Remarks.—This species is similar to Suffrian's *G. robustum* in coloration except that Suffrian described the outside of the legs of *robustum* as being also steely blue. The two Cuban specimens that I have rather doubtfully identified as *robustum* are twice as large as this little Puerto Rican species and much more heavily punctate.

THE SARCOPHAGIDAE OF GUAM

(DIPTERA)

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Six species of Sarcophagidae occur on Guam, largest of the Marianas Islands, in the western Pacific. Five of these species are widely distributed in the Pacific Ocean areas. Two have not been described hitherto.

Shortly after the attack on Guam early in August 1944, the fly population there was so great that it became essential to inaugurate various control measures. Human and animal remains were heavily blown by various species of muscoid flies and it was necessary to poison the corpses and carcasses with sodium arsenate. *Chrysomya rufifacies* (Macq.) and *Sarcophaga dux* Thom. were the species most involved in the blowing, but *S. ruficornis* (Fabr.) was also frequently reared from such remains.

Human excrement deposited on the open ground was also a source of many flies. *Chrysomya megacephala* (Fabr.), normally a breeder in latrines, as well as *Sarcophaga knabi* Park., *S. peregrina* (R.D.), and *S. dux*, were frequently reared from this type of refuse.

Other muscoid flies, particularly those of the genus *Musca*, made life miserable for everyone. *Musca* flies swarmed everywhere. No single species of insect, even mosquitoes, caused so much complaint among the men as did *Musca sorbens* Wied., a most persistent, though nonbiting fly.

The aerial distribution of approximately 30,000 gallons of 5-percent DDT solution in fuel oil over Army installations and their surroundings by means of C-47 type cargo-carrying aircraft in October and November 1944 so reduced the entire fly population that it became nonprofitable for several months thereafter to collect them in treated areas either by trap or by hand net. In September and October 1945 the entire island was sprayed again in the same manner with the same formula, with similar results.

This island was visited by the senior author a number of times during the 14-month period from August 1944 through

October 1945. Considerable collecting was accomplished on each visit. The junior author, with J. E. Gressitt, collected there during 1945 and 1946. The combined collections, plus others forwarded to the United States National Museum by members of both military services, represent nearly 16 months of continuous collections on this island.

This paper is based on about 65,000 specimens taken on Guam during 1944, 1945, and 1946 by Bohart, Gressitt, and Hall. Only about 10 percent of these specimens were sent to this country. The remainder were discarded immediately after identification. Trapped specimens were often too badly damaged to keep, and only the best specimens were retained for collections.

Sarcophaga knabi, a species supposedly occurring in India, China, and on various islands in the Pacific, is probably the most abundant species of *Sarcophaga* on Guam. It is attracted into traps baited with almost any sort of filth, particularly decaying meat and carnivorous excrement, and also to decaying fruits, vegetables, and mixed garbage. Adults were frequently found in deep pit latrines, but larvae were never reared from feces in such pits; nevertheless, larvae were recovered from human excrement deposited on the top of the ground. Carcasses of animals were almost invariably blown by this species, and larvae were frequently collected from dead sea urchins above high-tide lines. It is the most abundant species of *Sarcophaga* on Pacific islands where the pig population is high. This is believed to be the only species of *Sarcophaga* recovered from cases of human myiasis on Guam. In August and September 1944 it was frequently recovered from blood-soaked blankets at evacuation hospitals. *Sarcophaga knabi* must be considered an important public health factor wherever it occurs because of its tendency toward myiasis and its undoubted tie-in with excrement of carnivores.

Sarcophaga dux is said to occur throughout the Palaearctic, Oriental, and Australian Regions. On Guam it is the second species in order of abundance. Adults were collected in traps baited with decaying meat, and less frequently in traps baited with excrement of carnivores or garbage such as decaying fruits and vegetables. Almost every corpse or carcass was blown with this species. Dead birds, toads, and other similar types of carrion are doubtlessly the reason for the high incidence of this species in areas where it occurs. The larvae of this species were frequently encountered in blood-soaked blankets at evacuation hospitals.

Sarcophaga dux, together with *S. knabi*, must be considered the most important sarcophagids on Guam, and in all other Pacific ocean areas where they occur.

Sarcophaga ruficornis was taken in considerable numbers in meat-baited traps, and less frequently in traps baited with human excrement. Larvae were often collected from corpses, carcasses, and from fish and other similar bodies found swept up on beaches by waves and tides. It was never reared from excrement, but adults are attracted to the excrement of carnivores. It was frequently found in mess halls, but never in deep pit latrines. This species, has been identified from Africa, India, China, and various Pacific Islands. On Guam *S. ruficornis* is the third species of *Sarcophaga* in order of abundance.

