tsacas 1967:158 after inspecting the type specimen).

References: de Meijere 1908:158; Duda 1924a; Wheeler and Takada 1964; Okada 1970.

This is a highly dimorphic species. Body length 2–2.5 mm. Mesonotum tannish brown, scutellum the same, the apex not paler; pleurae pale; halteres pale; palpi variable, light tan to more brownish, very large in ♀, smaller in ♂. Male abdomen nearly entirely black, only 2nd tergite somewhat pale. Female abdomen with pattern of dark spots; the typical pattern of Taiwan specimens is as follows: 2nd tergite darker on lateral corners, 3rd segment all pale, 4th with three prominent black areas, 5th with a small central spot, 6th with a small spot in each posterior corner. Wings without markings.

Specimens examined: TAIWAN: 4 ♂, 5 ♀, Puli; Liu Fen; Yun-shui; Kenting Park; Ta-shuei-ku. JAPAN: 1 ♂, Kirishima. MICRONESIA: 12, Yap, Palau. The species is also known from Korea and Java, and it seems probable that the species reported from the Fiji Islands by Bezzi (1928) as *guttiventris* was in reality *angusta*.

Leucophenga argentata (de Meijere)

Drosophila argentata de Meijere 1914:258 (Java).
Leucophenga argentata, Duda 1924a:188; 1924b:138.
= *Leucophenga halteropunctata* Duda 1924a:188; 1924b:239 [female of *argentata*] (Taiwan).

References: Wheeler & Takada 1964; Okada 1966.

This species is remarkably dimorphic; males are pale colored with a bright silvery effect on both thorax and abdomen, while females are brown, not silvery. Wheeler and Takada (1964) discussed this phenomenon on the basis of specimens from Micronesia; our present series of specimens from Taiwan support the same conclusion. Okada (1966), however, studying flies from Nepal, reported both males and females of *argentata* plus females of *halteropunctata*. This may indicate that different species are concerned; for example, both "species" were reported from Africa, but Bächli (1971) showed that those earlier identifications were in error, and he assigned the specimens to four new species described by him.

♂. Body length 2.5–3 mm. Front quite narrow, pale to white; mesonotum pale, silvery; pleurae pale. Halteres pale but with a round black mark dorsally. Palpi pale or light brown. In certain views the abdomen is all silvery, but from most other angles a pattern of black marks becomes evident (Fig. 4A); the number of marks and their intensity is variable,—some males have no marks on the 5th tergite, some have 2, some 3, and when 5 are present, their sizes vary. Wings clear, apex of 1st vein darker (more so on ♀).

♀. Front wider than male. On both sexes the ocellar bristles are smaller and thinner than usual. Scutellum with apex whitish, but with blacker areas near

basal bristles. Haltere with black spot as in male. Abdominal pattern more conspicuous than on male (Fig. 4B), but also variable.

Wheeler and Takada (1964) figured the male genitalia of specimens from Micronesia; Okada (1966) illustrated various features of both *argentata* and *halteropunctata* using specimens from Nepal.

Specimens examined: TAIWAN: 40 ♂, 40 ♀, Puli; Yun-shui; Wulai; Yang Ming Shan; Khan Ing Lang; Liu Fen; Chi-tu; Pi-shan; Ta-shuei-ku. NEPAL: 2 ♂, Berganj (Canadian National Coll.). NEW GUINEA: 1 ♂, Sogeri Plateau, Ft. Moresby; 2 ♀, Samarai-Sariba, Papua. MICRONESIA: 15 ♂, 5 ♀, Palau.

Duda (1924b) listed 1 ♂ of *argentata* and 1 ♂, 1 ♀ (of *halteropunctata*) from "Paroe nördl. Paiwandistr."; Hennig (1941) added localities from the Kertesz specimens: Takao, Sokotsu and Toa Tsui Kutsu. Sturtevant (1927:364) reported Philippine specimens from Mt. Maquiling and Los Baños, Laguna Province, Luzon. This may be still another species; we have 1 ♂, 1 ♀ from Baguio, Luzon, which resemble *argentata* very much, but both specimens have a more complex abdominal pattern, and the scutellar apex of the male is quite pale, as on the female.

Leucophenga atriventris n.sp.

This is a member of the *angusta* complex, and greatly resembles males of *angusta*, having a wholly black abdomen. However, the black abdomen is present in both sexes of *atriventris* and the palpi are very black.

♂, ♀. Body length 2 mm. Front tan, face more yellow; palpi black, in ♀ they are large, flat and nearly without bristles, while those of the ♂ are smaller, narrower, and have a few bristles on lower edge and at apex. Antennae pale; arista with about 5 dorsal and 3 ventral branches in addition to the terminal fork. Mesonotum light brown or tan, a little darker posteriorly on some specimens; scutellum of the same color, but paler at tip. Pleurae tan. Legs pale. Halteres pale. Wings clear, without markings. Abdomen black, velvety, on both ♂ and ♀; a little paler basally, on 1st and edge of 2nd segments.

HOLOTYPE ♂, NEW GUINEA, Wau, C 26.63, Oct. 1961 (H. L. Carson coll.). Allotype ♀, Goroka, New Guinea, Oct. 1961 (H. L. C.); 1 ♂ paratype, Wau, N.G. and 1 ♀ paratype, Goroka, N.G. One ♂ paratype, NEW IRELAND, Danu, Kalili Bay, Apr. 29, 1962 (Noona Dan Exped.). One ♂ paratype, TAIWAN, Chung-tou, I-lan, May 1968 (Throckmorton and Lin, coll.).

Leucophenga bifasciata Duda 1923

Leucophenga bifasciata Duda 1923:30 (Taiwan).

♀ (after Duda). Body length 2.25 mm. Palpi yellow, large, with bristles. Mesonotum and scutellum reddish brown, the scutellar apex lighter brown. Halteres pale. Abdominal pattern: 2nd tergite with black apical band, broadly interrupted in middle; 3rd more yellow basally and blacker apically, centrally broadened to reach base; 4th with broad black apical band; 5th and 6th all dark. Legs pale, the knees darker. Wings clear.

Specimens examined: none. Duda based the species on 1 ♀ from Chip-Chip.

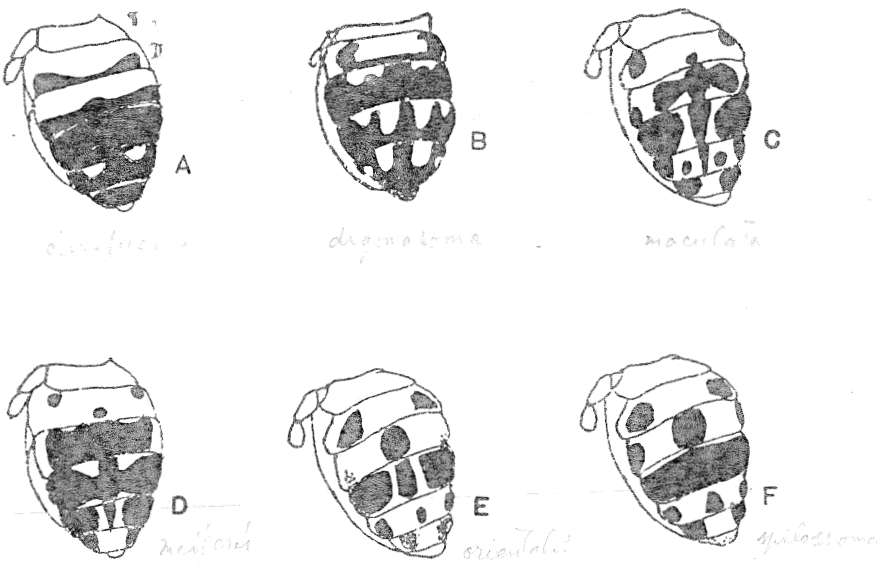

FIG. 2. Abdominal patterns of *Leucophenga* species; A—*confluens* ♂; B—*digmasoma* n. sp. ♀ (paratype); C—*maculata* ♂ (Yun Shui); D—*meijerei* ♂; E—*orientalis* n. sp.; F—*spilossoma* n. sp., ♂ (holotype).

Leucophenga confluens Duda

Leucophenga maculata var. confluens Duda 1923:32 (Taiwan).

Reference: Duda 1924. a, b.

This appears to be one of the most common species in Taiwan, and is clearly distinct from *maculata*; Duda (1924a) also considered it possible that this was only a "variety" of *meijerei* which it resembles. We feel, however, that this is a distinct species.

♂. Body length 2.5–3 mm. Front and face pale yellow to whitish; palpi small, pale basally becoming browner apically. Mesonotum tan to brownish, with silvery pollinosity when seen from certain angles. Scutellum dark brown to black, whitish on apical ¼. Pleurae with some brownish areas on mesopleura, sternopleura, and more posteriorly past halteres. Halteres pale. Legs pale. Wings clear, a little darker over 1st vein.

Abdominal pattern as in Fig. 2A. The extreme posterior margin of 2nd tergite and the basal pale area of 3rd quite silvery. Male genitalial complex pale, rather large and prominent.

♀. With a few differences from the ♂; palpi larger and darker; pleural brownish areas darker; very little pollinosity on mesonotum and none on abdominal pale areas.

Specimens examined: TAIWAN: 24♂, 10♀, Wulai; Puli; Ta-shuei-ku; Chitou; Shih-ting; Nankang. Duda's original specimens (5♂, 9♀) were from Chip Chip and Mt. Hoozan.

Leucophenga digmasoma n.sp.

♂, ♀. Body length 2.5–3 mm. Front tan, face more yellowish; palpi small, light

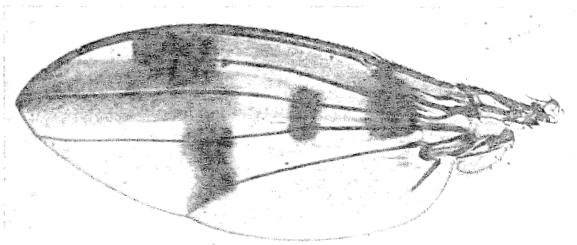

FIG. 3. Wing pattern of *L. digmasoma* n. sp.

brown. Mesonotum tan to brown, becoming darker posteriorly and on scutellum, the scutellar apex much paler. Pleurae tan with darker brown areas which are not well defined, and are variable. Halteres pale; legs pale, 2nd femur with an unusually stout series of bristles along anterior surface. Abdominal pattern complex; ♂ and ♀ patterns appear to be similar; on some specimens the pattern is easily observed, but on others the pale marks are mostly lost due to increase in black portions. The pattern of a paratype ♀ (Khan Ing Lang) is shown in Fig. 2B.