Sarcophaga peregrina, fourth in order of abundance of flesh-fly species on Guam, is definitely tied up in the complex of flies involved in the blowing of human and animal remains. It was frequently reared from corpses in 1944, and later from carcasses of toads, fish, and sea urchins. It was not trapped with decaying fruits or vegetables, and only rarely with excrement of carnivores. Adults were sometimes collected over freshly deposited human excrement, and one series was recovered from collections made in a shallow-pit latrine.

Key to Species

Adults

1. First vein bare 2
   First vein setulose ..... *Sarcophaga gressitti*, new species
2. Palpus, antenna, and genital segments black or deep brown 3
   Palpus, antenna, and genital segments orange red ..... *Sarcophaga ruficornis* (Fabr.)
3. Squamal lobes white or only slightly infuscated 4
   Squamal lobes bright yellow to orange ..... *Sarcophaga stricklandi*, new species
4. Propleuron totally bare 5
   Propleuron pilose at least in center ..... *Sarcophaga peregrina* (R. D.)
5. Second abdominal segment of male with one strong lateral bristle and a pair of weak median bristles; female with first hypopygial tergite not cleft medially and with marginal bristles only at the lateral margins ..... *Sarcophaga knabi* Park.
   Second abdominal tergite of male with two lateral bristles but without a distinct median pair; female with the first hypopygial tergite cleft medially, the marginal bristles extending nearly to the mid dorsal line ..... *Sarcophaga dux* Thom.

Larvae (Third Instar)

1. Posterior spiracles separated by a distance equal to one-half the diameter of one spiracle; abdominal tergites usually with extensive smooth areas 2
   Posterior spiracles separated by less than one-third the diameter of one spiracle; abdominal tergites nearly or entirely covered with microtubercules 5

2. Posterior spiracles with ventral sclerotized margin extending as far, or almost as far, medially as the inner spiracular margin.... 3
   Posterior spiracle with ventral sclerotized margin extending only slightly further medially than the portion of the lateral slit..... 4
3. Abdominal tergites with smooth areas more extensive than the microtuberculate areas ..... *dux*
   Abdominal tergites with microtuberculate areas much more extensive than smooth areas ..... *ruficornis*
4. Anterior spiracle with about 10 to 12 branches in a single row, each branch appearing laterally as subequal egg-shaped structure ..... *gressitti*
   Anterior spiracle with over 20 to 22 branches in two or more irregular rows, some small and difficult to discern ..... *stricklandi*
5. Dorsal surface completely and closely covered with microtubercules; a smooth protuberant area present on the anterior margin of anus; a pair of small tubercles generally present at bases of the usual ventral pair at posterior end; anterior spiracle with about 12 to 15 short branches ..... *knabi*
   Dorsal surface with narrow transverse smooth areas; anterior margin of anus without conspicuous smooth area; only one pair of posteroventral tubercles; anterior spiracle with about 18 to 20 branches ..... *peregrina*

PUPARIA

1. Surface with alternate bands of asperate punctures and minute ridges, the latter areas often restricted or with weak asperities; opening of posterior cavity not deeply emarginate in lateral outline 2
   Surface almost entirely covered with minute transverse asperities or subasperate punctures; posterior cavity with the opening deeply emarginate in lateral outline, bordered with asperities but not distinctly tuberculate; faces of spiracular plates nearly in line with long axis of puparium (with 17 fingerlike projections in an irregular row on anterior spiracle.) ..... *knabi*
2. Posterior cavity generally deeper than diameter of opening; spiracular plates usually almost in same plane with longitudinal axis of puparium 3
   Depth of posterior cavity generally much less than diameter of opening; spiracular plate often placed almost horizontally in relation to transverse axis of puparium; (anterior spiracle with 11 to 14 fingerlike projections; puparium with a smooth appearance, its striate areas extensive and rather satiny) ..... *gressitti*
3. Anterior spiracle with 11 to 14 fingerlike projections; margin of posterior cavity with low, rounded tubercles; posteroventral tubercles sometimes large but usually not erect; asperities of surface rarely in form of reclining teeth in contiguous oblique series 4

Anterior spiracle with 21 fingerlike projections; margin of posterior cavity with a number of conspicuous subvermiculate tubercles, the ventral subcaudal pair prominent and erect; asperities of surface in form of reclining, triangular teeth which are in an oblique, almost contiguous series ..... *stricklandi*