Wings with a distinctive pattern of spots (Fig. 3).

HOLOTYPE ♀, TAIWAN, Wulai, July 1968, Throckmorton and Lin, colls.; 1 paratype ♂, 3 paratype ♀, Wulai, April and May, 1968, Throckmorton, Lin and Ting, colls.; 1 paratype ♀, Khan Ing Lang. Allotype ♂, teneral in appearance, Yun-shui, June 1967, Lin, coll.

Leucophenga flavicosta Duda

Leucophenga subpollinosa var. *flavicosta* Duda 1926:53 (Sumatra).

Reference: Bächli 1971.

Duda (1926), in a discussion of *subpollinosa*, mentioned 3 ♂ which lacked the dark clouding over the 1st vein, and referred to them as "var. *flavicosta*." Bächli (1971) examined Duda's holotype specimen and stated that in addition to the wing difference, in *flavicosta* the front was relatively broader and more strongly silvery, the mesonotum was very silvery but did not show signs of stripes in the dorsocentral rows, and the basal 3 abdominal tergites were yellow with silvery effect while the remainder was shiny black.

This difference in abdominal pattern (Fig. 4D) seems to us to be significant, probably representing a true species difference, while the degree of silvery pollinosity, etc. seems to be more variable, and the wing cloud may also be less obvious in many specimens. Therefore, we are considering *flavicosta* to be the name applied to the species with this abdominal pattern, seen on specimens from Sumatra, Taiwan, New Guinea and Micronesia.

Specimens examined: TAIWAN: none. NEW GUINEA: 1 ♂, Madang. MICRONESIA: 4, Palau (reported by Wheeler and Takada 1964 as *subpollinosa*). Bächli (1971) listed a male from Taiwan (Toyenmongai, Tainan) which he said was like the holotype in most respects.

Leucophenga fuscipennis Duda

Leucophenga fuscipennis Duda 1923: 28 (Taiwan).

References: Okada 1970; Duda 1924a.

Duda described the species from one ♂ (Takao, 800 m), at the same time expressing the opinion that it was probably the male of *guttiventris*. Okada (1970) treated them as different species, and we believe that he was correct. We have a single ♂ which agrees in all respects with Duda's brief description. Body length 2.25 mm.; palpi (♂) brownish, typical in shape of males of the *angusta* complex; mesonotum and scutellum dark tan to brownish, nowhere silvery, the scutellar apex not paler; halteres pale. Abdominal pattern of a few distinct spots: 2nd segment with a faint discoloration along the hind margin, 3rd without marks, 4th with 3 well-developed spots, 5th without evident marks, 6th with darkened areas at extreme lateral corners. Wing figured by Duda (1924b: Fig. 26), lightly but evenly darkened over the entire blade.

Leucophenga guttiventris (de Meijere)

Drosophila guttiventris de Meijere 1911: 414 (Java) [*nom. nov.* for *Drosophila maculiventris* de Meijere 1908: preocc.].

References: Duda 1923, 1924a; Bezzi 1928; Okada 1956, 1966, 1970; Wheeler & Takada 1964; Bächli 1971.

This is a member of the *angusta* complex, having sexual dimorphism of both palpi and abdominal pattern.

♂, ♀. Body length 2 mm. A light brown species with clear wings, pale halteres, and complex abdominal pattern. Palpi of ♀ broad and flat, rather pale brown, and lacking bristles; those of male narrower, pale brown, with some bristles below. De Meijere (1908, Pl. 4, Fig. 11) illustrated the abdominal pattern of his only specimen [probably ♀]; Duda (1924b) shows a wing photograph (Fig. 27); Okada (1956) figured the wing and ♂ genitalia of specimens from Japan, and (1966) figured the head, wing and abdominal pattern of a ♀ from Nepal. Okada (1970) illustrated the many variations in abdominal pattern in both ♂ and ♀, based on specimens from Japan, Taiwan, India, Java and Nepal.

Wheeler and Takada (1964: 231) confused ♀ *guttiventris* with ♀ "*nigriventris*" (i.e., *angusta*); as shown by Okada (1970) the ♀ abdominal patterns are extremely similar and both are highly variable. On the otherhand, the ♂ abdomen of *angusta* is largely black, while that of *guttiventris* shows an extensive pattern of dark areas on a pale background.

Duda (1923) stated that his new species, *fuscipennis*, might be the ♂ of *guttiventris*, but Okada (1970) considered them to be distinct species; we agree with his decision. Bächli (1971: 87) placed the African form, *L. guttiventris* var. *curvipila* Duda as a wholly distinct species, *L. curvipila*.

Specimens examined: None. Hennig (1941) listed Paroe; Tahoku Distri., Gai-So-Kai; Macuyama; Takao; Chip Chip; Yentempo; Chipun; Pilam; Kankau; Tainan. Specimens have also been reported from Japan and Nepal (Okada *op. cit.*) and from the Fiji Islands (Bezzi 1928); the latter, however, was more probably *L. angusta* Okada.

Leucophenga interrupta Duda

Leucophenga interrupta Duda 1924a: 187; 1924b: 237 ("Paroe nördl. Paiwan-Distr.).

References: Okada 1956, 1964, 1966.

♂, ♀. Body length 3 mm. Palpi tan; mesonotum and scutellum light brown; Pleurae yellowish tan; halteres pale. Abdominal pattern (Fig. 4F) with contrasting dark brownish black areas and pale yellow areas, but variable. Wings with conspicuous pattern of dark clouds, mainly a broad dark region across costal margin, clearly interrupted just beyond 2nd costal break, and wider apically. Duda (1924: Fig. 24) shows a wing photograph; Okada (1956: 36) also figures the wing as well as the male genitalia.

Specimens examined: TAIWAN: 4♂, 2♀, Yun-shui; Puli.

Okada (1956, 1966) listed specimens from Kyushu, Japan and from Nepal. We have two specimens from Nepal (Balaju, 4500 ft.), but the 3rd tergite is patterned as are the others rather than being solid color, and the wing pattern is less extensive.

Leucophenga latifrons Duda

Leucophenga latifrons Duda 1923: 32 (Taiwan).

♂ (after Duda). Duda stated that this might possibly be the male of *setipalpis*, differing from that species only in having the front no longer than broad, and having the black median longitudinal stripe of the abdomen more distinct than in *setipalpis*, and with the 6th tergite yellow with black lateral marks.

After discussing *setipalpis* and *latifrons*, Duda (*op. cit.*) stated that these two might possibly be only "varieties" of *salatigae* de Meijere. We believe that it is a distinct species.

Specimens examined: TAIWAN: 3♀, Khan Ing Lang. Duda listed one male from Takao.

Leucophenga maculata (Dufour)

Drosophila maculata Dufour 1839: 50. Ann. Sci. nat., 2nd Ser., Zool., 12 (Europe).

Leucophenga maculata, Mik 1886. [Type species of Genus *Leucophenga*]. References: Duda 1924a, b, 1934; Okada 1956.

This species is apparently the most widespread species of *Leucophenga* in the world, ranging from Europe across the entire Palaearctic Region to Korea and Japan, and south to Taiwan and Indonesia. It is extremely similar in appearance to *meijerei*; judging from the specimens which we have available, the following few differences are *usually* seen: scutellum of *maculata* much blacker on the sides, basally, then elsewhere; pleurae often extensively darkened; palpi of both sexes smaller, pale; abdominal pattern, although variable, usually consisting of a complex series of dark spots. The abdominal pattern of a male from Yun Shui is shown in Fig. 2C.

Specimens examined: TAIWAN: 9♂, Chung-tou; Puli; Yun-shui; Wulai. JAPAN: 2♂, 5♀, Kamakura; Kirishima; Hakone. Duda (1924a) listed it from Taiwan and Java, but later (1934) indicated that it was limited to Europe.

Leucophenga magnipalpis Duda

Leucophenga magnipalpis Duda 1923: 27 (Taiwan).

♀ (after Duda). Palpi large and black; mesonotum brownish with some silvery

pollinosity before scutellum, the latter black but whitish on its apical ⅓. Halteres pale. Abdomen black, only 2nd tergite with paler marks on posterior lateral corners. Pleurae extensively marked with dark areas, eg., mesopleura with a large roundish black area. Legs pale but middle and hind "knees" blackened. Wings mostly pale but a little darker along costa.

Duda suggested that this might be only the ♀ of *nigroscutellata*; this does not appear to us to be true. Further, the species which has been reported on several occasions from Japan, Okinawa and Korea as *magnipalpis* (e.g., Okada 1956; Takada and Wakahama 1967) seems to be a misidentification; we are describing it below as a new species, *orientalis*.

Specimens examined: None. Duda's original specimen (1♀) came from "Chip Chip", Taiwan.

Leucophenga meijerei Duda

Leucophenga Meijerea [n.sp. or var. of *albiceps*] Duda 1924a: 190 (Taiwan). *Leucophenga albiceps* var. *Meijerei* Duda 1924b: 240.

References: Hennig 1941; Okada 1966.

This is a member of the *maculata-albiceps* complex; there is so much variation in color, pollinosity, and abdominal pattern that species limits are uncertain. Okada (1966) considered *meijerei* to be the same as *albiceps*; for the present time we are treating *meijerei* as a distinct species.

♂. Body length 2.5–3 mm. Front and face typically milky-white, sometimes yellowish; antennae whitish; palpi small, pale basally but browner apically. Mesonotum tan to brown dorsally, covered with dense silvery pollinosity, much paler on the sides, becoming milky-white on humeral callus and posteriorly from there. Scutellum as dark as mesonotum, much paler on apical ⅓, also showing pollinosity when seen from certain angles. Pleurae mostly pale, with brownish areas on sternopleura, posteriorly on mesopleura, and with brownish areas continuing back beyond halteres. Legs pale; halteres pale. Wings clear.