4. Dorsolateral portions of third, fourth, and fifth abdominal segments with posterior halves asperate; asperities generally small and not almost touching 5

Dorsolateral portions of third, fourth, and fifth abdominal segments with posterior half completely ridged, without asperities; with strong ridges and large closely spaced asperities which have broadly oval bases which almost touch in many areas ..... *dux*

5. Posterior two-thirds of tergites in middle portion of puparium largely with narrowly elliptical transverse tubercles, sometimes bearing feeble, transparent teeth; third tergite, except for a very narrow band, covered with elliptical or prostrate triangular tubercles ..... *ruficornis*

Posterior two-thirds of tergites in middle portion of puparium with strong ridges bearing narrow, anteriorly directed scalelike teeth; third tergite in large part coarsely ridged and without tubercles ..... *peregrina*

Sarcophaga gressitti, new species

A small, grey, rather smooth, and more or less glabrous species with the first vein setulose and the propleuron with several hairs.

Male.—Head: Bucca with scattered medium-length, black hairs, none pale before the metacephalic suture, and with greyish-yellow pollen on the anterior half; parafrontale with greyish-yellow pollen, with some hairs in rows which extend to the parafaciale; frontal bristles about nine, the rows extending to the middle of the second antennal segment, only narrowly diverging from the other anteriorly; inner vertical bristles straight; clypeus yellowish-golden; parafaciale with greyish-yellow pollen, with scattered minute, black hairs near eye; palpus black; antennal segments black, third segment one and one-half times as long as second; back of head with two and a partial third row of postocular cilia, and with whitish hair below.

Thorax black, with thick greyish, yellow, and brown pollen, and with brown and black longitudinal stripes; propleuron with a few black setae on the anterior margin; no anterior acrostichal bristles; two anterior dorsocentral bristles; three sternopleural bristles arranged 1-1-1; four postsutural dorsocentral bristles, strong only in the prescutellars; one postsutural acrostichal bristle; scutellum with one subapical discal bristle, one apical bristle, and two lateral bristles.

Legs black, hind tibia with long hairs.

Wing hyaline, with a small costal spine, first and third vein setose; squamal lobes infuscated, white.

Abdomen black with silvery and brown pollen, tesselated; third apparent segment with long, erect, median marginal bristles; fourth segment with a marginal row of bristles, fifth sternite cleft, with strong short, inward-pointing spines

Genital segments black; first segment large, globose, with thin silvery pollen; second segment globose, shining. Internal features as illustrated.

Female.—Similar to male, but front of head wider, claws nearly equal in length, and scutellum without apical bristles. Genital segments somewhat similar in shape to those in *orchidea* Boett.

Length 5-6 mm.

Type material.—Holotype: Male, No. 58664, U. S. National Museum, reared from a corpse, June 19, 1945, Point Ritidian, Guam (Bohart and Gressitt). Allotype; Collected from corpses of man, August 24, 1944, Agana beach, Guam (Hall). Paratypes: A series of 113 male and female specimens collected in several beach areas or in the immediate vicinity of beaches on Guam, during 1944 and 1945.

Adult habits.—Specimens of this species are collected only on or near ocean beaches, where they take stations in the sun on rocks, pebbles, or shells. Females are attracted to various types of filth, mainly carrion such as dead fish or crayfish cast up on shore by tide or wave action, or to dead land crabs and snails immediately behind beaches. They are infrequently attracted to the excrement of carnivores, including that of humans. Of all baits tried in traps, human excrement proved least, decaying liver most, attractive.

Larval habits.—Larvae are found typically in carrion, although Bohart and Gressitt reared two adults from larvae collected in human excrement. Adults were reared from human dead, from the decaying skin of a pig, and from ground beef. Decaying ground lean beef was used as a larval medium in the laboratory by Hall, decaying liver by Bohart. Larvae recovered from gravid females reached maturity in about 72 hours; adults were recovered from pupae in 9 to 15 days. The total cycle requires from 14 to 20 days.

Remarks.—Adults which appear to be very similar, if not identical, to *gressitti,* occur on many island groups in the western Pacific ocean areas. Specimens were first collected and reared by Hall in July and August 1944 on Kwajalein, island of the Kwajalein Atoll, in the Marshall Islands. Later in 1944 specimens were collected or reared on the Eniwetok Atoll and Majuro Atoll in the Marshall group; on Makin, Tarawa, and Apamana in the Gilbert Islands group; on Nanomea and Funifuti in the Ellice Islands group; as well as on Saipan, Tinian, and Rota, in the Marianas Islands group.