Abdominal pattern variable; a "typical" ♂ pattern is shown in Fig. 2D. On some males the dark regions are larger, making the pattern less distinct.

♀. Similar to the ♂ in most respects; front tan, not white; palpi much darker brown, much larger, flat, and protruding (but with ventral and apical bristles present); mesonotum only slightly pollinose; abdominal pattern more distinct, the pale areas more developed.

Specimens examined: TAIWAN: 13♂, 5♀, Wulai; Puli; Yun-shui; Alishan; Ken-ting. Hennig (1941) lists 21 specimens from Taihoku, Sokutsu, Chip Chip, Tainan, and Mt. Hoozan.

Leucophenga nigrinervis Duda [?]

Leucophenga nigrinervis Duda 1924a: 186; 1924b: 236 (Taiwan).

Duda based the species on one female from "Kosempo, Formosa." Our specimens differ in a few respects from his description, as described below.

Body length 3 mm. Palpi light brown; mesonotum brown; scutellum with a paler apex; halteres pale; pleurae pale below, broadly brown on upper half. Wings with very black, narrow clouds over both crossveins and with a dark diagonal

streak near base. Abdomen (according to Duda): with black bands and pale areas, the latter quite silvery; 2nd tergite with only black lateral marks, 3rd, 4th and 5th tergites with broad bands extended in middle to anterior margin; 6th tergite all black. On our specimens there is no trace of a silvery appearance, and tergites 3–5 have lateral extensions of the black band as well as that in the middle.

Specimens examined: TAIWAN: 3♂, Yun-shui; Wulai.

Leucophenga nigripalpis Duda

Leucophenga nigripalpis Duda 1923: 29 (Taiwan).

References: Duda 1924a; Okada 1970.

♂, ♀. Body length 2.5–3 mm. Palpi black; mesonotum and scutellum tan to brown; halteres pale; pleurae all pale. Pattern of abdominal spots somewhat variable, usually as follows: 2nd tergite with diffuse lateral marks and sometimes with a darkish band along posterior margin; 3rd segment with a median spot; 4th segment with 3 spots, these often so large and fused that the entire tergite appears black; 5th segment with a median spot; 6th segment with small blackish areas in each lateral posterior corner. Wings unmarked.

Specimens examined: TAIWAN: 2♂, 3♀, Wulai; Puli. Duda's original specimen (1♂) was from "Chip Chip," Taiwan.

Okada (1970) has several figures of this species, and also pointed out that the specimen from Nepal listed by him earlier (1966) as *nigripalpis* was in fact "*nigriventris*" (i.e., *angusta*).

Leucophenga nigroscutellata Duda

Leucophenga nigroscutellata Duda 1924a: 186; 1924b: 237 (Taiwan).

♂, ♀. Body length 2–2.5 mm. Face and cheeks narrow, cheek extremely narrow; palpi black, smaller in ♂, not so unusually large in ♀; front pale with darker median stripe. Mesonotum dark but with silvery pollinosity (both ♂ and ♀); scutellum dark with pale yellow tip. Halteres pale; pleurae mostly dark with paler longitudinal stripe from humerus to haltere, and another across lower margin of mesopleura. Legs pale, but middle and hind "knees" dark. Abdomen (♂) black except for 2nd tergite which is pale and quite silvery; ♀ abdomen not studied. Wing with distinct darker area basally and along costa, as figured by Duda (1924b, Fig. 22).

Specimens examined: TAIWAN: 2 ♂, 1 ♀, Yun-shui. Duda (1924 a, b) based the species on 2 ♂ from "Toa Tsui-Kutsu", Taiwan; Duda suggested that this might be only the ♀ of *magnipalpis*, but this does not seem to be true.

Okada (1966) reported *nigroscutellata* from Nepal, but he later (Okada 1970) stated that this was an error.

Leucophenga orientalis n.sp.

= *Leucophenga magnipalpis* of authors, not Duda 1923.

This species was described and figured by Okada (1956:25–7), who reported it (as *magnipalpis*) from all of the main Japanese islands. Takada and Wakahama (1967) also reported it from Okinawa, and Lee (1966) listed numerous localities in Korea.

♂, ♀. Body length 2–2.5 mm. Frons and face tan to yellow; cheeks narrow, pale but a little darker along the row of oral hairs. Palpi black, those of ♀ large, flat and nearly without bristles, those of ♂ smaller, narrower, and with a few bristles along ventral edge and at apex. Antennae grayish yellow, arista with 5–6 dorsal and 2–3 ventral branches in addition to the terminal fork.

Mesonotum tan; scutellum tan to light brown, much paler at apex, and with dark brown to black areas in each basal lateral corner. Pleurae tan, sometimes a little darker on mesopleura (Taiwan specimens), or distinctly darker, including some darkness on sternopleura (Japanese specimens). Legs pale, mid and hind "knees" darker. Wings clear, the 1st vein and costa a little darker than the other veins.

Abdominal pattern of both ♂ and ♀ alike, showing only a little variation. The typical pattern is shown in Fig. 2E.

HOLOTYPE ♂, TAIWAN, Puli, Nan-Tou, Feb. 26, 1968 (Ting, coll.); allotype ♀, 2♂ and 1♀ paratypes, same data as type. One ♂ paratype, Wulai, Taipei, Apr. 6, 1968 (Throckmorton and Lin). Other specimens seen: JAPAN: 6♂, 5♀, Hakone; Kirishima; Asakawa (Tokyo). Several Hakone specimens are darker than the remainder of the Japanese material.

Leucophenga ornata Wheeler

Leucophenga ornata Wheeler 1959:184 *[nom. nov.* for *Drosophila ornatipennis* de Meijere, Preocc.] (Java).

References: Duda 1924a, b; Okada 1956.

♂, ♀. Body length 3 mm. Palpi brown; mesonotum tan to brown, halteres pale, pleurae pale with a brown stripe above. Scutellar apex somewhat pale. Abdomen of ♂ all black, that of ♀ with a pattern of dark and light areas. Males from Japan seem to have a much darker pleural color, while the females have a more extensive abdominal pattern than do those from elsewhere. On the other hand, two ♂ from Philippines lack a pleural stripe, while two others have it. Wing with distinct pattern of four dark areas, at base, over each crossvein, and at end of 2nd vein. Wings were figured both by Duda (1924b) and Okada (1956).

Specimens examined: TAIWAN: 9♂, 11♀, Yun-shui; Alishan; Puli; Chung-tou; Wulai; Pi-shan. JAPAN: 5♂, 5♀, Hakone; Hikosan; Kirishima; Tokyo. PHILIPPINE IS.: 4♂, Baguio, Tagatay, Luzon. Okada has also reported specimens from Korea, Okinawa and Nepal.

Leucophenga pectinata Okada

Leucophenga pectinata Okada 1968:310 (Taiwan).

This species was based on a male from Ken-ting, Ping-tung; no other specimens have been reported. Okada (1968) figured the wing, abdominal pattern, and male genitalia (his Fig. 3, A-D).

♂. Body length 4 mm. Palpi slender, black. Mesonotum dark orange-brown; scutellum with white apex; pleurae paler than mesonotum, with a black stripe above, its upper margin not well defined. Wings a bit darkened and with three more obvious dark areas,—below apex of 1st vein, and over each crossvein. Haltere knob black. Male genital clasper oval, projecting below genital arch, and

bearing near its distal margin a row of about 5 stout black setae [in this respect resembling *Paraleucophenga*].

Leucophenga setipalpis Duda

Leucophenga setipalpis Duda 1923: 31 (Taiwan).

♀ (after Duda). Body length 2.25 mm. Palpi pale, bristled. Mesonotum and scutellum light brown, pleurae paler and with a darker brown, diffuse, longitudinal stripe. Halteres pale. Abdomen: 2nd tergite yellow with a black mark on each side; tergites 3, 4 and 5 yellow with black, giving the appearance of having a black longitudinal stripe and black tranverse apical bands, leaving pairs of pale basal areas; 6th tergite pale. Legs pale, and wings clear.

Specimens examined: none. Duda described the species from a single ♀ from Takao. He also stated that it might be only a form of *salatigae* de Meijere.

Leucophenga sordida Duda

Leucophenga sordida Duda 1923:31 (Taiwan).

♂ (after Duda). Body length 2.25 mm. Palpi yellow, with bristles. Mesonotum and pleurae tan; halteres pale. Scutellum yellowish. Abdomen reddish brown with diffuse darkening along posterior margins of tergites. Legs pale; wings clear.

Specimens examined: none. Duda based this species on 1 ♂ from Koshun.

Leucophenga spilossoma n.sp.

Since this species has sexually dimorphic palpi, we are placing it in the *angusta* complex; in many respects it resembles Duda's description of *magnipalpis*, but in the present species both sexes have a spotted abdominal pattern.

♂, ♀. Body length 3–3.5 mm. Front and face tan; antennae pale; arista with about 6 dorsal and 3 ventral branches in addition to the terminal fork. Palpi black, those of ♀ large, flat, protruding from the oral cavity; ♂ palpi smaller, narrower, and with a few bristles. Mesonotum tan with two conspicuous brown longitudinal stripes; these are located on each side just outside the dorsocentral rows. The stripes are largest and darkest anteriorly, becoming narrower posteriorly and finally ceasing completely at the level of the posterior dorsocentral bristle. Scutellum dark brown to black, but pale yellow to white on the apical ¼. Halteres pale. Pleurae with a complex pattern of dark brown marks: mesopleura almost covered by a large rounded mark; sternopleura almost covered by a large triangular mark; a 3rd dark area begins just before base of haltere and runs back over the metanotum. Legs pale, the mid and hind "knees" conspicuously darkened. Wings without pattern, but both 1st vein and Costa much darker than are the other veins. Abdominal pattern of ♂ and ♀ alike, consisting of a complex pattern of spots and larger areas. The pattern of the holotype ♂ is shown in Fig. 2F.

HOLOTYPE ♂, TAIWAN, Shih-ting, Taipei, March 1968, F. J. Lin, coll. Allotype ♀, 8 ♂ and 3 ♀ paratypes, Alishan, Chia-I, July 1968 (F. J. Lin and L. Throckmorton).