These specimens are not included in the type series of *gressitti* because of minute differences between series from different islands and island groups. If these differences prove to be subspecific, the typical form will be that described herein from Guam.

The length of the type series of *gressitti* might indicate that *gressitti* was fairly common. However, its distribution was localized along the beaches. Conditions of warfare, and later recreation, resulted in a great amount of collecting in restricted areas where this species was abundant.

The species seems to have little public health significance. It may occur periodically in cases of human and animal myiasis, but no single rearing was so recorded during 1944 and 1945 by the Medical Department of the Army so far as we are aware. It is an uncommon species which must be searched for with considerable diligence. It occurs throughout the year, but adults appear to be most frequent from May to August.

Named for J. L. Gressitt, with whom Bohart served in the Pacific during U. S. Naval duty in 1945.

Sarcophaga stricklandi, new species

A black and yellowish, medium-sized species with the abdomen mostly shining black, the wing base and squamal lobes bright orange.

Male.—Head: Bucca with abundant, medium-length, black hair, with many pale hairs before the metacephalic suture, and heavily grey pollinose; parafrontale with grey pollen, and with some scattered setae in several rows; frontal bristles about 13, the rows extending to the base of the third segment of the antenna and diverging widely from each other anteriorly; inner vertical bristles strong and straight; outer vertical bristles one-half as long as the inner verticals; vertex black pollinose; clypeus yellowish silvery; parafaciale with silvery-grey pollen, and with well-developed setae in a row below near eye which extends to the parafrontale; palpus black; antennal segments black, the third segment two and one-half times as long as the second; back of head with 3 rows of postocular cilia and with abundant, elongate, golden brown hairs below.

Thorax black, greyish pollinose, and with darker brown and black longitudinal stripes; propleuron bare; one or two anterior acrostichal bristles; three anterior dorsocentral bristles; three sternopleural bristles, with the second sometimes duplicated; postalar callosity orange; one postsutural acrostichal bristle; four postsutural dorsocentral bristles; haltere orange; scutellum with one apically located discal bristle, two lateral bristles, and one apical bristle

Legs brownish black, hind tibia without long hair; claws and pulvilli small, orange.

Wing, hyaline, rather milky, deeply infuscated, yellow to orange basally; bases of all veins orange; no costal spine; subcostal sclerite yellow orange; only third vein setose; both squamal lobes deep yellow to orange.

Abdomen black with a bluish cast, thinly silvery, with a fixed pattern; second apparent segment with a pair of median marginal bristles, third and fourth segments each with a marginal row of bristles.

Genital segments small, black, and retracted; first segment small, slightly silvery, and without a marginal row of bristles; second segment small, shining, and with scattered black setae. Internal features as illustrated.

Female: Essentially like male with usual female differences, but lacking median marginal bristles on the second apparent abdominal segment, and apical bristles on the scutellum. Female genital segments rather reddish and somewhat similar in pattern to those of females in the *Ravinia—Euravinia* complex.

Length: 7-9 mm.

Type material.—Holotype: Male, No. 58665, U. S. National Museum, collected from a tree trunk in deep jungle shade September 23, 1944, near the original village of Dededo, (now Harmon Field), Guam, by Hall. Allotype: Collected December 27, 1945 at Mogbog, Guam, by Gressitt. Paratypes: A series of 93 male and female specimens collected on Guam during the months of May, and August through December, by Hall, Bohart, and Gressitt.

Adult habits. Female specimens were infrequently collected in a hand net from bases of large trees in deep jungle. A few males were collected in the same manner. The species was never encountered except in deep woods areas. Although numerous trap settings with many different kinds of attrahents were made in such locations, very few specimens of *stricklandi* were so collected. Bohart and Gressitt collected specimens over human excrement, but Hall never did so. Although much effort was expended in attempting to discover the natural breeding habits of the species, no facts were found in this regard.

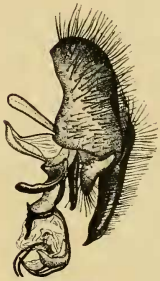
Remarks. Notwithstanding the length of the type series of *stricklandi*, this is by far the most uncommon flesh fly species on Guam. More hours were spent in collecting this species than all others combined. It has little or no public health significance.

The name selected for this interesting and unusual species of *Sarcophaga* is that of Benj. A. Strickland, Lt. Col., M.C., U.S.A., with whom the senior author served many interesting hours during late 1945 in the Pacific Ocean areas.

STRICKLANDI

PEREGRINA

DUX



GRESSITTI

KNABI

RUFICORNIS

PLATE 13.

MALE GENITALIA OF GUAM SARCOPHAGA