Leucophenga subacutipennis Duda

Leucophenga subacutipennis Duda 1924a:189; 1924b:239 (Taiwan).

♂, ♀ (after Duda). Body length 2 mm. Palpi pale, bristled. Mesonotum tan, pleurae not darker; scutellum tan to brown, not paler at apex. Abdomen: tergites 2–5 with brown bands across the posterior margins. Legs pale, the knees darker. Wings clear, a bit pointed at apex.

Specimens examined: none. Duda had 3 specimens, from Paroe and Macuyama. Bezzi (1928) reported the species from the Fiji Islands; this was more likely a misidentification.

Leucophenga subpollinosa (de Meijere)

Drosophila subpollinosa de Meijere 1914: 263 (Java).
Leucophenga subpollinosa, Duda 1923:28; 1924a:186.

References: Duda 1923, 1924a, b, 1926; Okada 1956, 1966; Wheeler and Takada 1964; Bächli 1971.

Bächli (1971) examined numerous specimens from Asia (Java, Sumatra, Taiwan, Nepal) and Africa, including the holotype (♀) and other type specimens from Java. On the basis of these many specimens he expressed the suspicion that a species-mixture was involved, but stated that it was not yet possible to determine which features were polymorphic and which were truly species differences. This is quite evident when one compares the descriptions and figures of de Meijere, Duda, Okada, Wheeler and Takada, and Bächli.

Bächli (1971) also examined the holotype ♂ of *subpollinosa* var. *flavicosta* Duda from Sumatra (and an additional specimen which seemed to be the same, from "Toyenmongai", Taiwan). *L. flavicosta* is discussed elsewhere.

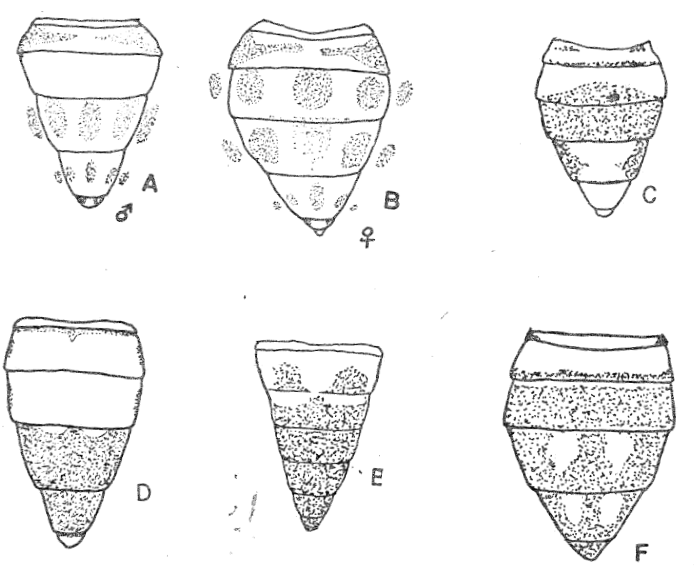

FIG. 4. Abdominal patterns of *Leucophenga* species: A—*argentata* ♂; B—*argentata* ♀; C—*taiwanensis* n. sp., ♂ (holotype); D—*flavicosta*; E—*umbratula*; F—*interrupta*.

Bächli (1971) considered the following to be "true" *subpollinosa*: 1♂, 2♀ from Java (de Meijere's material), 1♂ from Sumatra (seen by Duda), specimens from Nepal (also seen by Okada), specimens from Africa (So. Africa and Eritrea), and 1♂ from Sauter's collection from Taiwan (Taihoku).

♂, ♀. Body length 1.5–2 mm. Front pale, narrower on male; mesonotum light brown, sometimes with a darker stripe in dorsocentral lines; pleurae with darker stripe above; haltere knob blackish; abdomen mostly black, only 2nd tergite pale and silvery (see Fig. 18 in Bächli 1971). Wing clouded over 1st vein and with a weak darker stripe below it.

Specimens examined: TAIWAN: 1♂, Khan Ing Lang. PHILIPPINE ISL.: 2♀, Trinidad, Luzon. NEPAL: 2♂, 1♀, Birganj. For other localities, see the discussion above. The Japanese specimens described by Okada (1956) seem to us to represent a different species.

Leucophenga taiwanensis n.sp.

Since this species has sexually dimorphic palpi, it appears to belong to the *angusta* complex; it resembles the description of *limbipennis* de Meijere in some features, but seems to be a different species.

♂, ♀. Body length 2 mm. Front and face pale yellow; palpi black, those of ♀ large, flat, protruding, nearly bristleless, those of ♂ smaller and with a few ventral bristles. Mesonotum and scutellum light tan, scutellar apex only a little paler. Pleurae, halteres and legs all very pale. Wings with a pattern of dark areas as shown for *L. limbipennis* (see Fig. 21 of Duda, 1924b): a broad dark area along costal margin extending to apex of 3rd vein, and a narrow dark area going along 4th vein as far as posterior crossvein, then going down under this vein and extending in both directions along the 5th vein from the point where it intersects the crossvein.

Abdominal pattern of the holotype male is shown in Fig. 4C. Apparently the ♀ has a similar pattern.

HOLOTYPE ♂, TAIWAN, Yun-shui, Chia-I, July 1967, F. J. Lin, coll. Allotype ♀ with the same data; 1 paratype ♂, Puli, Nan-tou, July 1967, F. J. Lin.

Duda (1924a: 228 and 1924b: 237) mentioned a specimen of *limbipennis* from "Paroe, Formosa" and figured the wing of this specimen. It seems most probable that his specimen actually belongs to *taiwanensis*.

Leucophenga umbratula Duda

Leucophenga umbratula Duda 1924a: 187; 1924b: 238 (Taiwan).

Duda based the species on a single female from "Paroe, nördl .Paiwandistr." Our specimens agree well with most of his statements; the exceptions are noted below.

♂, ♀. Body length 1.75–2.5 mm. Mesonotum tan to light brown, scutellum darker brown on each side basally. Pleurae pale below, with a brown stripe dorsally. Abdomen mostly black, with a solid pattern on segments 2, 3 and (rarely) 4 (Fig. 4E): 2nd tergite with large dark areas on each side; 3rd with a small pale area basally on each side; 4th with a small pale area basally on each side on a few individuals. Wings slightly dark all over, but without special markings.

Duda's descriptions failed to mention the darker basal areas of the scutellum (obvious on all of our specimens); he implies in his key (1924a:187) that the wing has some degree of a darker basal area (not seen on our specimens and not described by him either on p. 238); and his remark that the last section of the 4th vein is twice as long as the preceding section does not agree—on ours it is only 1.25 to 1.5 times as long.

Specimens examined: TAIWAN: 17 ♂, ♀, Wulai; Puli; Khan Ing Lang; Shih-ting. The species was also listed, with doubt, from Africa by Duda but Bächli (1971:68) stated that the specimens more probably belonged to *L. nigrorbitata* Bächli.

Leucophenga varinervis Duda

Leucophenga varinervis Duda 1923:31 (Taiwan).

♀ (after Duda). Duda described this as being similar to *bifasciata*, but with "dirty yellow" halteres, and a different abdominal pattern: 2nd tergite black; 3rd white; 4th with a narrow whitish basal area and broad black apical bands; 5th and 6th black.

Specimens examined: none. Duda based the species on 1 ♀ from Sokotra, Formosa.

Genus Paraleucophenga Hendel

Paraleucophenga Hendel 1914. Suppl. Entomol. 3:14 (not = *Paraleucophenga* Oldenberg 1914). Type species: *Helomyza invicta* Walker, as *Paraleucophenga triseta* Hendel.

= *Trichiaspiphenga* Duda 1924a. Type species: *H. invicta* Walker.

References: Hendel 1914; Duda 1924a; Henning 1941; Okada 1956; Bächli 1971.

Only three species of this little-known genus have been described: *P. invicta* (Walker), widespread in Asia; *P. argentosa* (Okada), from Japan; and *P. semiplumata* (Duda), from Africa.

Bächli (1971) characterized the genus as follows: arista with long branches on dorsal side only; 4 large plus several smaller scutellar bristles; 3 very strong sternopleural bristles; costal wing margin broadly darkened; 3rd costal section without the thornlike spines found in *Leucophenga;* male abdominal tergites mostly silvery (true in some *Leucophenga*); forceps (clasper) of male genitalia with a row of teeth.

Paraleucophenga invicta (Walker)

Helomyza invicta Walker 1857. Proc. Linn. Soc. London: 130 (Borneo).

Drosophila (Leucophenga) invicta, de Meijere 1914: 255 (Java).

Paraleucophenga triseta Hendel 1914: 114 (Taiwan).

Leucophenga (Trichiaspiphenga) invicta, Duda 1924: 185; 1924b, 236. Wing, Fig. 15.

Paraleucophenga invicta, Hennig 1941: 150.

Length 4–5 mm. Arista (Fig. 5) with 10–12 long dorsal branches, a few tiny hairs below. Frons of male narrower than on female, pale; palpi black, less

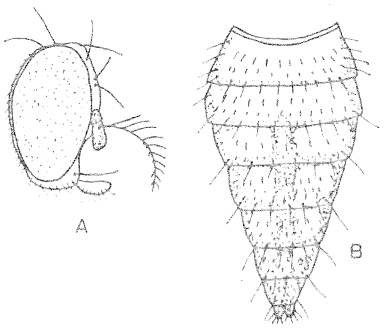

FIG. 5. *Paraleucophenga invicta*, ♀: A—head in profile; B—abdominal pattern.

strongly so on male. Male mesonotum somewhat silvery, the abdomen very silvery, only the last few tergites with black coloration; female not silvery, abdomen with distinct pattern (Fig. 5).

Specimens examined: TAIWAN: 5 ♂, 6 ♀, Yun-shui, Liu Fen, Chi-tou, Nankang. NEPAL: 6 ♂, 1 ♀, Balaju, Godavari, Kathmandu (Canadian National Collection).

Duda (1924b:236) listed 17 ♂, 5 ♀ from "Taihoku Distr. 1 Gai-So-Koi"; Hennig (1941: 150) reported that the two type specimens of *triseta* came from "Kankau (Koshun)," Taiwan.

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